

Determinants of the Effect of COVID-19 in Bangladesh: Binary Logistic Regression Analysis Based on an Online Survey

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Abstract: The unprecedented COVID 19 fallout is a worldwide public health problem influencing both developing and industrialized nations and has major consequences for human health as well as social and economic development. This study was conducted to isolate the potential determinants during the impact of COVID 19 in Bangladesh and find out to associations with socioeconomic, demographic, and nutritional feasible multiplier. Here, public survey link was shared on social media platform such as facebook, twitter and messenger, targeting participant individuals who had been tested or isolated for COVID 19 morbidity. The survey title was “Determinants the effect of COVID 19”, and questions, focused on wide COVID 19 influencing factors and presentation to prevent bias. After that, we have analysed data through the binary logistic model. The sample size of our study was 862. The overall effect of COVID 19 was 72.6% whereas urban area was 41.02% and rural area was 31.04%. Our study shown that family members, family income are strongly association with the effect of COVID 19 at 95% confidence interval. Therefore, the effective rate of COVID-19 is increasing day by day which imply the policymaker to established a way which may reduce the effect of COVID-19 on the society of Bangladeshi individuals.

Keywords: COVID-19; Binary logistic regression; Online survey; Effective rate of COVID-19.

Introduction: Several cases of pneumonia of unfamiliar ethology have been reported in Wuhan, Hubei province, China, in early December 2019 [1, 2]. On January 7, 2020, the Chinese Center for Disease Control and Prevention (CDC) has discovered a novel beta-coronavirus from a patient's throat swab sample using high-throughput sequencing [3, 4]. The disease has been dubbed the 2019-novel coronavirus disease (COVID-19) by the World Health Organization (WHO) because it resembles the extreme acute respiratory syndrome coronavirus (SARSCoV) [5-7]. Evidence of person-to-person transmission has been found among near hospital and family contacts [8, 9]. Controlling outbreak would make necessary significant measures to reduce transmission. Coronaviruses, like SARS-CoV [10] and MERS-CoV [11], can infect a variety of animals and humans, primarily causing respiratory tract infection [10].

Bangladesh, a low-middle-income country in South Asia, has gone through a demographic and epidemiological transformation, with fast urbanization and a rise in life expectancy. Rapid urbanization and nearly half of all slum dwellers in Bangladesh are to blame for the rising burden noncommunicable diseases [11-13]. Testing and proper patient treatment of COVID 19 has limited in Bangladesh. Until 26 March 2020, when a second facility was granted testing rights for COVID 19, the IEDCR was Bangladesh's only institute with testing facilities [14]. COVID 19 fallout has been declared a pandemic globally. In addition, Bangladesh's institute of epidemiology, disease control, and research (IEDCR) announced three confirmed cases of COVID 19 for the first time on March 8, 2020. As a result, no reported cases were discovered on March 13, 2020.

However, two more confirmed cases were discovered in Bangladesh on March 14, 2020. Within a month, it has spread to the majority of the country's districts. By 25.04.2020, it was confirmed in 63 out of 64 districts [15]. According to a joint survey conducted by the Power and Participation Research Centre and the BRAC Institute of Governance and Development, the recent countrywide shutdown imposed by the government to stop the spread of COVID 19 has reduced per capita daily income of urban slum and rural poor by 80%. A nationwide BRAC survey (31 March - 5 April 2020), nearly 40% of respondents have no idea how to avoid being infected with the virus [16-18]. While 96.9% of Bangladeshi citizens were aware of the COVID 19 epidemic, the overall rate of awareness was only 25%. Besides that, only 33.5 percent of people keep lock down and 40.0 percent maintain their distance from others. We establish a lack of knowledge among people who spread COVID 19, which may have increased by 68.1 percent across the world, and that there is a positive correlation between people who know COVID 19 and their level of awareness [19, 20].

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As Bangladesh is the developing country, it was tough for facing COVID-19 wave whereas the first world like United States, United Kingdom, Italy and Spain were suffered from high death tolls. So, such research work is very crucial for our country to isolate the determinants which are solely liable for out-break of COVID-19 [21]. As well as, this research study also helps our health sector immensely to introduce social distancing, hand washing and lockdown procedure which situation was fully unpractised our nation and also to experience our doctors and nurses regarding this noncommunicable diseases. At the same time, this pandemic was also explored intense corruption at health sector in Bangladesh. Bangladesh has a healthcare system that lacks reliability, responsiveness, and empathy, and that has already been proved inadequate to deliver proper health care to the public on many occasions. Amid such a situation, the COVID-19 pandemic reveals many loopholes in the healthcare system of Bangladesh which helps to reorganise our health sector in future [22, 23].

