

## Does Grameen Bank Membership change Secondhand Smoke Exposure Among Women in Bangladesh?

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### Abstract

**Background:** Reduction in secondhand smoke (SHS) exposure leads to better health and economic outcomes due to reduced healthcare expenditures and increased productivity. In Bangladesh, 53.5 percent of women of reproductive age reported SHS exposure. Bangladesh also has high levels of poverty. Minimal research exists on Bangladeshi women who are microfinance loan recipients and the SHS exposure they experience.

**Objective:** This study assesses whether secondhand smoke (SHS) exposure among women of reproductive age (13-49) in Bangladesh is correlated with membership to the Grameen Bank.

**Methods:** This is a cross-sectional study that uses data collected in the 2011 Bangladesh Demographic Health Survey. A logit regression model was used for analysis. Stata v14 was used. To account for the complex sample design, survey commands were applied.

**Findings:** Grameen Bank membership was statistically associated with in-home smoke exposure, controlling for all covariates in the study (OR=1.31,  $p<0.01$ ). Several other factors were also statistically associated with in-home smoke exposure including urban residence (OR= 1.17,  $p<0.05$ ); living in Sylhet (OR= 2.92,  $p<0.01$ ), and living in Dhaka (OR= 2.53,  $p<0.01$ ). Some variables were protective against in-home smoke exposure such as being widowed (OR=0.20,  $p<0.01$ ), being divorced (OR= 0.52,  $p<0.01$ ), and no longer living with spouse/separated (OR=0.53,  $p<0.01$ ).

**Conclusions:** This is the first study to use a multivariate regression model to show microcredit access, using Grameen Bank membership as a proxy, is correlated with in-home smoke exposure among Bangladeshi women of reproductive age. This suggests a need for education on the risks of SHS exposure for adults in these households. This also suggests similar investigations should be conducted in other low- and middle-income countries with microfinance programs and populations with high susceptibility to smoking tobacco products.

### Background

Exposure to tobacco smoke, even if an individual does not smoke herself, can cause serious health and public health problems. Secondhand smoke (SHS) exposure (SHSe), also referred to as environmental tobacco smoke, is defined as exposure to fumes from smoking tobacco products by a nonsmoker.<sup>1</sup> The health effects can be the same as what an active

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<sup>1</sup> Office on Smoking and Health, *Introduction, Summary, and Conclusions* (Centers for Disease Control and Prevention (US), 2006, 2006). <https://www.ncbi.nlm.nih.gov/books/NBK44328/files/380/NBK44328.html>.

smoker would experience; for example, some of the health effects of SHS exposure in adults, causally linked, are: stroke, lung cancer, and coronary heart disease.<sup>2</sup> Some health effects among children, all of which are causally linked, include: inner ear problems, impaired lung function, lower respiratory disease, sudden infant death syndrome, and more frequent and extreme asthma attacks. SHS exposure is associated with low birth weight in children exposed in-utero, and has also been statistically associated with lower IQ.<sup>3</sup> The long-term effects are more pronounced in children because their bodies are still developing, and because the volume of smoke inhaled per pound of body weight is more than that of adults. In Bangladesh, more than 435,000 children (below age 15) are afflicted with tobacco-related diseases, and more than 61,000 cases (14 percent) are attributable to SHS exposure at home.<sup>4</sup>

Secondhand smoke exposure is associated with reduced productivity among individuals and high healthcare costs at the national level. From 2017 to 2018, deaths and the burden of tobacco-induced diseases cost the economy of Bangladesh 305.6 billion Bangladeshi Taka (BDT), equivalent to \$3.6 billion U.S. Dollars.<sup>5</sup> This is 1.2% the size of Bangladesh's gross domestic product, which is \$302.6 billion USD, as of 2019.<sup>6</sup> In addition, SHS exposure accounted for 41.3 percent of total health costs. Children and adults both experience reduced health outcomes, and this translates to loss in gross economic output from lost productivity and high healthcare costs associated with the treatment of tobacco-induced diseases. In addition, it has been shown that households that use tobacco spend less on food, energy, and education among other expenditures than non-tobacco households.<sup>7</sup>

Socio-economic status is a significant determinant of SHS. In Bangladesh, 38 percent of the population is considered extremely poor.<sup>8</sup> A study from 2010 in Bangladesh, which used the International Tobacco Control Policy Evaluation Survey, found that non-smokers who made between 5,000-10,000 Taka a month were at higher odds of secondhand smoke exposure (OR=2.34) compared to those who made less than 5,000 taka per month (OR=1.00), and those who made greater than 10,000 taka per month (OR=2.28).<sup>9</sup> Prevalence of exposure to SHS for participants that had an income of less than 5,000 taka per month was 44.6 percent; for participants that had an income between 5,000 and 10,000 taka per month, 49.2 percent; and

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<sup>2</sup> CdctobaccoFree, "Health Effects of Secondhand Smoke," *Centers for Disease Control and Prevention* (2017/01/11/ 2017),

[https://www.cdc.gov/tobacco/data\\_statistics/fact\\_sheets/secondhand\\_smoke/health\\_effects/index.html](https://www.cdc.gov/tobacco/data_statistics/fact_sheets/secondhand_smoke/health_effects/index.html)  
files/206/index.html.

