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CONTENTS

Paternal Tobacco Intake and Increased Risk of Adverse Health Effects Among Children in the *Chars* of Northern Bangladesh

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Abstract

The smoking habit of parents adversely affects the health of their children. These adverse health effects are significantly more extensive on children of a transient population residing on remote riverine islands (*chars*) of Bangladesh. This is due to low levels of literacy among the population, little to no regulations on tobacco advertisements in *chars* and a significant lack of awareness on the adverse effects of smoking. Utilizing a unique dataset, this paper looks into the extent of health effects such as stunting, underweight and wasting among the children due to their paternal smoking habits in these regions. Breath carbon monoxide content is used to measure paternal short-term tobacco intake to address recall and measurement bias concerns that arise from self-reported tobacco intake data. Using an ordered logistic regression, it is found that the children's odds of being severely stunted, as opposed to their joint odds of being of normal growth and moderately stunted, is increased 1.15 times with each level increase in paternal carbon monoxide content. The odds are 1.075 times greater of being severely underweight. No significant relation was, however, observed for the case of wasting.

Keywords: Riverine islands, tobacco intake, child weight, child health

Introduction

Since 2013, the Bangladesh Center for Communication Programs (BCCP), a non-profit Non-Governmental Organization (NGO) has been collaborating with the Bloomberg Initiative, the Bangladesh Tobacco Control Research Network and the Johns Hopkins Bloomberg School of Public Health, USA in implementing a Tobacco Control Research Grant Program in Bangladesh. The program aims to bring together researchers from across the country and offer grants to undertake tobacco control research.

As part of an initiative in January 2018, a grant was awarded to the Department of Economics and Social Sciences (ESS) of BRAC University to investigate the effectiveness of a unique rural anti-tobacco advocacy campaign catered towards the poor. This included a journal-keeping cessation practice designed to reduce tobacco consumption in the riverine islands (referred to as *chars* in the local language) of Gaibandha district of northern Bangladesh. The proposed advocacy campaigns aimed to nudge a sample of smokers by exposing them to graphic anti-tobacco household posters and Focus Group Discussions (FGDs) with a view to relaying associated health hazards. Additionally, the cessation intervention introduced a record keeping behavior of tobacco consumption on a daily basis, thereby inducing a cognitive awareness of tobacco intake.

As part of the investigation, ESS designed a questionnaire and conducted an enumeration in 985 households spread across 24 *chars* following a randomized two-stage cluster sampling design. The primary data contained information on, among others, tobacco consumption, exhaled carbon monoxide (CO) levels, education, household consumption expenditure, household characteristics, and anthropometric measures. This particular information permitted us to examine the health impact of parental tobacco use on children, specifically those aged between 0 and 59 months, using the unique primary data collected for the studies. To the best of our knowledge, this is the first study in Bangladesh where exhaled CO was measured directly in contrast to other known studies examining the effects of adult tobacco intake on child health which relied on self-reported tobacco use.

The rest of the paper is organized as follows: the next section highlights some prior significant work done in this area, the section that follows explains the study method, the one after that describes the data used, followed by a section that presents results. The last section concludes with a discussion and policy recommendations.

Tobacco Intake and Child Health in Bangladesh and Other Developing Countries

The relationship between adult tobacco intake and child health in developing countries has been examined in a number of studies. Utilizing a logistic regression framework, Best et al. (2008) investigated 438,336 Indonesian households and found that paternal smoking was associated with increased risks of being underweight and severely underweight as well as stunting and severe stunting in children up to 59 months in age. Kyu, Georgiades, and Boyle (2009) analyzed samples from seven developing countries and found that exposure to environmental tobacco smoke (generated by maternal tobacco use) and biofuel smoke was associated with stunting and severe stunting in children (up to 59 months). Similarly, Ikeda, Irie, and Shibuya (2013) examined stunting in a pooled sample of 10,366 Cambodian children (up to 59 months) using a multivariate, hierarchical, logistic model and found that maternal tobacco use was a contributory factor to stunting.