To the best of our knowledge, there is no similar study has been done mentioned to the above title still now in Bangladesh. Here, in this current study, the salient objectives to find out the determinants the consequences of COVID-19 in Bangladesh along with isolating the effective factors due to COVID-19. Hence, the findings of this study may help to reduce related responsible factors that influence on the Bangladeshi individuals through establishing a proper policy.

Materials & Method: An anonymous survey was distributed through various social media outlets with the aim of collecting a large number of responses in a limited amount of time during this crucial time of data collection and dissemination. The public survey connect was shared on social media platforms such as Facebook, Twitter, Messenger, and Nextdoor, with the aim of recruiting volunteer participants who had been screened or quarantined for COVID 19 symptoms. Between July 10 and August 10, 2020, anonymous self-reported responses were collected. Participants who were over the age of 18 and had a history of previous COVID 19 testing or being quarantined for COVID 19 symptoms were eligible to participate. The survey title, "Determents the impact of COVID 19," and questions based on strong COVID 19 influence factors and presentation to prevent bias. COVID 19 impact factors, demographic details, and COVID 19 related comorbidities were all identified by respondents. There were forced choice and binary (yes/no) questions in the survey. Besides that, here dependent variable was Covid-19 which has two category (effect and not effect) and also taken 19 independent variables which are associated to affected by Covid-19 or not.

Outcome Variable: COVID 19's influence was one of our research variables. Our primary objective was to determine how much of an impact Covid-19 had on people's lives during the Corona fallout [24]. In general, this epidemic has a lot of impact on a variety of issues. It has a great impact on normal life, movement and education [25]. For this reason, we have selected the effect of covid-19 is outcome variable [26]. It has two categories such as "effect" which was indicate as "Yes" and other category is "not effect" which is indicate as "no".

Independent Variable: Two of the five questionnaires used in the online survey questionnaire provided us with socioeconomic, demographic, influence factor, and household statistics for our research [27]. Structured (precoded) and non-structured (open-ended) questions were included in the questionnaires. Several independent variables were used in this study were: type of place (urban/rural); Division; Family member (2-4,5-6,6+ people); Earning member (one, two or more than two); Income source; Monthly income (below 30K, between 30K-50k, above 50K); influence factors (education, jobs, business or agricultural work); who most affected (students, farmers, govt. employs or businessmen); increasing price (yes or no); fall standard life(yes/no); most benefiter (doctors, students, farmers or govt. employs); enough govt. role(yes/no); to help govt. (yes/no); increasing domestic violence (yes/no); income affected; social disturb(yes/no) and overall cost increasing (yes/no).

Statistical Analysis: Research Electronic Data Capture tools and Microsoft Excel were used to collect and handle data (Microsoft Corp.). The Statistical Package for the Social Sciences version 20 was used to conduct the statistical analysis (SPSS; IBM Corp.) [28]. Descriptive statistics were used to report demographic data, and univariate analysis was used to assess the prevalence of each impact factor. Given the values of explanatory variables, in this case a single categorical variable; $\pi = Pr(Y = 1|X = x)$, binary logistic regression estimates the probability that a characteristic is present (e.g. estimate probability of "effect") [29]. Suppose a statistician is interested in estimating the proportion of effect of COVID 19 in social being. Naturally, she understands that not everyone in the population has the same probability of 'effect, i.e. being COVID 19. Consider the predictor variable X to be any of the disease-causing variables that can be identified. The probability of an effect will be determined by the levels of the effective factors [30]. Here, Y_i is the dependent variable in categorical and $\beta_1 x_i$ is the independent variable of i term whereas β is parameter.

Variables:

- Let Y be a binary response variable
- $Y_i = 1$; if the effect of COVID 19 is present in observation (person, unit, etc.) i
 $Y_i = 0$; if the effect of COVID 19 is NOT present in observation i
- $X = (X_1, X_2, \dots, X_k)$ be a set of explanatory variables which can be discrete, continuous, or a combination. x_i is the observed value of the explanatory variables for observation i . In this section of the notes, we focus on a single variable X .