<sup>3</sup> F. P. Perera et al., "Prenatal Airborne Polycyclic Aromatic Hydrocarbon Exposure and Child IQ at Age 5 Years," *PEDIATRICS* 124, no. 2 (2009/08/01/ 2009), <https://doi.org/10.1542/peds.2008-3506>,  
<http://pediatrics.aappublications.org/cgi/doi/10.1542/peds.2008-3506>.

<sup>4</sup> G. M. Faruque et al., "Economic cost of SHS exposure in terms of healthcare costs," (2019/02/23/ 2019).

<sup>5</sup> Ibid

<sup>6</sup> "Bangladesh Data," 2020, 2020, <https://data.worldbank.org/country/bangladesh>.

<sup>7</sup> Muhammad Jami Husain et al., "Money Gone Up in Smoke: The Tobacco Use and Malnutrition Nexus in Bangladesh," *Annals of Global Health* 82, no. 5 (2016/09/01/ 2016), <https://doi.org/10.1016/j.aogh.2016.07.005>,  
<http://www.sciencedirect.com/science/article/pii/S2214999616307548>  
files/117/S2214999616307548.html.

<sup>8</sup> Training National Institute of Population Research and, Associates Mitra and, and I. C. F. International, "Bangladesh Demographic Health Survey 2011," (NIPORT, Mitra and Associates, and ICF International, 2013 2013).

<sup>9</sup> Abu S. Abdullah et al., "Correlates of exposure to secondhand smoke (SHS) at home among non-smoking adults in Bangladesh: findings from the ITC Bangladesh survey," *BMC pulmonary medicine* 14 (2014/07/16/ 2014), <https://doi.org/10.1186/1471-2466-14-117>, <http://www.ncbi.nlm.nih.gov/pubmed/25027238>.

for participants with an income greater than 10,000 taka per month, SHS exposure was 39.5 percent. In another study, on the other hand, where wealth was defined in “poor”, “middle”, and “rich” wealth divisions, women in the Poor wealth quintile levels had 2.08 times higher odds of daily SHS exposure than women in the Rich group, and women in the middle group had 1.44 times higher odds of exposure than women in the Rich group.<sup>10</sup>

Bangladesh also has low levels of completed education among women. Approximately 57 percent of women in Bangladesh were reported to have completed less than or up to their primary education.<sup>11</sup> As this relates to SHS exposure, women with no education had 2.3 times higher odds of daily exposure to SHS than those with higher education.<sup>12</sup>

To combat poverty and promote women empowerment in Bangladesh, non-profit and community organizations provide financial support. The Grameen Bank is a community development bank that provides microcredit to the poor and women, who traditionally have been excluded from commercial banks.<sup>13</sup> The Grameen Bank, for example, provides microcredit to support businesses and agricultural ventures.<sup>14</sup> Over 97 percent of their clientele are women.<sup>15</sup> Studies suggest that participation in a microcredit is associated with increased income and is also utilized for consumption smoothing, which is the ability to deal with short-term financial difficulties.<sup>16</sup>

In the 2011 Bangladesh Demographic Health Survey (DHS), participants were asked whether they belonged to women’s organizations.<sup>17</sup> Previous studies suggest positive health outcomes among women and children are associated with borrowing from a microfinance institution (MFI). For example, participation in microcredit programs has been linked with increased health knowledge among borrowers.<sup>18</sup> Participation in microcredit programs has also been linked with increased arm circumference of both boys and girls,<sup>19</sup> increased knowledge on

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<sup>10</sup> Florian Fischer et al., "Prevalence and determinants of secondhand smoke exposure among women in Bangladesh, 2011," *Nicotine & Tobacco Research: Official Journal of the Society for Research on Nicotine and Tobacco* 17, no. 1 (2015/01// 2015), <https://doi.org/10.1093/ntr/ntu129>, <http://www.ncbi.nlm.nih.gov/pubmed/25125322>.

