

COMPARATIVE HEALTH HAZARD ANALYSIS OF NON-TOBACCO AND TOBACCO PRODUCER IN MANIKGANJ DISTRICT OF BANGLADESH

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ABSTRACT

Tobacco farming people, especially women and children, suffer from specific kinds of respiratory diseases at the time of curing in direct sunlight or the fired-cured method. Tobacco cultivation is responsible for severe non-communicable diseases among tobacco producers and other people in tobacco-cultivated areas. To estimate the health costs of individuals in tobacco-cultivated areas, a cross-sectional and comparative study was undertaken among tobacco and non-tobacco farmers with family members in Manikganj districts. A total of 120 households were selected through a multi-stage cluster sampling technique, and each household head was interviewed face-to-face using a semi-structured questionnaire to gather information on households, family members, health hazards (categorized as severe, moderate, and mild), and farming. The quantitative data were analyzed using both descriptive and inferential statistical approaches. In this study, 120 households consisted of a total of 501 household members. About three-fifth (64.27%) of all household members suffered from tobacco-related sickness. The average treatment costs for non-tobacco and tobacco growers were BDT 5,015 and BDT 9,733.57, respectively. The average number of sick days and lost workdays were 17.74 and 9.82 for non-tobacco growers, compared to 20.17 and 12.29 for tobacco growers. The binary logistic regression results indicate that sicknesses were found to be a higher risk for tobacco growers at the severe level compared to non-tobacco growers. The health risks of tobacco farming, including green tobacco sickness and other issues caused by excessive exposure to pesticides, chemicals, tobacco dust, and long working hours; the severity of these issues increased during cultivation. Moreover, tobacco cultivation carries the risk of disease burden. To achieve a tobacco-free country by 2040, tobacco farmers should cultivate food crops that are profitable and no health hazard of the farmers from a broader perspective instead of cultivating tobacco.

Keywords: Health hazard, tobacco, logistic regression, sickness, smoke-free.

INTRODUCTION

Farmers who plant, cultivate and harvest tobacco are at risk of suffering from a form of nicotine poisoning known as "Green Tobacco Sickness". This symptoms causes nausea and vomiting that can lead to hospitalization and lost work time (Ballard *et al.*, 1995). Green tobacco sickness (GTS) is the condition that mainly affects the tobacco harvesters. It is caused by the absorption of nicotine through the skin while the workers are engaged in handling the uncured tobacco leaves (Fotedar S & Fotedar V 2017). It is estimated that 86% of the nicotine absorbed by the body is bio-transformed into cotinine, the main metabolite of nicotine, with a half-life of around 20 hours (Dhar P. 2004). For a season, in search of even more profits, the tobacco industry has encouraged countries and farmers to grow more tobacco (Dhar P. 2004). While the tobacco industry argues that tobacco farming is a major contributor to the country's economy, the seriously damaging health and environmental impacts caused by tobacco farming have been well documented (Mackay & Eriksen, 2005). The hazards posed by tobacco cultivation place tobacco workers at increased risk of injury and illness. Children and adults (mainly women) working with tobacco frequently suffer from green tobacco sickness (GTS), which is caused by dermal absorption of nicotine from contact with wet tobacco leaves. GTS is characterized by symptoms that may include nausea, vomiting, weakness, headache, dizziness, abdominal cramps, and difficulty in breathing, as well as fluctuations in blood pressure and heart rate (Kinh & Bales, 2002). Five parameters particulate matter (PM_{2.5}, PM₁₀), carbon dioxides (CO₂), volatile organic compounds (VOCs), temperature and humidity are measured and mentioned to reduce the air pollution (Sarker *et*

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al., 2022). Tobacco use is one of the major risk factors for non-communicable diseases. About 46.0% of adult males and 25.2% of adult females in Bangladesh use tobacco (WHO, 2019). In 2018, Bangladesh experienced nearly 126,000 deaths caused by tobacco-attributable diseases, accounting for around 13.5% of all-cause deaths in the population (Faruque *et al.*, 2020). To meet demand for tobacco leaf from both domestic and foreign manufacturers of tobacco products, the extent of tobacco cultivation remains considerably high. Bangladesh is the 12th largest tobacco producing country in the world [(Maps of world. 2018) & (Catfish, 2018) & (World list mania, 2018)]. Tobacco farming is growing fast and competing for the limited and fixed arable land of 37,674,000 acres. While in 2007–2008, a total of 72,000 acres of land was used for tobacco cultivation, it increased to 127,000 acres by 2014-2015—a 74% increase over seven years (BBS, 2016). In order to enforce the policies on tobacco control in Bangladesh, reliable information on the economic and health effects of tobacco farming is urgently needed. To the best of my knowledge, there remains no research on the health and economic impact of the tobacco on cultivators of tobacco cultivated area in Bangladesh. While all of the studies discussed about the harmful effects of tobacco cultivation on health and environment and regarded it as an important dimension, no attempt has been made to measure, compare or estimate it. Without these estimates, making decision by policymakers is not possible. By estimating five parameters (particulate matter (PM_{2.5}, PM₁₀), carbon dioxides (CO₂), volatile organic compounds (VOCs), temperature and humidity), by examining the relationship between tobacco and non-tobacco cultivation and self-reported illness in the study population between tobacco and non-tobacco around the year, this study will fill the evidence gap of tobacco cultivation. The findings of this study may be of use for evidence-based policy making against tobacco in Bangladesh and elsewhere.

