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Association between being employed in a smoke-free workplace and living in a smoke-free home: Evidence from 15 low and middle income countries ☆

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ABSTRACT

Objective. To assess whether being employed in a smoke-free workplace is associated with living in a smoke-free home in 15 low and middle income countries (LMICs).

Methods. Country-specific individual level analyses of cross-sectional Global Adult Tobacco Survey data (2008–2011) from 15 LMICs was conducted using multiple logistic regression. The dependent variable was *living in a smoke-free home*; the independent variable was *being employed in a smoke-free workplace*. Analyses were adjusted for age, gender, residence, region, education, occupation, current smoking, current smokeless tobacco use and number of household members. Individual country results were combined in a random effects meta-analysis.

Results. In each country, the percentage of participants employed in a smoke-free workplace who reported living in a smoke-free home was higher than those employed in a workplace not smoke-free. The adjusted odds ratios (AORs) of living in a smoke-free home among participants employed in a smoke-free workplace (vs. those employed where smoking occurred) were statistically significant in 13 of the 15 countries, ranging from 1.12 [95% CI 0.79–1.58] in Uruguay to 2.29 [1.37–3.83] in China. The pooled AOR was 1.61 [1.46–1.79].

Conclusion. In LMICs, employment in a smoke-free workplace is associated with living in a smoke-free home. Accelerated implementation of comprehensive smoke-free policies is likely to result in substantial population health benefits in these settings.

Introduction

Approximately 600,000 deaths are attributable to secondhand smoke (SHS) exposure globally each year (Öberg et al., 2011). Adverse health effects from SHS exposure include sudden infant death syndrome and respiratory disorders in children and lung, breast cancer (California Environmental Health Protection Agency, 2005; Johnson et al., 2011), cardiovascular disease and poorer reproductive outcomes in adults (U.S. Department of Health and Human Services, 2006; World Health Organization, 2011). The bulk of the burden from SHS exposure falls on women and children living in low and middle income countries (LMICs), where 80% of the world's smokers reside (World Health Organization, 2013a) and where SHS exposure at home is typically high, ranging from 17% in Mexico to 73% in Viet Nam among countries participating in the Global Adult Tobacco Survey (GATS) (King et al., 2013). Further, SHS exposure at home among non-smokers is higher among females compared with males (King et al., 2013).

Comprehensive smoke-free policies have high levels of public support and have been associated with substantial health benefits (Fong et al., 2006; IARC, 2009; Tang et al., 2003). These include reduced tobacco consumption and increased quit attempts, the virtual elimination of SHS from workplaces, lower hospital admission rates for myocardial infarction and stroke, lower admissions for acute respiratory illness in both children and adults (Millett et al., 2013; Tan and Glantz, 2012), and lower rates of small for gestational age births (Kabir et al., 2013). However, these health benefits are not equitably distributed as only 16% of the world's population are covered by comprehensive smoke-free policies (World Health Organization, 2013b).

Research evidence suggests that smoke-free workplace policies may change social norms about exposing others to SHS in the home (Berg

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et al., 2012; Cheng et al., 2011; Fong et al., 2006; St. Claire et al., 2012). These findings indicate that early concerns that smoke-free workplace policies would lead to *behavioural compensation* through an increase in smoking at home have not materialized; rather, results from richer countries (Berg et al., 2012; Cheng et al., 2011; St. Claire et al., 2012) and India (Lee et al., 2013) have consistently found that people employed in a smoke-free workplace are more likely to live in a smoke-free home. Replication of this finding in other LMICs would indicate that implementation of smoke-free policies in these settings will likely result in substantial reductions in tobacco related harm globally. This study examines whether there is an association between being employed in a smoke-free workplace and living in a smoke-free home in 15 LMICs participating in GATS between 2008 and 2011.

Methods

Study design, setting and data

This study involved secondary analysis of GATS data from 15 LMICs. GATS is a nationally representative cross-sectional household survey of non-institutionalized adults aged 15 years and over (World Health Organization, 2013c). It is considered to be the global standard for monitoring adult tobacco use and key tobacco control indicators. GATS employs standardized survey methodology with a few country-specific variations in the questionnaire, and is designed to collect household as well as individual level data. Multi-stage cluster sampling design is employed in GATS to select a nationally representative study sample. Between 2008 and 2011, the first round of GATS was implemented in 17 LMICs in five WHO regions (Centers for Disease Control and Prevention, 2013a). Country-specific, anonymous GATS data for 15 of the 17 LMICs (all but Indonesia and Malaysia) was freely available from the CDC GTSS Data website, which was used for secondary data analysis. Poland and the Russian Federation are now classified as high income countries by the World Bank; however, when first round of GATS was conducted in these countries in 2009, they belonged to the upper middle income category. Therefore, for the purpose of our study, we treated them as middle income countries.