<sup>11</sup> Ibid.

<sup>12</sup> Ibid.

<sup>13</sup> "Introduction | Grameen Bank," <http://www.grameen.com/introduction/files/230/introduction.html>.

<sup>14</sup> Ibid.

<sup>15</sup> Ibid.

<sup>16</sup> "Role of microcredit and microfinance in the eradication of poverty," (2008/07/29/ 2008), <http://digitallibrary.un.org/record/634648>.

<sup>17</sup> National Institute of Population Research and, Mitra and, and International, "Bangladesh Demographic Health Survey 2011."

<sup>18</sup> Priya Nanda, "Women's participation in rural credit programmes in Bangladesh and their demand for formal health care: is there a positive impact?11," *Health Economics* 8, no. 5 (1999 1999), [https://doi.org/10.1002/\(SICI\)1099-1050\(199908\)8:5<415::AID-HEC450>3.0.CO;2-L](https://doi.org/10.1002/(SICI)1099-1050(199908)8:5<415::AID-HEC450>3.0.CO;2-L), <https://onlinelibrary.wiley.com/doi/abs/10.1002/%28SICI%291099-1050%28199908%298%3A5%3C415%3A%3AAID-HEC450%3E3.0.CO%3B2-L> files/352/(SICI)1099-1050(199908)85415AID-HEC4503.0.html.

<sup>19</sup> Mark M. Pitt et al., "Credit Programs for the Poor and the Health Status of Children in Rural Bangladesh\*," *International Economic Review* 44, no. 1 (2003 2003), <https://doi.org/10.1111/1468-2354.t01-1-00063>, <https://onlinelibrary.wiley.com/doi/abs/10.1111/1468-2354.t01-1-00063> files/361/1468-2354.html.

respiratory illness among borrowers,<sup>20</sup> and increasing immunization coverage for children and women of reproductive age.<sup>21</sup>

Although the beneficial health impact of MFI services has been studied in the past, minimal papers exist on SHS exposure among microfinance borrowers. The only study found to examine this issue did a bivariable analysis and found that 53 percent of MFI loan recipients were exposed to SHS.<sup>22</sup>

The gap in prior knowledge on this subject is troublesome because there is a high prevalence of smoking in Bangladesh, a low and middle-income country (LMIC), where 19.4 percent— 37 percent of males smoke and 0.9 percent of women— of the population smoke.<sup>23</sup> There is a major difference between the smoking prevalence among women and men, which is another reason to investigate SHSe among women. Evidence also is not clear whether increased income or increased wealth status and the risk of SHSe applies to Grameen Bank members.

There also have not been many negative health risks reported with the participation in microcredit programs in the past. As a result, this study will aim to understand the relationship between SHSe among women of reproductive age and Grameen Bank membership to assess whether women who are Grameen Bank members have higher odds of exposure to in-home SHS than non-Grameen Bank members. Since women were the 2011 Bangladesh Demographic Health Survey (BDHS) participants and because women constitute a majority of Grameen Bank members, they will be the focus of the study.

This analysis will help answer whether there should be a tobacco and SHS exposure education policy for women with a Grameen Bank account or access to microfinance through other institutions. These findings may apply to MFI members in other South Asian countries.

## **Methods**

### *Data Source*

Data were obtained from the 2011 Bangladesh Demographic Health Survey. The BDHS is a two-stage stratified nationally representative survey of the population. More information about the questionnaire methodology can be found elsewhere.<sup>24</sup> The survey was given to 17,811 ever-married girls and women of reproductive age, ages 12 to 49.

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<sup>20</sup> A. Hadi, "Integrating prevention of acute respiratory infections with micro-credit programme: Experience of BRAC, Bangladesh," *Public Health* 116, no. 4 (2002/07/01/ 2002), <https://doi.org/10.1038/sj.ph.1900863>, <http://www.sciencedirect.com/science/article/pii/S0033350602900739> files/366/S0033350602900739.html.

<sup>21</sup> Anna T. Schurmann and Heidi Bart Johnston, "The Group-lending Model and Social Closure: Microcredit, Exclusion, and Health in Bangladesh," *Journal of Health, Population, and Nutrition* 27, no. 4 (2009/08// 2009), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2928107/>.

<sup>22</sup> Abdullah et al., "Correlates of exposure to secondhand smoke (SHS) at home among non-smoking adults in Bangladesh."

<sup>23</sup> Nigar Nargis et al., "Prevalence and Patterns of Tobacco Use in Bangladesh from 2009 to 2012: Evidence from International Tobacco Control (ITC) Study," *PLoS One* 10, no. 11 (2015 2015), <https://doi.org/10.1371/journal.pone.0141135>, <http://www.ncbi.nlm.nih.gov/pubmed/26559051>.

