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Patterns, prevalence and determinants of environmental tobacco smoke exposure among adults in Bangladesh

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ABSTRACT

Background: Exposure to environmental tobacco smoke (ETS) has been suggested as a risk factor for various health problems. Thus, this study examines the patterns and predictors of ETS exposure among adults at home, workplace and public places.

Methods: The dataset covered a nationally representative sample of 9629 respondents extracted from the Global Adult Tobacco Survey. Diamond-shaped equiponderant graphs were used to exhibit the prevalence of ETS. In Logistic regressions, ETS exposure at home, workplace and public places were used as response variables. Demographic and socioeconomic variables, health knowledge about ETS, attitude towards ETS, perception of smoking restrictions were considered as predictors.

Results: Adults in higher age groups and females were less exposed to ETS. Better education, high wealth status, better health knowledge on ETS, practice of no smoking at home, and support smoking restrictions were significantly associated with lower ETS exposure at home. Those residing in rural areas and living with many people together were more likely to be exposed to ETS at home. In contrast with home and workplace exposure, adults with higher education, better wealth status, good knowledge on ETS, and support smoking restrictions experienced a high level of exposure at public places. Interestingly, results suggest that those with high levels of ETS exposure at home and workplace had lower exposure to ETS in public places.

Conclusions: ETS control should not be overlooked in public health policy. Protection from ETS at home is particularly important, given its impact on the attitude towards and awareness about ETS exposure at all places.

1. Introduction

Environmental tobacco smoke (ETS) exposure is one of the most common preventable health hazards in the community. The estimated attributable deaths due to ETS totaled 603,000, of which 28% were estimated to be children (WHO, 2009a, 2009b). Although ETS exposure is a well-known risk factor for cancer in adults, there is emerging evidence that it may also be associated with childhood cancers (Boffetta, Tredaniel, & Greco, 2000; Filippini et al., 2002; Krajinovic, Richer, Sinnett, Labuda, & Sinnett, 2000). ETS has been established as a causal risk factor for a number of health problems for women, and adults. In pregnant women, reduced fetal growth, low birth weight, pre-term delivery and sudden infant death were linked to ETS exposure (CEPA, 2005; Filippini et al., 2002). Other associated risks include: spontaneous abortion, intrauterine growth retardation, adverse impacts on cognition and behaviour, allergic sensitization, elevated decreased pulmonary function growth and adverse effects on fertility or fecundity, and elevated risk of stroke (CEPA, 2005). Smoking tobacco especially cigarette/*bidis*[1] is the principal source of exposure of nonsmokers or smokers to tobacco smoke. The burning cigarette produces smoke primarily in the form of mainstream smoke (MS), that is the smoke inhaled by the smoker during puffing and side stream smoke (SS), that is the smoke released by the smoldering cigarette while not being actively smoked (Eriksen, Mackay, & Ross, 2012). Nonsmokers or smokers are exposed to the combination of diluted SS that is released from the cigarette's burning end and the MS exhaled by the active smoker (First, 1985). This mixture of diluted SS and exhaled MS has been referred to as ETS. Exposure to ETS is also commonly referred to as passive or involuntary smoking. Over 3000 different chemicals, including irritant gases, carcinogens and fine particles are contained in tobacco smoke (WHO, 2009a, 2009b). Nonsmokers or smokers who live or work with a smoker generally have the greatest exposure to ETS. Although ETS in

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[1] Consist of a small amount of crushed tobacco, hand-wrapped in dried *temburni or tendu* leaves, and tied with string. It tends to deliver more tar and carbon monoxide than manufactured cigarettes because users must puff harder to keep them lit. *Bidis* are mostly used in South Asian countries.

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public places is important as a nuisance, it usually contributes only a small amount to personal ETS exposure (WHO, 2009a, 2009b).

In addition to a large and growing health burden, ETS exposure also imposes economic burdens on individuals and countries, both for the costs of direct health care as well as indirect costs from reduced productivity (WHO, 2009a, 2009b). Literature showed socio-economic and demographic factors, and knowledge, attitude and perception (KAP) towards ETS to significantly influenced the exposure level (Abdullah et al., 2011; Bolte et al., 2009; Hyland et al., 2009; Sims et al., 2010; Akhtar, Currie, Currie, & Haw, 2007; Rachiotis et al., 2010; Rudatsikira, Siziya, Dondog, & Muula, 2007; Mei et al., 2009; Oberg, Jaakkola, Woodward, Peruga, & Pruss-Ustun, 2011; Mak, Loke, Abdullah, & Lam, 2008; Liu et al., 2008; Chen et al., 2009).

Like direct smoking, ETS was linked to enormous health problems among adults (Eriksen et al., 2012; Oberg et al., 2011; WHO, 2010a, 2010b, 2010c). Evidence shows that the ETS problem is also serious in Bangladesh compared to developed countries and this is due to population density, lower level of knowledge and awareness, lack of strict public law enforcement (Oberg et al., 2011; WHO, 2010a, 2010b, 2010c). Numerous studies have been conducted on ETS and their adverse health effects in many developed countries and some middle-income countries. However, comprehensive research on developing countries where their consequences are serious lags behind. Research on ETS and its influencing factors in Bangladesh are scarce and limited to micro level data. Thus, this study examines the patterns and predictors of ETS exposure among adults at home, workplace and public places. Moreover, the factors identified in this study based on nationally representative data will help to fill the research gap and also offer helpful insights for the design and implementation of smoke free environment in Bangladesh and can replicate to other developing countries for policy action.