Focusing on a sample of 77,608 households in Bangladesh, Best et al. (2007) employed logistic regressions and found that parental tobacco use was associated with an increased risk of stunting, being underweight and wasting. Chowdhury et al. (2011) used a sample of 13,555 children aged under 60 months and found that paternal smoking was responsible for children's increased risks of stunting and for being underweight. While the sample sizes of all the mentioned papers are indeed impressive, the studies relied upon self-reported tobacco usage from respondents. This self-reporting is known to suffer from recall, and subsequently measurement bias (Muraven, 2010). This study, within the scope of the grant, utilizes directly measured exhaled CO which is a more accurate measure of the intensity of tobacco use (Deveci, Deveci, Acik, and Ozan, 2004; Erb, Raiff, Meredith, and Dallery, 2015). This approach of measurement also mitigates any recall bias which may adversely affect the results.

Study Method

The study was conducted in 24 *chars* (riverine islands) in Gaibandha district. The geological processes of erosion and accretion of rivers create sandbars which are generally known as *chars* in Bangladesh. Despite being transient landmasses, they are able to generate opportunities for establishing human settlements and create a scope to pursue agricultural activity (Sarker, Huque, Alam, and Koudstaal, 2003). *Char* regions were purposefully chosen for the greater study mentioned above, whose primary remit was the investigation of an anti-tobacco intervention, since being separated land masses, the chance of intervention spillover share lowered. The size of the selected chars reflected a balance between sample size and survey management.

All investigators and enumerators of the project were given training on "Protecting Human Subject Research Participants" as required by BRAC University. Ethical approval was obtained from the Institutional Review Board of the James P. Grant School of Public Health of BRAC University, a required ethical clearance certificate was also procured from the US National Institutes of Health (NIH). Informed written consent to participate in the interviews was obtained and participants were provided full and correct information regarding the purpose of the study, nature of information required, benefits of the study, confidentiality to be maintained and freedom to be exercised by the respondents during the interviews using their native language (Bengali).

Gaibandha has over 100 *chars* (at any given point in time the number of *chars* could vary since they are transient landmasses), out of which 24 were randomly chosen for the study. Given that *char* dwellers share similar socio-economic attributes and reside on similar geographic terrains, stratification at the *char* level is inherently optimal as the randomly chosen respondents would be representative of the population at large. Responses were taken from 42 randomly selected households from each *char*, following a skipping factor of 3 households, chosen so that each *char* could be entirely sampled, resulting in a total sample size of 985 households. The sample size is lower due to non-responses and a lower than estimated number of total households in certain *chars* due to out-migration of the residents during the enumeration process.

The sample size and cluster size chosen for the primary data collection was based on calculations done using the Optimal Design® software. Census data collected was used as a reference for determining the Standardized Effect Size equal to 0.32. Based on an Intra Cluster Correlation (ICC) of 0.07, obtained from the Global Adult Tobacco Survey (GATS) Bangladesh dataset, surveying 42 households from each of the 24 clusters provided us with a power of 83.5% at an $\alpha=0.05$ (a minimum of 33 households from each of the 24 clusters is required to maintain a power of 80%, which is the usual acceptable cutoff). Therefore, if an impact is statistically significant at exactly the 5% level, then we are 83.5% likely to detect the impact. Details of the sampling procedure can be found in Fakir et al. (2018) and the data used is publicly available in the Harvard Dataverse repository (Fakir, 2018).

Data Description

Exhaled CO was measured using the Smokerlyzer® (Bedfont Scientific, UK) portable device. The device measures breath CO levels in parts per million (ppm), the respondents were asked to exhale completely, inhale fully, and then hold their breath for 15 seconds before rapidly exhaling into a mouthpiece. After this procedure CO levels were reported in 7 different strata ranging from 0 to 31+ ppm. Advancement from one stratum to the next meant an increase in the concentration of CO levels in the blood. Based on the reported CO (ppm) measures, subjects were identified as being either a non-smoker, light smoker or regular smoker.