Overall objective: To analyze the health hazard with comparison of non-tobacco and tobacco producers in Manikganj District of Bangladesh.

Specific Objectives

- i. To determine the health status of related individuals;
- ii. To estimate the economic cost of the adverse health effects of tobacco and non-tobacco farming households;
- iii. To compare the health hazard of tobacco and non-tobacco growers.

MATERIALS AND METHODS

Selection of the study area

A preliminary survey in Manikganj district, Bangladesh, was conducted to gather data on tobacco cultivation, with farmers randomly selected from various villages.

Sampling technique and sample size

Total 120 farmers were randomly selected taking 62 from tobacco farmers another 58 from non-tobacco farmers. A simple random sampling technique was followed in the present study for minimizing cost, time and to achieve the ultimate objectives of the study.

Preparation of the survey schedule:

A draft questionnaire was prepared for a survey, pre-tested by tobacco farmers, and revised with necessary amendments and alternatives.

Period of the study:

Data were collected during the period of August to September in 2022 through direct interview with the farmers. Data relating to inputs and outputs were obtained by making time to time visit in the study area.

Data collection method:

The study conducted a field survey with tobacco and non-tobacco farmers, involving interviews and systematic questions to gather relevant information for a scholarly analysis.

Processing, tabulation and analysis of data:

Data was manually coded, edited, and thoroughly analyzed using Microsoft Excel and SPSS (version 23), first obtained in local units and then translated into international units.

Analytical techniques

The study examines the impact of tobacco cultivation on the health of related individuals, using self-reported illness data from the last twelve months. A multivariate binary logistic regression model will determine relative risk, while a simple linear logistic regression will predict success.

model can be expressed as $\log_e \left[\frac{\pi(X_i)}{1 - \pi(X_i)} \right] = \beta_0 + \beta_1 X_i$

Where, the quantity $\pi(X_i) = E(y_i = 1 | X_i)$ represent the conditional probability that $Y=1$ given X and expressed as $\pi(X_i) = \frac{e^{\beta_0 + \beta_1 X_i}}{1 + e^{\beta_0 + \beta_1 X_i}}$.

If one consider a collection of p independent variables denoted by the vector $X=(X_1, X_2, \dots, X_p)$ then the multiple logistic regression model is given by the equation as

$$\log_e \left[\frac{\pi(X_i)}{1 - \pi(X_i)} \right] = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_p X_{pi}$$

RESULTS AND DISCUSSIONS

Health status

The overall prevalence of tobacco-related sickness stood at 63.7 percent for household members in tobacco cultivated area (Table 1). That's because this survey collected data on three different severity levels of illness—severe, moderate, and mild—and found that the aggregate of these three was higher in Manikganj. Taking into account the level of illness separately helped illustrate the causes which are shown below.

Table 1. Distribution of health status of the household population by farmer type

Symptom of Sickness of Total HH Member		Total HH Members
No.	%	No
319	63.7	501

Severe sickness:

The members who were working half of the working hours generally they were suffering severe weakness. In tobacco-cultivated areas, 22% of members suffered severe weakness, whereas 58.3% of tobacco-cultivated household members suffered severe weakness and non-tobacco cultivated household members was 47.7%. Severe nausea is a condition in which a person feels nauseous at the thought of eating. In tobacco-cultivated areas, 1.8% of members suffered severe nausea, where all were tobacco-cultivated household members (Table 2). When a person feels dizzy all the time when standing up, they are suffering from severe dizziness. In tobacco-cultivated areas, 3.7% of household members experienced severe vertigo, where all were tobacco-cultivated household members. A person is deemed to have a severe headache if they have head pain for the at least four hours per day. Approximately 2.8% of inhabitants in tobacco-growing regions reported experiencing severe headaches. Whereas, approximately 66.7% of residents living in tobacco-growing families suffered from excessive headaches, whereas the remainder were in non-tobacco-growing households. A person is considered to have severe upper abdominal pain when they feel pain in the upper abdomen half time a day or more. In areas where tobacco was grown, 6.4% of residents reported severe upper abdominal pain, whereas 57.1% of residents in tobacco-cultivated households suffered excessive upper abdominal pain, and the rest 42.9% of residents in non-tobacco-cultivated households suffered extreme upper abdominal pain. A person is considered to have severe lower abdominal pain when they feel pain in the lower abdomen half time a day or more. About 1.8% of residents reported severe lower abdominal pain in areas where tobacco was grown. While, approximately 50% of residents in non-tobacco-cultivated households suffered excessive lower abdominal pain, while the rest, 50% of tobacco-cultivated households, suffered extreme lower abdominal pain. When individuals suffer from acute insomnia, they do not

sleep for more than four hours day after day. In areas where tobacco was cultivated, 3.7 percent of residents suffered from severe insomnia, whereas half of severe insomnia was found in households where tobacco cultivation took place, and the remaining half of residents in households where tobacco cultivation did not take place suffered from extreme insomnia. People are deemed to have severe asthma when they cannot maintain regular breathing and experience difficult breathing throughout the day. In tobacco-growing regions, 5.5% of residents had severe asthma. In contrast, around 66.7% of people in tobacco-growing households suffered from severe asthma, compared to 33.3% of residents in non-tobacco-growing household. People with a heart rate that fluctuates more than 25 times per minute are at a significant risk for heart attacks and are deemed to have extremely high heart rates. In locations where tobacco was grown, approximately 11.9% of residents reported severely elevated heart rates, whereas 53.8% of residents in tobacco-cultivated households and 46.3% of residents in non-tobacco-cultivated households suffered from excessively high heart rates. People are believed to have excessive sweating; when they work, their bodies are typically drenched with sweat. In tobacco-growing regions, 11% of residents reported excessive perspiration. In comparison, 58.3% of those living in tobacco-growing households and 41.7% of those living in non-tobacco-growing households experienced excessive perspiration. When someone needs medication three times a day for their muscle discomfort, medical professionals classify their condition as severe. In regions where tobacco was grown, 12.8% of inhabitants reported having severe muscular pain, 64.3% of severe salivation symptoms were discovered in tobacco-cultivated households, and the remaining 35.7% of residents in non-tobacco-cultivated households' member suffered from extreme muscle pain. When a person eats food only once in a day, this is considered to be a serious loss of appetite. 2.8% of residents in areas where tobacco was grown reported having a severe loss of appetite, while 33.3% of severely lost appetite were found in households where tobacco was cultivated, and the remaining 66.7% of residents in households where tobacco was not grown had members who suffered from an extreme loss of appetite (Table 2). People are said to be suffering from acute itching since they are constantly scratching all over their bodies. About 4.6% of residents in areas where tobacco was grown reported having severe itching, whereas 80% severe itching was found in households where tobacco cultivation took place, and the remaining 20% of residents in households where tobacco cultivation did not take place suffered from extreme itching.

Table 2. Symptoms of Severe Sickness of the Household Population by Farmer Type

Severe Sickness	Tobacco		Non-Tobacco		Total	
	No.	%	No.	%	No.	%
Weakness	14	58.3	10	41.7	24	22.0
Nausea	2	100.0		0.0	2	1.8
Vomiting	1	100.0		0.0	1	0.9
Dizziness	4	100.0		0.0	4	3.7
Headache	1	33.3	2	66.7	3	2.8
Pain upper abdominal	4	57.1	3	42.9	7	6.4
Pain lower abdominal	1	50.0	1	50.0	2	1.8
Insomnia	2	50.0	2	50.0	4	3.7
Asthma	4	66.7	2	33.3	6	5.5
High heart rate	7	53.8	6	46.2	13	11.9
High sweating	7	58.3	5	41.7	12	11.0
Pale body	1	100.0		0.0	1	0.9
Extreme salivation	1	100.0		0.0	1	0.9
Muscle pain	9	64.3	5	35.7	14	12.8
Loss appetite	1	33.3	2	66.7	3	2.8
Itching	1	20.0	4	80.0	5	4.6
Others	1	12.5	7	87.5	8	7.3

Moderate sickness:

From table 3 in tobacco-growing regions, 17.8% of people reported feeling moderately weak, with 46.0% in tobacco-growing households and 54.0% in non-tobacco-growing households. Moderate nausea occurs between two and three times daily, with 1.4% experiencing mild to moderate nausea in tobacco-growing regions. Moderate vomiting occur when people throw up twice or three times a day, with 1.1% experiencing moderate vomiting. Moderate dizziness is a fleeting sensation of lightheadedness upon standing up, with 12.1% reporting moderate vertigo. Moderate headaches occur for less than four hours per day, with 12.4% in tobacco-growing areas and 54.5% in non-tobacco-growing households. Moderate upper abdominal pain occurs less than half the time a day, while moderate lower abdominal pain occurs less than half the time per day. Moderate insomnia affects 56.7% of people in tobacco-growing households and 43.3% in non-tobacco-growing households. Moderate heart rates fluctuate 24 to 25 times per minute, with 2.5% in tobacco-growing areas and 77.8% in non-tobacco-growing areas. People sweat moderately, with 44.4% in tobacco-growing households and 55.6% in non-tobacco areas. Moderate loss of appetite occurs when a person eats food 1-2 times a day, with 5.9% in tobacco-growing areas and 57.1% in non-tobacco-growing households. Moderate eye irritation occurs when more than 25% of the eyes itch, with 0.3% in tobacco-growing areas. (Table 3).

Table 3. Symptoms of Moderate Sickness of the Household Population by Farmer Type

Moderate Sickness	Tobacco		Non-Tobacco		Total	
	No.	%	No.	%	No.	%
Weakness	29	46.0	34	54.0	63	17.8
Nausea	2	40.0	3	60.0	5	1.4
Vomiting	2	50.0	2	50.0	4	1.1
Dizziness	25	58.1	18	41.9	43	12.1
Headache	24	54.5	20	45.5	44	12.4
Pain upper abdominal	5	50.0	5	50.0	10	2.8
Pain lower abdominal	1	33.3	2	66.7	3	0.8
Insomnia	17	56.7	13	43.3	30	8.5
Asthma	6	42.9	8	57.1	14	4.0
High heart rate	2	22.2	7	77.8	9	2.5
High sweating	4	44.4	5	55.6	9	2.5
Muscle pain	41	50.0	41	50.0	82	23.2
Loss appetite	12	57.1	9	42.9	21	5.9
Itching	7	43.8	9	56.3	16	4.5
Eye itching	1	100.0		0.0	1	0.3
Total						100.0

Mild sickness:

The study found that 16.9% of people felt weak in tobacco-growing regions, 50% in tobacco-growing households, and the rest in non-tobacco-growing households. Mild dizziness was reported by 18.3% of households, while 19.2% reported mild headaches. Upper abdominal pain was reported by 3.6% of residents, while insomnia affected 53.8% of people in tobacco-growing households. Muscular pain was reported by 7.5% of inhabitants, with 39.1% found in tobacco-growing households (Table 4). Overall, mild symptoms were prevalent in tobacco-growing regions, with varying degrees of severity in tobacco-growing and non-tobacco-growing households. In the majority of cases of mild sickness such as nausea, vomiting, upper abdominal pain, asthma, and muscle pain, non-tobacco growers suffered on a large scale because non-tobacco growers were residents of the same area and were affected by tobacco cultivation, particularly curing time.

Table 4. Symptoms of Mild Sickness of the Household Population by Farmer Type

Mild Sickness	Tobacco		Non-Tobacco		Total	
	No.	%	No.	%	No.	%
Weakness	26	50.0	26	50.0	52	16.9
Nausea		0.0	2	100.0	2	0.7
Vomiting		0.0	1	100.0	1	0.3
Dizziness	31	53.4	27	46.6	58	18.9
Headache	29	49.2	30	50.8	59	19.2
Pain upper abdominal	3	27.3	8	72.7	11	3.6
Pain lower abdominal	1	100.0		0.0	1	0.3
Insomnia	14	53.8	12	46.2	26	8.5
Asthma	4	40.0	6	60.0	10	3.3
High heart rate		0.0	3	100.0	3	1.0
High sweating	7	58.3	5	41.7	12	3.9
Pale body		0.0	1	100.0	1	0.3
Muscle pain	9	39.1	14	60.9	23	7.5
Loss appetite	22	57.9	16	42.1	38	12.4
Itching	2	40.0	3	60.0	5	1.6
Eye itching	5	100.0		0.0	5	1.6

Health status and treatment cost:

In a tobacco-cultivated area, table 5 shows that the average treatment cost for self-reported illness was considered for the last year. In the area where tobacco was grown, people spent on average tk. 711 as a doctor's fee, which was 13.8% of the total cost. Tobacco growers spent tk. 889, which was 61.6%, and non-tobacco growers spent tk. 537, which was 38.4%. In a tobacco-cultivated area, people spent on average tk. 3567 on medicine, which was about 69.2% of the total treatment cost, while tobacco growers spent on average tk. 4742 (65.4%) and non-tobacco growers spent on average tk. 3567 (34.6%). In every sphere, such as hospital costs, transportation costs, and accompanying costs, tobacco growers spend more than non-tobacco growers because tobacco growers are more affected by tobacco cultivation.