<sup>24</sup> National Institute of Population Research and, Mitra and, and International, "Bangladesh Demographic Health Survey 2011."

The survey was conducted in, at the time, all seven administrative divisions of Bangladesh.<sup>25</sup> The study utilizes the household and individual questionnaires that detail the subject's sociodemographic background, health, and child information, among other metrics. In addition to 2011, similar surveys were given in other years: 1997, 2001, 2007, and 2014. The 2014 survey was not used because it does not include all variables of interest. The household survey contained the variable on in-home smoke exposure while all remaining questions were in the individual survey. Since the individual and household surveys both contained variables included in the conceptual model (Figure 1), the two datasets were merged.

Figure 1.

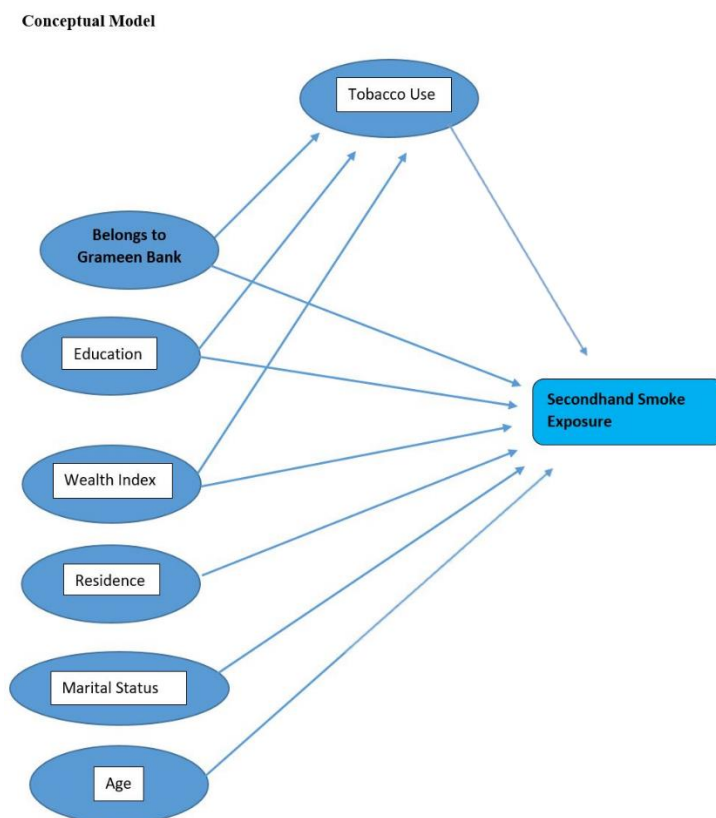


Table 1 provides the list of variables used in the study. The predictor variable of interest, Grameen Bank membership, is based on the individual survey question that asked whether individuals belonged to the Grameen Bank (Table 1). Variables were selected based on the

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<sup>25</sup> Ibid.

health belief model and based on the literature on predictors of SHS exposure.<sup>26,27, 28</sup> The bivariable analysis from Fischer et al. suggests that age, location of residence, wealth quintile, whether the respondent works, and marital status have a statistically significant relationship with SHS exposure.<sup>29</sup>

The data had svyset commands applied to them to make the effective sample size nationally representative. Statistics obtained during analysis may vary from the crude statistics as a result. Odds ratios (OR) are reported. STATA 14.0 was used to explore the dataset and conduct the analysis. The outcome variable selected was based on the question from the household survey that asked respondents to describe the frequency of in-home smoking (Table 1).

**Table 1: List of Variables used in Analysis**

Secondhand smoke exposure	Respondent exposed to in-home smoke from smoking products daily/weekly/monthly/less than monthly =1; no=0
Residence	Respondent lives in an urban area=1; Respondent lives in a rural area=2
Age	A continuous variable for age of respondent at the time of interview
Marital Status	Married=1; widowed=2; divorced=3; no longer living together/separated=4
Wealth Index	Poorest=1; Poorer=2; Middle=3; Richer=4; Richest=5
Grameen Bank Member	No=0; Yes=1
Administrative Division	Respondent lives in Barisal=1; Chittagong=2; Dhaka=3; Khulna=4; Rajshahi=5; Rangpur=6; Sylhet=7
Works	If the respondent did not work in the last 12 months=0; currently working=1; has a job, but on leave past 7 days=3
Education	The respondent completed no education=0; primary education=1; secondary education=2; above secondary education=3

Once general descriptive information was gathered, the relationship between the outcome variable and control variable were determined using a logistic regression. The base outcome was specified to be no exposure to SHS. Results with p-values less than 0.05 were considered to be

<sup>26</sup> "Health Communication | Health Belief Model," *Universiteit Twente*, <https://www.utwente.nl/en/bms/communication-theories/sorted-by-cluster/Health-Communication/Health-Belief-Model/files/217/Health-Belief-Model.html>.