The weights (in kilograms) and heights (in centimeters) of children falling within the target age range were measured. *Z*-scores were calculated against height for age (stunting), weight for age (underweight), and weight for height (wasting) using Stata14. For comparison purposes the World Health Organization (WHO) child growth standards were used. If the calculated *Z*-score is greater than –2 standard deviations, the child is neither stunted nor underweight. If the *Z*-score is less than –2 standard deviations, but greater than –3 standard deviations, the child is moderately stunted or underweight, and a *Z*-score less than –3 standard deviations puts the child in the severe category.

The undertaken survey collected data not only on tobacco use as measured directly using CO levels but also on a range of personal and household characteristics. Table 1 summarizes the key variables mentioned above that were used in our analyses.

Ownership of assets would indicate an elevated economic standing, which is likely to have a positive bearing on child health (Fakir, 2016). In this study, land ownership information was used as an indicator of asset status. In *char* areas, in comparison to the functionally landless, landowners are in a better position to supplement their existing nutrition (from vegetable plots and fruit trees) and survive nutritional crises. The presence of more than one room in a household is expected to mitigate the adverse impact of second-hand smoke. Thus, the land ownership status of inhabitants and the number of rooms were included as controls.

Shared facilities such as kitchens are expected to affect child nutrition. If kitchens are shared, for example, cooking time gets rationed which not only puts an upper limit to the amount of cooked food which can be made, but also inhibits the preparation of food for children under five which needs separate preparation. Importantly, shared kitchens are located in close proximity to several households and used for extended periods. A greater volume of timber generated second hand smoke is thus created and possibly inhaled by children on top of the tobacco smoke created by their fathers. Shared kitchens and timber usage were therefore included as controls.

Table 1: Descriptive Statistics of Some Key Variables Used

Characteristics	**n**	**Smoker%**	**n**	**Non-smoker%**
CO Level				
0-6 ppm	14	5.2	35	79.5
7-10 ppm	15	5.6	1	2.3
11-15 ppm	17	6.3	4	9.1
16-20 ppm	12	4.5	0	0.0
21-25 ppm	21	7.8	2	4.5
26-30 ppm	22	8.2	0	0.0
31+ ppm	167	62.3	0	0.0
Child Age in months				
0-9	8	3.0	1	2.3
10-19	40	14.9	7	15.9
20-29	39	14.5	6	13.6
30-39	52	19.3	9	20.5
40-49	54	20.1	9	20.5
50-60	76	28.3	12	27.3
Maternal Age in years				
10-19	10	3.72	2	4.55
20-29	157	58.36	23	52.27
30-39	78	29.00	17	38.64
≥40	24	8.92	2	4.55
Maternal Education				
No education	120	45.1	12	27.3
Primary level of education	82	30.8	21	47.7
Secondary or higher level of education	64	24.1	11	25.0
Height-for-age (WHO Standard)				
Z score: Z > -2 (normal)	146	58.9	28	71.8
Z score: -2 ≥ Z > -3 (moderate)	67	27.0	10	25.6
Z score: Z ≤ - 3 (severe)	35	14.1	1	2.6
Weight-for-age (WHO Standard)				
Z score: Z > -2 (normal)	166	62.6	25	56.8
Z score: -2 ≥ Z > -3 (moderate)	55	20.8	15	34.1
Z score: Z ≤ - 3 (severe)	44	16.6	4	9.1
Weight-for-height (WHO Standard)				
Z score: Z > -2 (normal)	221	87.01	36	90
Z score: -2 ≥ Z > -3 (moderate)	27	10.63	4	10
Z score: Z ≤ - 3 (severe)	6	2.36	0	0

Table 1 continued				
Characteristics	**n**	**Smoker%**	**n**	**Non-smoker%**
Annual household consumption deciles (in BDT)				
Decile 1	45	16.7	5	11.4
Decile 2	41	15.2	6	13.6
Decile 3	29	10.8	12	27.3
Decile 4	30	11.2	3	6.8
Decile 5	26	9.7	2	4.5
Decile 6	24	8.9	1	2.3
Decile 7	19	7.1	7	15.9
Decile 8	24	8.9	3	6.8
Decile 9	19	7.1	3	6.8
Decile 10	12	4.5	2	4.5