The average total cost was tk. 5152, where tobacco growers spent on average tk. 9733.57 (66%) and non-tobacco spent on average tk. 5015 (34%). In one year, the average sick days in tobacco-cultivated areas were 19.04, whereas tobacco growers' average sick days were 20.17 days, and for non-tobacco growers, it was 17.74 days. The average time lost working in a tobacco-cultivated area was 11.11 days, compared to 12.29 days for tobacco growers and 9.82 days for non-tobacco growers.

Table 5. Area Specific Treatment Cost and Lost Working Days of the Household Population by Type of Farmer

Treatment Cost	Tobacco		Non-Tobacco		Total	
	No.	Row %	No.	Row %	No.	Column%
Doctor's Fee	889	61.6	537	38.4	711	13.8
Medicine Cost	4742	65.4	2429	34.6	3567	69.2
Hospital Cost	423	80.4	100	19.6	259	5.0
Transport	525	60.9	326	39.1	424	8.2
Accompany Cost	262	76.3	79	23.7	169	3.3
Other Cost	17	36.8	28	63.2	23	0.4
Total Cost	9733.57	66.0	5015	34.0	5152	100.0
Average Sick Days	20.17		17.74		19.04	
Lost Working Days	12.29		9.82		11.11	

Binary logistic regression analysis:

From table 6 Tobacco growers are at a higher risk of developing various health issues, including weakness, headache, upper abdominal pain, insomnia, asthma, high sweating, and high sweating. The risk of mild weakness is 1.029 times higher than non-tobacco growers, while moderate and severe weakness is 0.790 times and 1.302 times higher respectively. Headaches are 1.173 times higher for tobacco growers, 1.564 times higher for moderate growers, and 0.454 times higher for severe growers. Upper abdominal pain is 0.365 times lower for tobacco growers, 0.855 times lower for moderate growers, and 1.007 times higher for severe growers. Insomnia is 1.648 times higher for tobacco growers than non-tobacco growers, 0.926 times lower for severe growers, and 0.926 times lower for mild growers. Asthma is 0.635 times lower for tobacco growers than non-tobacco growers, 0.718 times lower for moderate growers, and 0.995 times lower for severe growers. High sweating is 1.604 times higher for tobacco growers than non-tobacco growers, 0.832 times lower for moderate growers, and 1.814 times higher for severe growers. These health risks are influenced by factors such as smoking, smoking-related diseases, and environmental factors.

Table 6. Predictors of Tobacco Growers by Binary Logistic Regression Analysis

Variables	Relative risk for Manikganj districts of tobacco growers	P-Value
Weakness	1.00	0.04
Mild	1.029	
Moderate	0.790	
Severe	1.302	
Headache	1.00	0.13
Mild	1.173	
Moderate	1.564	
Severe	0.454	
Pain of Upper Abdomen	1.00	0.05
Mild	0.365	
Moderate	0.855	
Severe	1.007	
Insomnia	1.00	0.10
Mild	1.169	
Moderate	1.648	
Severe	0.926	
Asthma	1.00	0.06
Mild	0.635	
Moderate	0.718	
Severe	0.995	
High Sweating	1.00	0.07
Mild	1.604	
Moderate	0.832	
Severe	1.814	
Constant	0.882	

CONCLUSION AND RECOMMENDATION

Conclusion

Tobacco cultivation carries the risk of disease burden and environmental hazards. Tobacco producers have been more suffered from severe tobacco related diseases such as weakness, nausea, vomiting, dizziness, upper abdominal pain than non-tobacco producers. Because non-tobacco households were impacted by environmental illnesses that were brought on by tobacco producers' actions, the moderate

and mild categories of these disorders were practically same between tobacco and non-tobacco producers. Total average treatment cost BDT. 5152 where tobacco households was almost double (BDT. 9733.57) than non-tobacco households (BDT. 5015). Tobacco growers were more likely to experience mild and severe weakness, mild and moderate headaches, severe upper abdominal pain, mild and moderate insomnia, asthma, and high sweating compared to non-tobacco growers. These factors contributed to the overall health risks associated with tobacco cultivation.

Recommendation

Given the prevailing high levels of illiteracy in the study area and the lack of awareness to take decisive measures to enhance awareness and educate the community about the risk with tobacco use.

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