<sup>27</sup> Fischer et al., "Prevalence and determinants of secondhand smoke exposure among women in Bangladesh, 2011."

<sup>28</sup> Abdullah et al., "Correlates of exposure to secondhand smoke (SHS) at home among non-smoking adults in Bangladesh."

<sup>29</sup> Fischer et al., "Prevalence and determinants of secondhand smoke exposure among women in Bangladesh, 2011."

statistically significant. The estimation sample utilized in the logistic regression analysis was used to obtain descriptive statistics of the sample population (Table 2).

**Table 2: Demographic Information among Women of Reproductive Age Sample, Bangladesh, 2011**

	<b>N (%)</b>
<b>Mean age (SD, range)</b>	30.75 (9.23, 13-49)
<b>Place of Residence</b>	
Urban	6,196 (26.01)
Rural	11,646 (73.99)
<b>Division</b>	
Barisal	2,065 (5.65)
Chittagong	2,863 (18.13)
Dhaka	3,082 (32.35)
Khulna	2,648 (12.02)
Rajshahi	2,605 (14.91)
Rangpur	2,467 (11.5)
Sylhet	2,081 (5.44)
<b>Marital Status</b>	
Married	17,000 (93.72)
Widowed	643(3.47)
Divorced	215 (1.22)
No Longer Living Together/Separated	279 (1.60)
<b>Grameen Bank Member</b>	
No	15,000 (86.73)
Yes	2,343 (13.27)
<b>Wealth Index</b>	
Poorest	3,092 (18.33)
Poorer	3,341 (19.67)
Middle	3,425(20.11)
Richer	3,764(20.60)
Richest	4,189(21.30)
<b>Highest Level of Education</b>	
No Education	4,629 (27.68)
Primary	5,324 (30.03)
Secondary	6,393 (34.96)
Higher	1,465 (7.34)
<b>In-Home Smoke Exposure</b>	
No	8,626 (46.5)
Yes	9,185 (53.5)
<b>Respondent worked in the Last Twelve months</b>	
No	15,000 (85.03)
In the past year	318 (1.83)
Currently Working	2,315 (12.86)
Have a Job, but on Leave Last 7 days	54 (0.29)

## **Results**

Respondents included in the estimation sample did not include respondents without answers to the coded questions. Therefore, the descriptive statistics for the estimation sample population may differ from the descriptive statistics of the 2011 BDHS survey population.

### *Univariate Analysis Results*

From this analysis, the mean age of the sample population was 30.75 years with a standard deviation of 9.23 years (Table 2). Among the study population, 93.72 percent were married (N=17,000). Approximately 6,196, or 26 percent of women, lived in urban areas, while the remaining respondents lived in rural areas (N=11,646). Approximately 27.68 percent

(N=4,629) reported no education, while 30.03 percent of the population (N=5,324) completed up to and including primary education. Approximately 53.5 percent (N=9,185) of respondents reported some level of exposure to tobacco smoke in the home. The descriptive statistics were similar to what was found in the literature.<sup>30,31</sup>

### *Bivariate Analysis results*

The number of Grameen Bank participants during analysis may vary from the crude number due to survey commands applied. Of the Grameen Bank participants, 97 percent were married, 2 percent were widowed, and 1 percent were divorced (Table 3). Among non-Grameen Bank members, approximately 93.21 percent were married. 22 percent of Grameen Bank members were in the Poorest wealth quintile, 25 percent were in the Poor wealth quintile, 23 percent belonged to the Middle wealth quintile, 20 percent were in the Richer wealth quintile, and 10 percent were in the Richest wealth quintile (Table 3). This shows even distribution of Grameen Bank (GB) members in the Poorest through Richer wealth quintiles.