Results

Since our outcome variables, stunting, underweight, and wasting, are ordinal in nature, we used an ordered logistic regression model to conduct our analysis. In order to assess the proportional odds assumption, we used the likelihood-ratio test of proportionality of odds across response categories and the Brandt test. For each of the three outcome variables, both tests yielded insignificant results (prob > Chi-squared is greater than 0.10) indicating that the ordered logistic model specification does not violate the proportional odds assumption. Further, we also calculated the variance inflation factor (VIF) to ensure our coefficients are not affected by multicollinearity between our control variables. The mean VIF for the full model specification is 1.29 with none of the individual control variable VIFs being greater than 2. With an acceptance cut-off of less than 10, this provides a high level of assurance that our model specification does not suffer from multicollinearity issues.

The results of the ordered logistic regression are shown in Table 2 below.

Table 2: Ordered Logistic Regression

Variables	Odds Ratio		
	Stunting	Underweight	Wasting
CO	1.15*** (0.04)	1.08* (0.05)	0.94 (0.07)
Weekly Tobacco Expenditure	1.00* (0.00)	1.00 (0.00)	1.00 (0.00)
Mother's Age	0.94** (0.02)	0.94*** (0.02)	1.04 (0.03)
Child's Age	1.00 (0.01)	1.01 (0.01)	0.99 (0.01)
Mother's Education	0.91*** (0.03)	0.94 (0.05)	1.06 (0.08)
Enrolled in School	0.45* (0.21)	0.45 (0.23)	0.66 (0.49)
Height of Mother (in cm)	0.97 (0.02)	0.98 (0.01)	1.02 (0.02)
Height of Father (in cm)	0.95** (0.02)	0.96** (0.02)	0.97 (0.03)
Annual Consumption	0.65 (0.25)	1.63 (0.52)	0.71 (0.35)
Female Child	1.14 (0.27)	1.28 (0.28)	1.69 (0.63)
Number of Children	1.17 (0.12)	1.22* (0.13)	0.81 (0.14)

Table 2 continued			
Land Ownership	0.69 (0.16)	0.65 (0.19)	1.46 (0.67)
Number of Rooms	0.87 (0.15)	0.89 (0.14)	1.28 (0.20)
Shared Kitchen	1.25 (0.40)	1.50 (0.45)	1.02 (0.60)
Timber Used for Cooking	0.87 (0.31)	0.76 (0.22)	0.76 (0.32)
Observations	285	307	292

Note: Robust clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Based on the regression results we can see that as the father's carbon-monoxide concentration increases by one level, the child's odds of being severely stunted versus the joint odds of being normal and moderately stunted are 1.15 times greater, which is statistically significant at the 1% level. The same change puts the child's odds of being severely underweight versus the joint odds of being normal and moderately underweight at 1.08 times greater, albeit at the 10% significance level. In addition, a one Bangladesh Taka (BDT) increase in weekly tobacco expenditure hardly changes the child's odds of being severely stunted (being 1.002 times greater, which is significant at the 10% level) and holds no significance in determining the child's odds of being underweight. Furthermore, a one-year increase in the mother's age slightly lowers the odds of being severely stunted, with an odds-ratio of 0.94 at moderate significance. We also observed that a one-year increase in mother's age slightly lowers the probability of being severely underweight, with an odds ratio of 0.94 which is highly significant. However, changes in the child's age and annual household consumption come out insignificant in determining the child's odds of being stunted or underweight.

Using available information, we also estimated regression results for wasting, but did not find any statistically significant association with any of the explanatory variables. As the health impact of exhaled CO was examined across seven different levels, it is possible to investigate the effects of the incremental levels on the child's health status. As wasting was not found to have a significant relationship with any of the covariates, we present the marginal effects of stunting and being underweight only, in the following table.