Model:

$$\begin{aligned}\Pi_i &= \Pr(Y_i = 1 | X_i = x_i) \\ &= \frac{\exp(\beta_0 + \beta_1 x_{i1})}{1 + \exp(\beta_0 + \beta_1 x_{i1})} \\ \text{logit}(\pi_i) &= \log\left(\frac{\pi_i}{1 - \pi_i}\right) \\ &= \beta_0 + \beta_1 x_i \\ &= \beta_0 + \beta_1 x_{i1} + \dots + \beta_k x_{ik}\end{aligned}\quad \text{eq. 1}$$

The parameter β_i refers to the effect of x_i on the log odds such that $Y = 1$, controlling the other x_i . The distribution of x_i is Bin (n_i, π_i), is the key assumption of this model, i.e., binary logistic regression model assumes binomial distribution of the response [31]. The dependent variable does not have to be normally distributed, but it usually infers a distribution since an exponential family (e.g. binomial, Poisson, multinomial, normal and so on). For binary logistic regression models, the Chi-square test was used to select independent variables and the Chi-square value was obtained from the ANOVA table of data analysis in SPSS [32]. At $p < 0.05$, statistical significance was accepted. So, $p < 0.000$ was strongly significant whereas $p < 0.235$ was not significant anymore.

Results and Discussion:

According to Table 1, the sample size of this study was 862. The overall effect of COVID 19 was 72.6 % (Urban: 41.02% and rural: 31.04%). The rate of effect of COVID 19 for urban was more than rural. From Table 1, the Chi-square (χ^2) test was used to investigate the relationship between COVID 19 and selected factors. When we have looked at the impact of COVID 19 by where people lived, we found that it was much higher in urban areas (41.02%) than in rural areas (31.04%), but the difference was not statistically significant ($p < 0.356$). The respondent's family members were statistically significant ($p < 0.002$) where the effective rate of covid-19 for 2-4 people (38.5%) is higher than 5-6 (22.9%) or 6+ people (11.3%). Here, the earning members were important for a family. Those family who has only one (46.9%) earning member is effective for two (19.1%) or more than two (6.7%) earning members of a family and the association was statistically significant ($p < 0.001$). The effective rate of family income for below 30K (40.0%) is higher than between 30K-50K (21.9%) or above 50K (10.7%) and the association was statistically significant ($p < 0.000$). The effective rate of influence factors for education is higher than others influence factors and the association was statistically significant ($p < 0.000$). According to Table 1, students were most affected by covid-19 than others like farmers, Govt. employ and businessmen and the association was statistically significant ($p < 0.000$). The rate of price increasing is 63.3% due to covid-19 and the association was statistically significant ($p < 0.000$). Due to covid-19 standard life style was falling inherently. The rate of effective for falling standard life is 63.9% and the association was statistically significant ($p < 0.000$). Due to covid-19, the most benefiter is Govt. Employs (45.6%) than others. This variable is statistically significant ($p < 0.000$) with association factors. Due to covid-19, Govt. action is not enough. The rate of action is 29.9% and the association was not statistically significant ($p < 0.521$). The social disturb due to covid-19 is increasing inherently. The effective rate of social disturb is 54.8% which is statistically significant ($p < 0.000$) with association factors. The effective rate of overall cost due to covid-19 is high (64.2%) which is statistically significant ($p < 0.000$) with association factors.

Table 1: Association between the effect of covid-19 and demographic and socioeconomic variables in Bangladesh 2020.

Variable	Category	No of Data (N)	Percentage of Effect of covid-19		X ² -Value	P-Value
			Effect	Not effect		
Division	Dhaka	271	24.2	7.3	28.692	P<0.000
	Khulna	206	17.1	6.9		
	Rajshahi	142	12.5	4.1		
	Chattogram	24	1.4	1.4		
	Barishal	56	4.3	2.2		
	Sylhet	23	0.9	2.3		
	Mymensingh	72	6.2	1.7		
Living Place	Rangpur	65	6.1	1.5	0.875	P<0.356
	Urban	486	41.6	14.7		
No. of Family Members	Rural	376	31.0	12.6	12.594	P<0.002
	2-4 people	461	38.5	15.0		
	5-6 people	288	22.9	10.6		
Earning Member	6+ people	113	11.3	1.9	27.285	P<0.000
	One	510	46.9	12.4		
	Two	253	19.1	10.2		
Family Income	More than Two	99	6.7	4.8	39.997	P<0.000
	Below 30K	428	40.0	9.6		
	Between 30K-50K	267	21.9	9.0		
Sources of Family Income	Above 50K	167	10.7	8.7	5.851	P<0.119
	Business	188	17.4	4.6		
	Jobs	425	35.3	14.4		
	Agricultural work	134	11.0	4.7		
Influencing Factors	Other	109	8.8	4.0	13.819	P<0.002
	Education	325	29.9	7.8		
	Agriculture	94	7.1	3.8		
	Business	221	18.2	7.4		
	Jobs	145	11.1	5.7		
Who's most Affected	Other's subject	77	6.3	2.7	21.173	P<0.000
	Students	286	26.9	6.3		
	Farmers	151	11.8	5.7		
	Govt. Employers	137	9.7	6.1		
Increasing price of product DC19	Businessmen	288	24.1	9.3	21.993	P<0.000
	Yes	716	63.3	20.1		
Falling standard life DC19	No	146	9.6	7.3	32.015	P<0.000
	Yes	721	63.9	19.7		
Most benefiter DC19	No	141	8.7	7.7	30.952	P<0.000
	Student	67	4.8	3.0		
	Farmers	66	3.7	3.9		
	Govt. Employs	510	45.6	13.6		
	Doctors	112	8.9	4.1		
	Businessmen	107	9.6	2.8		
Govt. Action Enough DC19	Yes	355	29.9	11.3	0.001	P<0.521
	No	507	42.2	16.6		
Helping Govt. DC19	Yes	709	62.3	19.4	29.377	P<0.000
	No	153	9.7	8.0		
Govt. Role DC19	Yes	181	15.0	6.1	0.521	P<0.575
	No	680	57.7	21.2		
Increasing other disease DC19	Yes	550	49.1	14.7	14.048	P<0.000
	No	312	23.5	12.6		
Social disturbing DC19	Yes	618	54.8	16.9	15.471	P<0.000
	No	244	17.9	10.4		
Increasing Domestic violence DC19	Yes	634	55.6	18.0	10.351	P<0.001
	No	228	17.1	9.4		
Income affected DC19	No effect	185	13.6	7.9	25.668	P<0.000
	Effect	348	27.7	12.6		
	Too much effect	329	31.3	27.4		
Overall cost increasing DC19	Yes	731	64.2	20.6	22.181	P<0.000
	No	131	8.5	6.7		