Table 3. Selected Sociodemographic Variables of Grameen Bank Members and Non-Grameen Bank members (N=17,749)

VARIABLE	Grameen Bank Members (%)	Not Members (%)	Grameen Bank Members out of Total Study Population (%)
<b>Marital Status</b>			
Married	97.04	93.21	12.87
Widowed	1.96	3.78	0.26
Divorced	0.72	1.34	0.05
Separated/no longer living together	0.66	1.67	0.09
<b>Wealth Quintile</b>			
Poorest	22.46	16.80	2.98
Poorer	24.79	18.05	3.29
Middle	23.44	18.66	3.11
Richer	19.59	21.32	2.60
Richest	9.72	25.17	1.29
<b>Education level</b>			
No Education	31.60	25.53	4.19
Primary	34.16	29.27	4.53
Secondary	30.69	36.38	4.07
Higher	3.54	8.83	0.47
<b>Respondent Worked in the last 12 months</b>			
No	83.42	85.13	11.03
In the past year	2.34	1.70	0.31
Currently working	13.90	12.88	1.84
Have a job, but on leave last 7 days	0.34	0.30	0.00

<sup>30</sup> Ibid.

<sup>31</sup> Abdullah et al., "Correlates of exposure to secondhand smoke (SHS) at home among non-smoking adults in Bangladesh."



Among non-Grameen Bank members, 16.80 percent of non-Grameen Bank members belonged to the Poorest wealth quintile, and 18.05 percent belonged to the Poorer wealth quintile (Table 3).

### *Multivariable Analysis Results:*

A logistic regression analysis (logit) was performed. The odds ratio gives the probability of in-home smoke exposure relative to the probability of no exposure to in-home smoke, controlling for all other variables in this study. Those who lived in Sylhet had 2.92 times higher odds of being exposed than those living in Barisal (Table 4). Those who lived in all divisions other than Barisal had 2 times higher odds of SHS exposure (Table 4).

Women who were Grameen Bank members were at greater odds of SHS exposure than women who were not members: Grameen Bank members had 31 percent higher odds (OR=1.31,  $p<0.01$ ) of being exposed to SHS relative to study participants who were not Grameen Bank members, controlling for study variables (Table 4). In addition to this, women who were widowed had 5 times lower odds of exposure relative to married women, controlling for all other characteristics (Table 4).

Risk of exposure decreased with increasing education (Table 4). Compared to women who reported no education, women with higher education had 3 times lower odds of exposure controlling for other study variables. Women who completed up to secondary education had 1.78 times lower odds. Women that completed up to primary education had 1.3 times lower odds of being exposed compared to women who reported no education.

Risk of exposure decreased with increasing wealth quintile (Table 4). Women in the Richest wealth quintile had 2.13 times ( $p<0.001$ ) lower odds of exposure to SHS, relative to odds of no exposure, than women in the Poorest wealth quintile (Table 4). Results pertaining to wealth index had a  $p$ -value of less than 0.05, except for Poorer wealth quintile (OR=0.94). The results for whether a respondent worked were not significant.

[insert table 4 here]

### ***Discussion and Conclusions***

It was not expected that those who lived in any division, except Barisal, to have 2 times higher odds of in-home smoke exposure. By administrative division, those who lived in Sylhet had the highest odds of exposure with 2.92 times higher odds than respondents living in Barisal. Barisal, at the time, since Bangladesh added another administrative region in 2015, was the only region that did not have a border with a neighboring country; a majority of Bangladesh borders India.<sup>32</sup> It is possible that reduced border access made it more difficult for smoking tobacco products to be purchased from Indian vendors. This is supported by a previous study that found, compared to Dhaka non-slum areas, those living in non-tribal/non-border areas outside Dhaka had 2.19 times higher odds of exposure, while the odds of exposure for those in tribal/border areas was 4.36.<sup>33</sup> Another study found, using Sylhet as the reference group, there were lower odds of daily SHS exposure in all other regions, and all results were statistically significant except Dhaka.<sup>34</sup>

This is the first study to indicate a positive correlation between MFI membership, using Grameen Bank membership as a proxy, and secondhand smoke exposure using a model that controlled for other variables (OR=1.33). These findings suggest women of reproductive age, who are Grameen Bank members, are at greater risk of exposure to SHS than women of reproductive

<sup>32</sup> "Divisions of Bangladesh," in *Wikipedia*.

<sup>33</sup> Abdullah et al., "Correlates of exposure to secondhand smoke (SHS) at home among non-smoking adults in Bangladesh."

<sup>34</sup> Fischer et al., "Prevalence and determinants of secondhand smoke exposure among women in Bangladesh, 2011."

age who are not Grameen Bank members. A positive association between Grameen Bank membership and in-home smoke exposure among women of reproductive age could be due to household access to money to buy tobacco products, even if the Grameen Bank participant is not smoking herself. Another explanation could be smoking as a result of the stress of running a farm or small business.