2. Materials and methods

2.1. The data and sampling

The data for this study were obtained from Global Adult Tobacco Survey-2009. The detailed methodology of data collection, sampling procedure, questionnaires and relevant information were reported in GATS Bangladesh report (WHO, 2010a, 2010b, 2010c). Briefly, based on the sampling frame from Bangladesh Bureau of Statistics, the implementing agency of Bangladesh population census in 2001, the GATS was a three-stage stratified cluster sample of households. In the first stage, 400 primary sampling units (PSUs) (200 from rural and another 200 from urban areas) were selected with probability proportional to size. In the second stage, a random selection of one secondary sampling unit (SSU) per selected PSU was done. The SSUs were based upon the enumeration areas (EAs) from Bangladesh Agricultural Census (2008). Each EA's consisted of 200 households in rural areas and 300 households in urban areas. In the third stage, households were selected systematically within the listed households from a selected SSU (an average of 28 households to produce equal male and female households). The sample consisted of 11,200 non-institutional households from all 6 administrative divisions covering 95.5% of the total population. One respondent was randomly selected for interview from each selected eligible household to participate in the survey. About 10,751 (96.0%) households and 9629 (86.0%) individuals successfully completed the interview. The sample design for GATS Bangladesh provides cross-sectional estimates for the country as a whole as well as by urban, rural and gender.

2.2. The tools of data collection

GATS in Bangladesh used two types of questionnaires, namely, household and individual. The questionnaires were based on GATS core and optional questions. The Ministry of Health & Family Welfare of Bangladesh with the consultation of local agencies (NIPSOM, NIPORT, BBS) and international collaborators such as WHO South East Asia Regional Office and Centers for Disease Control and Prevention conducted the survey. The survey used electronic system (handheld computer) that facilitated the complex skip pattern used in the GATS questionnaire, as well as some in-built validity checks on questions during the data collection. The main steps involved in quality control checks were: version checking for household and individual questionnaires, checking date and time, skipping patterns and validation checks. To improve representativeness of the sample in terms of the size, distribution and characteristics of the population, the data were suitably weighted. The weights were derived from design weight, household and individual response rates. The detailed weighting procedure can be found in Global Tobacco Surveillance System (GTSS), Global Adult Tobacco Survey (GATS): Sample Design Manual & Sample Weights Manual (WHO, 2010a, 2010b, 2010c).

2.3. The dependent and predictor variables

ETS at different settings, namely, home, workplace, and public places was considered as the response variable. Exposure at other places was excluded from bivariate and multivariate analysis due to small number of cases. Following the theory and literature on ETS exposure, and the nature of supporting data, predictors namely, age, gender, household members, residence, education, wealth index, general and specific health knowledge about ETS exposure, attitude about ETS at home and workplace, and perception of smoking restrictions at some places were selected for current study. The detailed of the variables and their coding for analysis are given in Table 1.

2.4. Statistical analyses

Statistical analyses were performed using SPSS version 20 (SPSS Inc., Chicago, IL). Frequency runs were generated to compute the prevalence of ETS at three settings. Diamond-shaped equiponderant graphs were used to exhibit the prevalence of ETS (Li, Buechner, Tarwater, & Muñoz, 2003). Bivariable analyses using cross tabulations were also performed to obtain the prevalence of ETS for various categories of the selected variables and to identify significant determinants using the Pearson's Chi-square (χ^2) test (Chan, 2003). Determinants that significantly explain ETS at three settings were entered into the logistic regressions for multivariable analyses (Chan, 2004). We utilized three binary logistic regression models separately for three different settings (Model A: exposed at home, Model B: exposed at workplaces, and Model C: exposed at public places).

The general logistic regression model is given by:

$\Pr(Y_i = 1) = \frac{\exp(X_i\beta)}{1+\exp(X_i\beta)}$ where Y_i is a binary variable that takes a value of '1' if the respondent is exposed ETS and '0' otherwise, X_i is a vector of independent variables and β is a vector of unknown parameters.

The estimated form of regression is as:

$$\ln\left[\frac{P_i}{1-P_i}\right] = \beta_0 + \beta_1 X_1 + \ldots + \beta_k X_k \quad (1)$$

The odds ratio (OR) in favour of $Y_i = 1$ together with its 95% confidence interval (CI) were computed for X_1, X_2, …, X_k to indicate how many times the group of interest is more likely to be exposed ETS compared to the reference group.

To examine the association between tobacco consumption (TC) and ETS after controlling for predictors used earlier, another model is as:

$$\Pr(Y_i = 1) = \mu + \alpha X_i + \beta_1 Z_1 + \beta_2 Z_2 + \ldots + \beta_k Z_k \quad (2)$$

where $Y_i = 1$ if respondent-i is exposed ETS and 0 otherwise, $X_i = 1$ if respondent-i is a tobacco users and 0 otherwise, and Z_1, Z_2, …, Z_k are variables used earlier as predictors that affect ETS. For instance, Y_i was