Table 3: Marginal Effects with Respect to CO Levels

	Stunting				Underweight		
Variables	Normal	Moderate	Severe		Normal	Moderate	Severe
CO							
1-6 ppm	-0.0256*** (0.0054)	0.0163*** (0.0037)	0.0093*** (0.0022)		-0.0145* (0.0081)	0.0071 (0.0044)	0.0074* (0.0038)
7-10 ppm	-0.0269*** (0.0060)	0.0165*** (0.0039)	0.0103*** (0.0027)		-0.0148* (0.0085)	0.0071 (0.0044)	0.0077* (0.0043)
11-15 ppm	-0.0280*** (0.0067)	0.0165*** (0.0039)	0.0115*** (0.0032)		-0.0151* (0.0089)	0.0070 (0.0044)	0.0081* (0.0047)
16-20 ppm	-0.0290*** (0.0071)	0.0163*** (0.0039)	0.0127*** (0.0038)		-0.0154* (0.0093)	0.0069 (0.0042)	0.0085 (0.0052)
21-25 ppm	-0.0298*** (0.0075)	0.0159*** (0.0036)	0.0140*** (0.0044)		-0.0156 (0.0096)	0.0067* (0.0041)	0.0089 (0.0057)
26-30 ppm	-0.0305*** (0.0077)	0.0151*** (0.0033)	0.0153*** (0.0051)		-0.0158 (0.0098)	0.0066* (0.0038)	0.0093 (0.0061)
31+ ppm	-0.0309*** (0.0078)	0.0141*** (0.0028)	0.0168*** (0.0059)		-0.0160 (0.0100)	0.0063* (0.0035)	0.0097 (0.0066)
Observations	285	285	285		307	307	307

Note: Robust clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

From the marginal effects presented in Table 3, increments in the level of CO concentration in the father's blood consistently lowers the probability of the child having a normal height and weight. As the father's exhaled CO concentration increases, the probability of the child having normal height and weight decreases starting from a 2.56% decrease in probability for the lowest level of concentration (1-6 ppm) and ending with a 3.09% decrease in probability for the highest level of concentration (31+ ppm) for the case of stunting at 1% significance level. We also observed a similar trend of a 1.45% to 1.54% decrease for the case of underweight at 10% significance level only for the first 4 levels. Furthermore, these increments consistently increase the probability of the child being severely stunted or underweight. The lowest level of CO (1-6 ppm) increases the child's probability of being severely stunted by 0.93%, and the highest level of concentration (31+ ppm) increases the probability by 1.68%, which are highly significant.

In the case of being underweight, the lowest level of concentration (1-6 ppm) increases the child's probability of being severely underweight by 0.74% and the highest level of concentration (31+ ppm) increases the probability by 0.97%. The changes in the probability of being underweight are significant at 10% for the lowest level of concentration (1-6 ppm) and for the subsequent two levels (7-10 ppm, 11-15 ppm). However, we find the probability of being underweight to be insignificant for the highest three levels of CO levels (21-25 ppm, 26-30 ppm, 31+ ppm). Figure 1 graphs the marginal effect trends with increasing CO levels for comparison.