The results of this study have important policy implications. Women are at risk, children they care for are at risk, as well as fetuses exposed during pregnancy. The population of Bangladeshi women ages 10-49 is 47,016,804.<sup>35,36</sup> The average number of children born to women in Bangladesh is 2.04,<sup>37</sup> and the prevalence of secondhand smoke exposure is 53.5 percent, which puts 51,867,528 children at risk of SHS exposure. As economic growth in Bangladesh increases but education remains low, loss in IQ points of 4.31, full-scale, and 4.67, verbal, would lead to a collective loss of 223,549,046.53 full-scale IQ points as a result of SHSe.<sup>38</sup> Among GB members' children, total full-scale IQ loss is 29,061,376.05. This could stymie future economic growth.

One suggestion is to incorporate health education into Grameen Bank membership; if health information is already provided by the Grameen Bank, information on SHS exposure needs to be incorporated in a stronger way. For example, other adult members of the household should also partake in health education programs. It is unclear who in the house is smoking. Women who were widowed had 5 times lower odds of exposure relative to married women. It is possible, given the power-dynamic in many Bangladeshi families which leaves women subordinate, the high smoking prevalence rate among men, and because men are often the head of household, they are smoking and need to be educated on the associated health risks.<sup>39</sup> If women were to possess this knowledge and say something to men, their requests often are not addressed; a study suggests that men are more likely to listen to children or to health professionals.<sup>40</sup> To learn the negative effects of SHSe from a health educator could help change smoking behavior. One study, including men and women, found that Bangladeshis who did not know SHSe causes lung cancer had 2 times higher odds of being exposed than those who knew.<sup>41</sup> This study also found that Bangladeshis that were "unconcerned/a little concerned" about smoking in the presence of children had 3.45 times higher odds of being exposed compared to Bangladeshis who were "very/extremely concerned".<sup>42</sup>

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<sup>35</sup> National Institute of Population Research and, Mitra and, and International, "Bangladesh Demographic Health Survey 2011."

<sup>36</sup> Bank, "Bangladesh Data."

<sup>37</sup> "Fertility rate, total (births per woman) - Bangladesh | Data," <https://data.worldbank.org/indicator/SP.DYN.TFRT.IN?locations=BDfiles/329/SP.DYN.TFRT.html>.

<sup>38</sup> Perera et al., "Prenatal Airborne Polycyclic Aromatic Hydrocarbon Exposure and Child IQ at Age 5 Years."

<sup>39</sup> Cath Jackson et al., "'He Doesn't Listen to My Words at All, So I Don't Tell Him Anything'—A Qualitative Investigation on Exposure to Second Hand Smoke among Pregnant Women, Their Husbands and Family Members from Rural Bangladesh and Urban India," *International Journal of Environmental Research and Public Health* 13, no. 11 (2016/11// 2016), <https://doi.org/10.3390/ijerph13111098>, <https://www.mdpi.com/1660-4601/13/11/1098files/126/htm.html>.

<sup>40</sup> Ibid.

<sup>41</sup> Abdullah et al., "Correlates of exposure to secondhand smoke (SHS) at home among non-smoking adults in Bangladesh."

<sup>42</sup> Abdullah et al., "Correlates of exposure to secondhand smoke (SHS) at home among non-smoking adults in Bangladesh."

SHSe decreased with increasing wealth quintile status; this finding is similar to findings from another study that found daily exposure to SHS decreased with increasing wealth quintile status.<sup>43</sup> Reduced economic output is particularly detrimental for Bangladesh because it already has high levels of poverty. Consistent with other studies, as education level rose, the odd of exposure to SHS decreased.<sup>44, 45, 46, 47</sup> Women that completed more than secondary education had the lowest odds of exposure (OR=0.33), followed by women that completed up to secondary education (OR=0.56), relative to women who had no education (OR=1.00). This is likely because as education increases, there is more awareness on the harmful effects of SHS exposure. Other studies suggest there is also more smoking among Bangladeshis with less education.<sup>48</sup>

Whether the respondent worked did not yield statistically significant results. Another study examined the prevalence of SHSe among Bangladeshi women found that daily exposure among women who worked was lower among women who did not work (OR=0.87, p=0.006). It is possible the sample size in this study was too small.

A limitation of the study is that although Grameen Bank membership is associated with SHSe, it is unclear how possessing credit is correlated with secondhand smoke exposure since causality cannot be inferred. Among Grameen Bank members, 83.40 percent reported not working, while 13.90 percent reported they were currently working (Table 3). Microcredit from the Grameen Bank could be used mostly for agricultural pursuits, which the respondent might not be reported as 'worked', but this is unclear. It is also possible new members had not received a loan yet, but were included in the dataset. If the analysis was done based on a question that asked respondents whether they have a microloan, then a better understanding as to whether financial gains from loans are connected with increased SHS exposure. An association could then be more directly made between possessing a microloan and in-home smoke exposure.