* DC19= Due to Covid-19; 30K= 30 thousands tk.

In a binary logistic regression model, all of the related factors were treated as independent variables for the impact of covid-19 [33]. From the Table 2, we have seen that family members, family income, income affected DC19, overall cost DC19, falling

standard life are strongly association with the effect of covid-19 at 95% confidence interval. On the other hand, most affected, influence factors, source of family income are strongly association with effect of covid-19 at 90% confidence interval.

Table 2: A binary logistic regression analysis considering the effect of covid-19 as dependent variable for Bangladesh, 2020.

Variable	Category	Estimated	Std. Error	P-value	Odds ratio	95% confidence interval	
						lower	Upper
Division	Dhaka(ref)						
	Khulna	.168	.242	.489	1.182	.736	1.900
	Rajshahi	.158	.273	.562	1.171	.686	2.000
	Chattogram	.479	.502	.341	1.614	.603	4.317
	Barishal	.433	.356	.224	1.541	.768	3.095
	Mymensingh	-.040	.345	.907	.960	.488	1.889
	Sylhet	1.232	.548	.024	3.428	1.172	10.025
Living Place	Rangpur	-.200	.378	.596	.819	.391	1.716
	Urban(ref)						
No. of Family Member	Rural	.227	.195	.243	1.255	.857	1.837
	2-4 people(ref)						
	5-6 people	.034	.190	.860	1.034	.712	1.502
Earning Member	6+ people	-1.245	.344	.000	.288	.147	.566
	One(ref)						
	Two	.043	.217	.842	1.044	.683	1.597
Family income	More than Two	.020	.309	.948	1.021	.557	1.869
	Below 30K(ref)						
	Between 30-50K	.365	.212	.085	1.440	.951	2.181
Source of Family income	Above 50K	1.128	.248	.000	3.091	1.902	5.022
	Business(ref)						
	Jobs	.240	.244	.325	1.271	.788	2.050
Influencing Factors	Agricultural work	.407	.317	.199	1.502	.808	2.793
	Others	.789	.315	.012	2.200	1.188	4.077
	Education(ref)						
	Agricultural	.133	.319	.677	1.142	.611	2.132
Who's most affected	Business	.349	.251	.165	1.417	.866	2.318
	jobs	.551	.263	.036	1.736	1.037	2.904
	Any other subject	.197	.335	.557	1.217	.631	2.347
	Students(ref)						
Increasing price of product DC19	Farmers	.437	.273	.110	1.548	.906	2.645
	Govt. Employs	.566	.276	.040	1.762	1.026	3.027
	Businessmen	.436	.249	.079	1.547	.950	2.519
Falling standard life DC19	Yes(ref)						
	No	.177	.235	.453	1.193	.752	1.893
Most benefiter DC19	Yes(ref)						
	No	.342	.254	.021	.587	1.829	2.288
	Students(ref)						
	Farmers	.309	.393	.432	1.362	.630	2.943
	Govt. Employs	-.414	.326	.203	.661	.349	1.251
	Doctors	-.253	.373	.498	.777	.374	1.613
Govt. Action enough DC19	Businessmen	-.619	.396	.118	.539	.248	1.170
	Yes(ref)						
Helping Govt. DC19	No	-.127	.188	.499	.880	.609	1.273
	Yes(ref)						
Govt. Role DC19	No	.161	.261	.538	1.174	.704	1.959
	Yes(ref)						
Increasing other disease DC19	No	.357	.230	.121	1.429	.911	2.243
	Yes(ref)						
Social disturbing DC19	No	.247	.186	.184	1.281	.889	1.845
	Yes(ref)						
Increasing Domestic violence DC19	No	.194	.202	.338	1.214	.817	1.805
	Yes(ref)						
Income affected DC19	No	.157	.205	.445	1.170	.783	1.748
	Effect	.058	.219	.790	1.060	.690	1.629
	Too much effect	-.647	.245	.001	.524	.324	.846
Overall cost increasing DC19	Yes(ref)						
	No	.525	.231	.023	1.690	1.073	2.660
Constant		-2.437	.482	.000	.087		