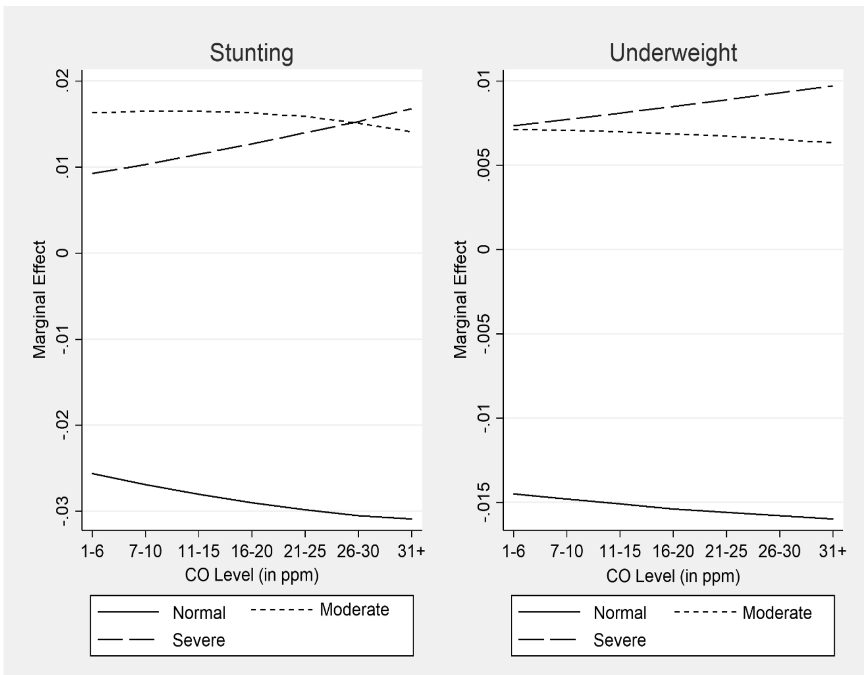

Figure 1: Marginal Effect Trends with Increasing CO Concentration Levels

Results show that an increase in exhaled CO of the father increases the probability of the child being moderately stunted for the first two levels of concentration (1-6 ppm, 7-10 ppm), the magnitude levels-off at a concentration of 11-15 ppm and gradually falls at higher concentrations, all values being highly significant. This suggests a lower limit of the CO concentration beyond which the child is pushed towards being severely stunted.

While Figure 1 provides the reader with a visual trend, it should be interpreted in conjunction with Table 3, since not all marginal effect values are statistically significant. The marginal effects of exhaled CO on normally underweight children show statistical significance for the first four levels, but not for the latter levels. This could be because the CO level has surpassed a threshold for a child to be of normal weight, resulting in few data points in that range. However, for the moderately underweight category, the marginal effects of increasing CO were found to be significant only for the latter levels, where the probability increments gradually lose magnitude from 21-25 ppm. The probabilities associated with the first four levels of CO are not statistically significant in the moderately underweight category. Turning our attention to the severely underweight category, the probabilities are seen to be continuously increasing, but only significant for the first three levels.

Discussion and Policy Recommendations

Utilizing directly measured carbon-monoxide, we find that while paternal smoking has statistically significant adverse effects on stunting and being underweight, the effect on wasting is not significant. Stunting is known to reflect the cumulative effects of undernutrition, infections and poor environmental conditions largely imparted during the growth of the child in-utero until the first 24 months after birth, with the effects generally being irreversible (Golden, 2009). The effects include, but are not limited to, delayed cognitive development and impaired motor functions (Mendez and Adair, 1999) as well as poor school performance (Hall et al., 2001). Paternal smoking can affect a child during the aforementioned critical phases primarily through second-hand smoking, thereby affecting the overall stunting of the child. Our findings are in agreement with the existing literature (Best et al., 2007; Chowdhury et al., 2011). Wasting, on the other hand, is the result of acute food shortage and is often an indicator of higher mortality. The avenues through which paternal smoking can affect wasting (wasting may result if expenditure on tobacco limits expenditure on food) are weaker compared to that of stunting. Unlike the earlier studies, we do not find any significant effect of paternal smoking on wasting. However, it is possible that this could be an outcome of the small sample size and is a matter for further investigation.

The findings are of grave concern, especially in the study area with a prevailing smoking rate of about 80% compared to the national average of 34% among men (Ng et al., 2014). While the *Amendment of Smoking and Tobacco Products Usage (Control) Act, 2013* explicitly bans any promotion of tobacco products in Bangladesh, enforcement of the Act itself is lax in our geographical area of study due to its relative remoteness, impediments to travel, and an absence of adequate on-site enforcement personnel. A wide variety of existing promotions for tobacco sales contributes to the high consumption and low quit rates in the region (Aziz, Fakir, and Khan, 2018). It is also a norm in the *chars* for agriculture employers to provide free *bidi* (a cigarette made of unprocessed tobacco leaves) packets to their employees every day before field work begins. With almost 77% of our sample involved in agriculture, we find 71% of our respondents to have received employer provided *bidis* during work. Such high rates of paternal tobacco consumption throughout the *chars* further accentuates its effects on child stunting.

The results imply that a targeted cessation intervention focusing on the *char* regions may be necessary to reinforce compliance with the anti-tobacco measures already in place following the passing of the *Tobacco Control Act, 2005* in Bangladesh. This is essential to minimize the sustained adverse effects of smoking, not only on the smokers themselves, but also on their children. Currently there is no proper anti-tobacco campaign targeting the rural poor in the *chars* of northern Bangladesh. Non-governmental organizations working in conjunction with government agencies could start focusing to resolve some of the enforcement issues.

