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CONTENTS

Cost-Effectiveness of COVID-19 Vaccination in Bangladesh

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Abstract

This study fills a knowledge gap regarding the COVID-19 vaccination by estimating the burden of disease and cost-effectiveness of the vaccination program in the context of Bangladesh. Although vaccination appears to be the only viable path towards normalcy, it has been initiated in most developing countries with lukewarm progress. The vaccination programs involve significant costs, and it is imperative to understand the cost burden of COVID-19 when analyzing the net benefits of vaccination. This study is based on data obtained from official government and international sources. It estimates the Disability Adjusted Life Years (DALY) due to COVID-19 in Bangladesh. The cost-effectiveness of the vaccination in the country is compared to the threshold of Incremental Cost-Effectiveness Ratio (ICER) recommended by the WHO. The study shows that people of ages 31-40 years contributed most to the total DALY implying that vaccination programs are most cost-effective for those above 30 years of age. The study also shows that the price of the vaccine should not exceed USD $20per dose to make the program sustainable, as the ICER is highly sensitive to the price. This evidence calls for government to prioritize the implementation of a vaccination program on a large scale, and the government should attempt to purchase the vaccine from low-cost sources.

Keywords: COVID-19, Disability Adjusted Life Years, Cost-effectiveness, Vaccination

Introduction

Ever since the World Health Organization (WHO) declared the COVID-19 outbreak a pandemic in March 2020, the virus has claimed more than three million lives globally with upwards of 165 million cases confirmed by May 2021, among which more than 17% of cases (29 million) are from south-east Asia (WHO, 2021). Facing a disastrous first wave of this disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), many countries are now being rattled by a deadly second wave (Pandey and Nazmi, 2021; Salyer et al., 2021).

Bangladesh faced 780,159 confirmed cases with 12,149 deaths caused by COVID-19 from the date of the first confirmed case until May 16, 2021 (MoHFW, 2021). Shattered by the first wave, Bangladesh has been tackling the second wave from April 2021, with the highest number of weekly and daily confirmed cases occurring in the first week of April (WHO, 2020). A higher infection rate for the disease has increased the burden on the health care system, causing an increase in the fatality rate (WHO, 2020).

Like many other countries, in order to curb the transmission of the virus, Bangladesh has imposed restrictions on public gatherings and closures of schools and workplaces at several phases (Hale et al., 2021). The economic cost has been about $39 million/day[1] (The Dhaka Tribune, 2020). In low and middle-income countries like Bangladesh, such measures are not sustainable and when these measures are withdrawn, the situation is worsened (Vassall et al., 2020). Therefore, in the developing world, vaccination has been one of the most cost-effective measures to prevent the disease burden and deaths (Greenwood, 2014). As of June 1, 2021, seven vaccines have completed phase III trials, and at least 23 other vaccine candidates were in phase III trials, whereas over 304 are in clinical trials (Shrotri, Swinnen, Kampmann, and Parker, 2021). To protect the community from the outbreak of this disease, about 70% of the population needs to vaccinate. This would assure an adequate level of herd immunity (Maragakis, 2021).

In Bangladesh, nationwide COVID-19 vaccination was launched on February 7, 2021, and since then 5.8 million people (3.6% of total population) have received the first dose of Oxford AstraZeneca (COVISHIELD) vaccine until May 16, 2021. From April 8, 2021, 3.6 million people have received a second dose of the vaccine, that is 2.2% people are fully immunized against coronavirus (MoHFW, 2021). The vaccination rate during that period is 38.6% and 32% for the US and UK, respectively (Mathieu et al., 2021). With the stock of AstraZeneca vaccines depleted, Bangladesh has received five million doses of Sinopharm vaccine from China (The Daily Star, 2021a) and a million doses of Pfizer vaccine was to take off on June 2, 2021 (The Daily Star, 2021b). Additionally, the authorities of Bangladesh and Russia are bargaining with the price of the Sputnik V vaccine (The Daily Jugantor, 2021).

While vaccination appears to be the only option left to get back to normalcy, vaccination interventions involve costs—both for the vaccine itself, as well as the distribution and administrative costs. Undoubtedly, these costs also involve some opportunity costs, as this money could be spent elsewhere—for instance, in strengthening capacity of health sector for non-communicable diseases, for urban health or for improving health facility for under-served or hard to reach areas. Therefore, to strengthen the platform for implementing the COVID-19 vaccination program nationwide, some cost-effectiveness analyses are required for policy makers. Although there are few studies focusing on the cost-effectiveness of the COVID-19 vaccination (Kohli, Maschio, Becker, and Weinstein, 2021; Hagens et al., 2021) and different infection prevention vaccines (Pecenka et al., 2017; Troege, Sack, and Chao, 2014), such an analysis using the Disability Adjusted Life Years (DALYs) has not been seen in the context of Bangladesh because of the limited knowledge of this disease. To address this knowledge gap, this study aims at estimating the burden of COVID-19 in Bangladesh using the DALYs, and then using these estimates to assess the cost-effectiveness of COVID-19 vaccination program.