*DC19= Due to Covid-19; 30K= 30 thousands tk.

The respondent who comes from the 5-6 people is 1.034[CI: .72-1. 52; $p < 0.86$] times more effect than the respondent comes from 2-4 people due to covid-19. On the other hand, the respondent comes from the 6+ people are 0.288[CI: .14-. 56; $p < 0.00$] times less effect than 2-4 people. Higher income family is most affected by covid-19. The respondent who comes from the above income 50K is 3.091[CI: 1.90-5.02; $p < 0.00$] times effect for covid-19 than low income family such as below 30K which was seen from Table 2. on the other hand the respondent family comes from between 30K-50K is 1.444[CI: .95-2.18; $p < 0.085$] times more effect due to covid-19 than lower income family. The respondent who comes from others group for source of family income is 2.200[CI: 1.18-4.07; $p < 0.012$] times more effect due to covid-19 than others source of family income. The rate of affected due to covid-19 for Govt. employs is 1.762[CI: 1.02-3.027; $p < 0.04$] times more than farmers, businessmen and students. The overall cost due to covid-19 is 1.690[CI: 1.07-2.66; $p < 0.023$] times more increasing others time.

Dealing with corona outbreak is a big problem for Bangladesh. According to our results, it has an effect of 72% which is similar to other results [34, 35]. Most of the people of our country lives in village. Due to covid-19, the effective rate of rural is higher than the effective rate of urban. From our study we see that which family has more than six member their effective rate is high than lower family member due to covid-19. the family of monthly income is above 50k, their effective rate is higher than the lower income family. Besides that, it was observed from Table 2, due to covid-19, the business sectors are falling down inherently. For this reason, the effective rate is increasing. The price of daily necessities product is increasing day by day due to covid-19. Because most of the industry are falling down. The growth of product is decreasing due to covid-19. Most of the cultivator cannot move their land to cultivate the agricultural product.

From our study, we have seen that the standard life style also falls in down. People cannot move anywhere they always still their home. Due to covid-19, the government role was not enough according to our study. Most of the people of our country are living under the poverty line. In this pandemic time, the poor people cannot move anywhere for their earning. Although our government still be helping them but it was not enough for them. Our government should take more action on the poor people due to covid-19. Due to covid-19, the social disturbances, domestic violence is increasing day by day according to our study. Any pandemic time, the situation is so critical. From our study we see that the effective rate for Dhaka division is (24.2%) higher than other division such as Khulna, Rajshahi, Mymensingh, Rangpur, Barishal, Sylhet. The lowest effective rate due to covid-19 is Sylhet division (0.9%) than others.

Conclusions: We have collected all data from the online survey study and was analysis through a binary logistic regression model. Finally, our study reveals that the COVID-19 epidemic could spread quickly from person to person. We are analysis highlights continuing public health challenge present the effect of Covid-19 of population in Bangladesh. This study explores the effective factors associated with COVID-19. From our analysis we have seen the following findings:

- (i) Member of family, family income, income affected, overall cost, falling standard life style, price of necessities is strongly association with the effect of COVID-19.
- (ii) COVID-19 out-break was found much higher in urban areas (41.02%) than in rural areas (31.04%).
- (iii) The price of daily commodities was increased 63.9% due to pandemic and standard life style was falling inherently.
- (iv) It was prominent that the effective rate for Dhaka division is (24.2%) higher than other division such as Khulna, Rajshahi and Sylhet.

From our study we see that about 72.6% are the effect of COVID-19 in our country. We analysed the data by the binary logistic model.

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