In earlier models, variables related to women empowerment, such as the respondent's role in making decisions on household purchases, whether they could go to the doctor or a relative's house alone, were included. These variables were highly correlated with marital status which resulted in collinearity. As a result, these variables were not included in the final model since marital status captures the same information. Given the information available, and the general trend that actions funded by microloans do provide income, it can be extrapolated that

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<sup>43</sup> Fischer et al., "Prevalence and determinants of secondhand smoke exposure among women in Bangladesh, 2011."

<sup>44</sup> Fischer et al., "Prevalence and determinants of secondhand smoke exposure among women in Bangladesh, 2011."

<sup>45</sup> Abdullah et al., "Correlates of exposure to secondhand smoke (SHS) at home among non-smoking adults in Bangladesh."

<sup>46</sup> Abu S. Abdullah et al., "Socioeconomic differences in exposure to tobacco smoke pollution (TSP) in Bangladeshi households with children: findings from the International Tobacco Control (ITC) Bangladesh Survey," *International Journal of Environmental Research and Public Health* 8, no. 3 (2011/03/ 2011), <https://doi.org/10.3390/ijerph8030842>, <http://www.ncbi.nlm.nih.gov/pubmed/21556182>.

<sup>47</sup> Mohammad Alamgir Kabir, Md Moyazzem Hossain, and Farhana Afrin Duty, "Patterns, prevalence and determinants of environmental tobacco smoke exposure among adults in Bangladesh," *Addictive Behaviors Reports* 8 (2018/09/12/ 2018), <https://doi.org/10.1016/j.abrep.2018.09.001>, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6139484/>.

<sup>48</sup> Roushney Fatima Mukti et al., "Score Based Risk Assessment of Lung Cancer and its Evaluation for Bangladeshi People," *Asian Pacific Journal of Cancer Prevention* 15, no. 17 (2014/09/15/ 2014), <https://doi.org/10.7314/APJCP.2014.15.17.7021>, <http://koreascience.or.kr/journal/view.jsp?kj=POCPA9&py=2014&vnc=v15n17&sp=7021>.

women included in this study, who were members, are likely to have experienced an increase in funds, short-term or long-term, compared to what they had available prior. A follow-up qualitative study could illuminate more understanding.

This paper provides evidence of the impact of SHSe on Bangladeshi women of reproductive age. This analysis will help answer whether there should be a tobacco education policy for women with a Grameen Bank account. These findings may apply to Grameen Bank members in other South Asian countries and LMICs with similar characteristics. In addition, further studies should illustrate the risk of SHS exposure among children in households involved in MFI programs, and examine the relationship between in-home smoke exposure and prevalence of respiratory illness and other tobacco-related injuries among children.

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**Table 4: Odds Ratio for Secondhand Smoke Exposure among Women of Reproductive Age in Bangladesh, 2011**

<u>VARIABLES</u>	<u>Odds Ratio</u> <u>(Standard Error)</u>
<b>Grameen Bank Member</b>	1.31*** (0.071)
<b>Age</b>	0.99*** (0.002)
<b>Residence</b> (ref group urban: rural)	1.17* (0.074)
<b>Division</b> (ref group: Barisal)	
Chittagong	2.23*** (0.231)
Dhaka	2.54*** (0.267)
Khulna	2.12*** (0.235)
Rajshahi	2.05*** (0.216)
Rangpur	2.21*** (0.251)
Sylhet	2.92*** (0.311)
<b>Marital Status</b> (ref group: Married)	
Widowed	0.20*** (0.023)
Divorced	0.52*** (0.084)
No longer living together/separated	0.53*** (0.083)
<b>Wealth Quintile</b> (ref group: Poorest)	
Poorer	0.94 (0.061)
Middle	0.76*** (0.048)
Richer	0.66*** (0.048)
Richest	0.47*** (0.041)
<b>Education</b> (Ref group: no education)	
Primary	0.77*** (0.039)
Secondary	0.56*** (0.033)
Higher	0.33*** (0.030)
<b>Worked</b>	
Worked in the past year	1.13 (0.152)
Currently working	1.04 (0.058)
Worked have a job but on leave the past 7 days	0.70 (0.251)

\*\*\*= p-value less than or equal to 0.01

\* = p-value less than or equal to 0.05

No star= p-value greater than 0.05

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