The rest of the paper is organized as follows: the next section presents methodology to estimate the DALY and cost-effectiveness of COVID-19 vaccination program, followed by the section on estimated results, and finally the last section presents discussion and conclusion.

Methodology

The DALYs in Bangladesh due to COVID-19 are measured using an incidence-based approach (burden-eu, 2020). DALYs are calculated by adding the number of years of life lost due to premature mortality (YLLs) and the number of years lived with disability (YLDs) (burden-eu, 2020):

$$DALY = YLL + YLD$$

Calculated from an incidence perspective, YLD can be defined as the product of the number of incident cases (N), the average duration until recovery or death (D), and the disability weight (DW), which basically echoes the adverse effect on health on a scale from 0 (no impact on full health) to 1 (death) (burden-eu, 2020). This can be presented as follows:

$$YLD_{inc} = N \times D \times DW$$

For calculating the YLDs, the numbers of confirmed cases by sex and age group, as well as the duration of disease and disability weights (DWs) of each health state (mild/moderate, severe, and critical) are needed (burden-eu, 2020). The numbers of confirmed cases of COVID-19 by sex and age group were obtained from a press release of the Directorate General of Health Services division of Ministry of Health and Family Welfare (MoHFW) of Bangladesh (2021), and morbidity and mortality weekly update of Bangladesh reported by World Health Organization (WHO, 2020). For each health state, the age specific confirmed cases for both males and females are estimated from the

COVID-19 pandemic modelling developed by the COVID-19 International Modelling Consortium (CoMo consortium) of the University of Oxford (2020). The duration of disease for each health state was found in a research report jointly conducted by the Health Economics Unit of MoHFW and the University of Dhaka (The Prothom Alo, 2021). Disability weights of each health state caused by coronavirus infection were collected from a protocol for calculating burden of disease of COVID-19 developed by the European Burden of Disease Network (burden-eu, 2020). Table 1 shows the parameters used for calculating the YLDs and range of sensitivity analyses. We considered the number of severe cases, disability weight, and morbid duration as variables with uncertainties.

Table 1: Parameters used to calculate the years lived with disability and cost of vaccination program

Parameters	Baseline	Sensitivity analysis		Reference
		Lower Limit	Upper Limit	
No of cases		-	-	Estimation
Mild/Moderate	678,659			
Severe	30,756			
Critical	3,076			
No of deaths – Total	10,182	-	-	MoHFW (2021)
Disability weight				burden-eu (2020)
Mild/Moderate	0.051	0.032	0.074	
Severe	0.133	0.088	0.190	
Critical	0.655	0.579	0.727	
Duration of Disease				The Prothom Alo
Mild/Moderate	14	-	-	(2021), Rees et al.
Severe	10	6	19	(2020)
Critical	08	5	13	
Burden of isolation for 2 weeks after the discharge per person	0.007	-	-	Jo et al. (2020)
Cost of purchasing 2 (two) doses of vaccine (US$)				The Daily Star (2021c),
AstraZeneca (COVISHIELD)	8	-	-	The Daily
Sputnik V	20	-	-	Jugantor (2021)
Administrative cost of 2 (two) doses of vaccine (US$)				Assumption
AstraZeneca (COVISHIELD)	4	-	8	
Sputnik V	4	-	8	

YLL can be calculated by multiplying the number of deaths (M) and the average remaining life expectancy (RLE) at the time of death (burden-eu, 2020):

$$YLL = M \text{ x } RLE$$

To calculate YLLs, the number of confirmed death cases were obtained from the press release of Directorate General of Health Services of the MoHFW in Bangladesh (2021), and sex and age specific confirmed death cases were estimated from morbidity and mortality weekly update of Bangladesh reported by the WHO (2020). The "ideal" life expectancy[2] at birth for both males and females are 86 years and was obtained from the new Global Burden of Disease (GBD) 2010 life table (WHO, 2017). To compare the results with other countries, we estimated the YLLs, YLDs and DALYs per 100,000 population by sex and age, using the data from the Bangladesh Demographic and Health Survey (NIPORT and ICF, 2020).