Study participants

We used individual level data from the first round of GATS in each of the 15 LMICs. GATS respondents in each country who reported working indoors (or both indoors and outdoors) but outside their home were included as participants for this study. Observations with missing values in the dependent or independent variables were dropped to obtain a final sample for each country. The proportion of missing cases ranged from 0.1% in Uruguay to 8.5% in China (Table 1). Table 1 describes the total number of participants included in our study from each of the 15 LMICs which ranged from 1174 in Romania to 12,912 in Brazil.

Measures

The GATS questionnaire includes core questions on tobacco use, SHS exposure at work and in the home, and socio-demographic information. For the present study, the dependent variable was '*living in a smoke-free home*'. A participant was classified as *living in a smoke-free home* if he/she replied 'never' to the question: *How often does anyone smoke inside your home?* If the participant responded 'daily', 'weekly', 'monthly', or 'less than monthly', he/she was considered as *not living in a smoke-free home*. The independent variable was '*being employed in a smoke-free workplace*'. The participant was classified as employed in a smoke-free workplace if he/she answered 'no' to the question: *During the past 30 days, did anyone smoke in the indoor areas where you work?*

The potential confounders included were: age group, gender, residence, education, occupation, current smoking, current smokeless tobacco (SLT) use and number of household members. A country-specific region variable was also included for India, Thailand, China, Brazil, Poland and Ukraine (this information was not available for other countries). Current SLT use was not included as a covariate for Uruguay, Romania and Turkey as there were only a very small number of users or no data on SLT use was available. In China, the occupation variable consisted of five categories rather than two as the categorization for employment differed substantially from other countries (Centers for Disease Control and Prevention, 2013b). Due to a negligible number of participants educated up to primary level in Romania, Russian Federation and Ukraine, we merged these with the 'up to secondary level' education category. See Supplementary Table for a detailed description of the definitions of variables used in this study.

Statistical analysis

We conducted country-specific, individual level data analysis for each LMIC. We tested for bivariate associations between the independent variable with the dependent variable using Chi-square tests. Country-specific multiple logistic regression models were run to estimate the adjusted odds ratio (AOR) and 95% confidence interval (95% CI) of living in a smoke-free home if employed in a smoke-free workplace compared with being employed in a workplace where smoking occurred. The logistic regression models were adjusted for all the covariates described above (with country-specific exclusions) to minimize confounding and ensure comparability of findings across countries. Age and number of household members were treated as continuous variables. In Brazil, the 'education' variable was not included in the model because the variable definition was not comparable with other GATS countries (Palipudi et al., 2012), however, we did conduct a sensitivity analysis by including education variable in the model and found that the results were consistent with those obtained without including it in the model.

We tested for multicollinearity between the covariates adjusted for in the analysis for each country. The multicollinearity diagnostics variance inflation factor (VIF) values were all less than five, indicating reasonable independence between the predictor variables for each country-specific model (Glantz and Slinker, 2001). The only exception to this was the covariate 'education' in Poland where VIF values were less than 6.5. The variable 'national region' was removed from the model in Egypt due to collinearity. Country-specific sampling weights were applied for all analyses to account for the complex study design.

To estimate the overall association of being employed in a smoke-free workplace with living in a smoke-free home across the 15 LMICs, we calculated a pooled AOR and 95% CI using a random effects meta-analysis based on the AOR's from the individual countries (The random effects meta-analysis accounts for heterogeneity between countries, $p < 0.0005$.). All the statistical analyses were conducted using STATA v.12.0.

Results

Descriptive statistics

Of the participants employed indoors outside the home, the percentage reporting a smoke-free workplace was 83% in Uruguay, 81% in Mexico, 76% in Brazil, 74% in Thailand, 70% in India, 68% in Ukraine and Philippines, 66% in Romania and Poland, 64% in Russian Federation, 63% in Turkey, 44% in Viet Nam, 40% in Egypt and 35% in Bangladesh and China (data not shown). In all the 15 LMICs, the percentage of participants living in a smoke-free home was higher among those employed in a smoke-free workplace compared with those employed in a workplace where smoking occurred (Fig. 1, Table 1). Among participants employed in a smoke-free workplace, the percentage living in a smoke-free home varied from 21% in China to 75% in Mexico. Among participants employed in a workplace that was not smoke-free, the percentage living in a smoke-free home varied from 9% in China to 69% in Mexico. Table 1 describes the country-specific percentages of participants reporting living in smoke-free homes by their socio-demographic characteristics.

Multiple logistic regression analysis

There were significant positive associations between being employed in a smoke-free workplace and living in a smoke-free home in all the LMICs except Uruguay and Mexico (Fig. 2, Table 2). The AOR estimates ranged from 1.12 [0.79–1.58] in Uruguay to 2.29 [1.37–3.83] in China. The pooled AOR for the all-country data was 1.61 [1.46–1.79].

Female participants were less likely than males to live in a smoke-free home in most LMICs but associations were only significant in India, Bangladesh, Brazil, Poland, Russian Federation, Turkey, Ukraine and Egypt. Participants from urban settings in India, Thailand, China, Philippines, Viet Nam, Brazil and Egypt were significantly more likely