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Conflict of Interest

All authors declare that they have no conflict of interest.

References

Aziz, M., Fakir, A., & Khan, A. (2018). *Tobacco tug-of-war: Anti-tobacco vis-à-vis tobacco sales promotion campaigns in the chars (riverine islands) of Bangladesh*. Working paper.

Best, C., Sun, K., de Pee, S., Bloem, M., Stallkamp, G., & Semba, R. (2007). Parental tobacco use is associated with increased risk of child malnutrition in Bangladesh. *Nutrition*, 23(10), 731–738.

Best, C., Sun, K., de Pee, S., Sari, M., Bloem, M., & Semba, R. (2008). Paternal smoking and increased risk of child malnutrition among families in rural Indonesia. *Tobacco Control,* 17(1), 38–45.

Chowdhury, F., Chisti, M., Hossain, M., Malek, M., Salam, M., & Faruque, A. (2011). Association between paternal smoking and nutritional status of under-five children attending Diarrhoeal Hospital, Dhaka, Bangladesh. *Acta Paediatrica*, 100(3), 390–395.

Deveci, S., Deveci, F., Açik, Y., & Ozan, A. (2004). The measurement of exhaled carbon monoxide in healthy smokers and non-smokers. *Respiratory Medicine,* 98(6), 551–556.

Erb, P., Raiff, B., Meredith, S., & Dallery, J. (2015). The accuracy of a lower-cost breath carbon monoxide meter in distinguishing smokers from non-smokers. *Journal of Smoking Cessation*, 10(1), 59–64.

Fakir, A. (2016). Revisiting the child health-wealth nexus. *Health Economics Review*, 6(1), 38.

Fakir, A. (2018). *Bangladesh Chars Tobacco Assessment Project (CTAP)*. Harvard Dataverse. 2018. https://doi.org/10.7910/dvn/yaav4x (Dataset)

Fakir, A., Aziz, M., Mubde, M., Karim, A., Khan, A., Raisa, R., Alim, L., & Fahmin, M. (2018). Bangladesh Chars Tobacco Assessment Project (CTAP) 2018: a data note. *BMC Research Notes*, 11(1), 914. http://doi.org/10.1186/s13104-018-4015-0

Golden, M. (2009). Proposed recommended nutrient densities for moderately malnourished children. *Food and Nutrition Bulletin*, 30(3 supplement), S267–S342.

Hall, A., Khanh, L., Son, T., Dung, N., Lansdown, R., Dat, D., & Bundy, D. (2001). An association between chronic undernutrition and educational test scores in Vietnamese children. *European Journal of Clinical Nutrition*, 55(9), 801–804.

Ikeda, N., Irie, Y., & Shibuya, K. (2013). Determinants of reduced child stunting in Cambodia: analysis of pooled data from three Demographic and Health Surveys. *Bulletin of the World Health Organization*, 91, 341–349.

Kyu, H., Georgiades, K., & Boyle, M. (2009). Maternal smoking, biofuel smoke exposure and child height-for-age in seven developing countries. *International Journal of Epidemiology*, 38(5), 1342–1350.

Mendez, M., & Adair, L. (1999). Severity and timing of stunting in the first two years of life affect performance on cognitive tests in late childhood. *The Journal of Nutrition*, 129(8), 1555–1562.

Muraven, M. (2010). Practicing self-control lowers the risk of smoking lapse. *Psychology of Addictive Behaviors*, 24(3), 446.

Ng, M., Freeman, M., Fleming, T., Robinson, M., Dwyer-Lindgren, L., Thomson, B., & Murray, C. (2014). Smoking prevalence and cigarette consumption in 187 countries, 1980-2012. *Jama*, 311(2),183–192.

Sarker, M., Huque, I., Alam, M., & Koudstaal, R. (2003). Rivers, chars and char dwellers of Bangladesh. *International Journal of River Basin Management*, 1(1), 61–80.