To analyze the cost-effectiveness of the vaccination program of COVID-19, incremental cost-effectiveness ratios (ICERs) are calculated. The ICER is defined as the ratio of the change in the costs of the COVID-19 vaccination program (compared to doing nothing) to the change in effects of the vaccination in terms of DALYs averted. Vaccine purchasing costs were obtained from different print media (The Daily Star, 2021c; The Daily Jugantor, 2021); while the administration cost of the vaccination program was assumed (Table 1).

The following equation is used for ICER:

$$\text{Incremental cost-effectiveness ratio (ICER)} = (C_1 - C_0) / (E_1 - E_0)$$

Where C_1 and E_1 are the cost and effect of the COVID-19 vaccination program while C_0 and E_0 are the cost and effect of the comparator respectively. For reporting the cost-effectiveness scenario, we used the common cost-effectiveness threshold level proposed by the World Health Organization: an intervention will be considered cost-effective if cost per DALY averted is less than *three* times the national annual per capita GDP, and an intervention will be considered highly cost-effective if cost per DALY averted is less than the national annual per capita GDP (Edejer et al., 2003).

Results

After more than one year of confirming the first case of COVID-19, that is from March 8, 2020, to April 16, 2021, atotal of 711,779 confirmed cases of COVID-19 with 10,182 deaths were reported in Bangladesh.

During the study period, a total of 544,898.8 YLDs were attributed to COVID-19 in Bangladesh, translating to 334.2 YLDs per 100,000 population. Males had greater YLDs than females did. The numbers are 392,568.7 and 152,330 in total, and 476 and 189.1 per 100,000 population for males and females, respectively. The burden of YLDs was the highest for the age group of 31-40 years, 106,396.2 for males and 34,068 for females, and the 80+ year old age group had the lowest proportion of YLDs - 5,409.2 in males, and 2318.1 in females (Figure 1A). The highest proportion of YLDs per 100,000 population was observed in those aged 51-60 years (1,064.2 in males and 454.5 in females) and the lowest proportion was in the group of people aged 0-10 years (30.4 in males and 29.9 in females) (Figure 1B).

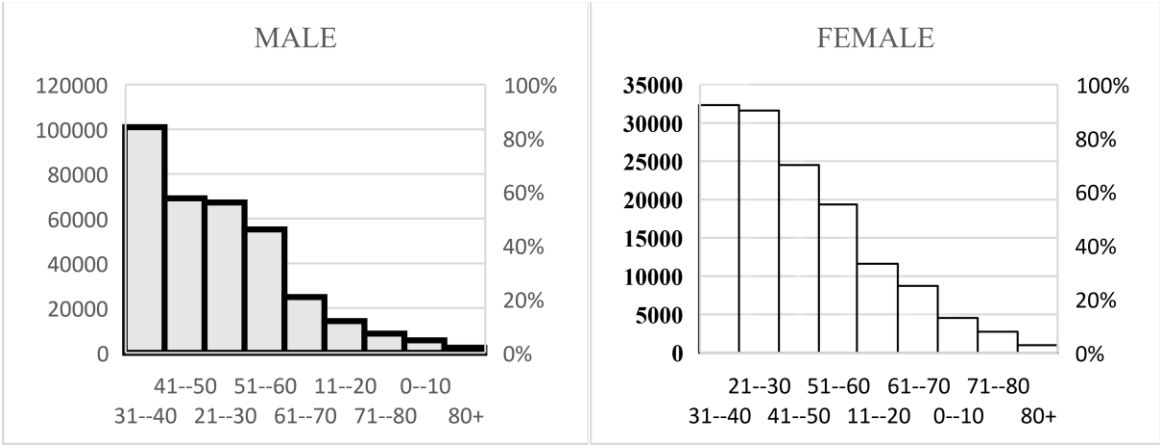

Figure 1A: YLDs for COVID-19 by sex and age group

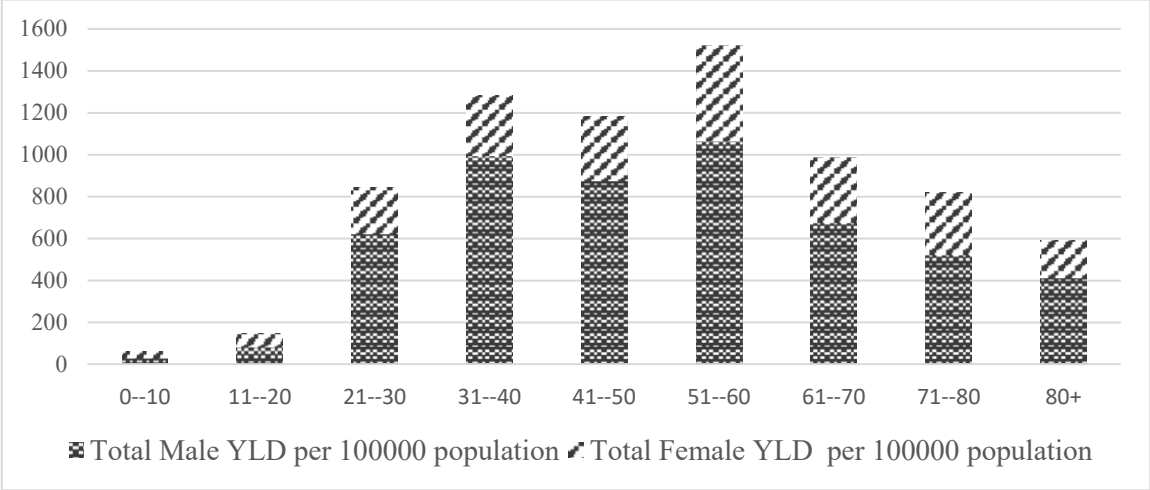

Figure 1B. YLDs for COVID-19 by sex and age group (per 100,000 population)

Table 2 presents the sensitivity analysis undertaken to investigate the effect of changes in the parameter estimates on the estimated YLDs. We considered the number of severe cases, disability weight, and the duration of morbidity as variables with uncertainties. From Table 2A, which can be found in the appendix, it was observed that increasing the severe (or those requiring hospitalization) cases by 10%, 20%, and 30% increased the YLDs by 0.7%, 1.4%, and 2% respectively for males, and 0.6%, 1.3%, and 1.9% respectively for females. When all possible lower limits on the disability weights were considered, the YLDs for both males and females declined by 36%. A consideration of all the upper limits increased the YLDs by more than 43% for both males and females. These can be found in Table 2B in the appendix, in which S1, S2, and S3 represent the scenario of YLDs with all the upper limits of DWs and the lower limits of DWs, respectively. Table 2C in the appendix also includes S4 and S5, which respectively denote upper and lower limits on the duration of morbidity and shows us that when the morbidity duration for severe and critical cases were increased to 19 and 13 days, respectively, YLDs for males and females increased by 8.8% and 8.1% respectively. On the other hand, reducing the duration to 6- and 5-days results in YLDs for males and females of 376,060.4 and 146,432.9, respectively. This is approximately 4% lower than the baseline for both males and females. When all the scenarios were combined in Figure 2, it was clear that the disability weight was the most sensitive parameter.

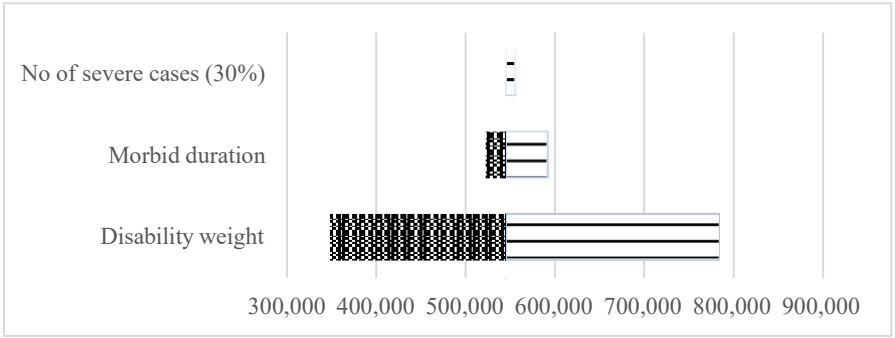

Figure 2: Sensitivity analyses of variables used in the calculation of YLDs.
(Note: The dark shade represents the lower limit of YLDs, and the light shade represents the upper limit of YLDs)

Until April 16, 2021, the total number of YLLs caused by COVID-19 was 242,502 and YLLs per 100,000 population was 148.9. As for the YLDs, YLLs were higher in males than in females, and were 181,826 and 60,676 for males and females, respectively. Males in the age group 51-60 years were 30% of total YLLs, and females in this age group were 25% of total YLLs (Figure 3). As shown in Figure 3, the YLLs were highest in 51-60 years age group for both male and female followed by 61-70 years age group, whereas YLDs were highest among 31-40 years age group for both males and females.

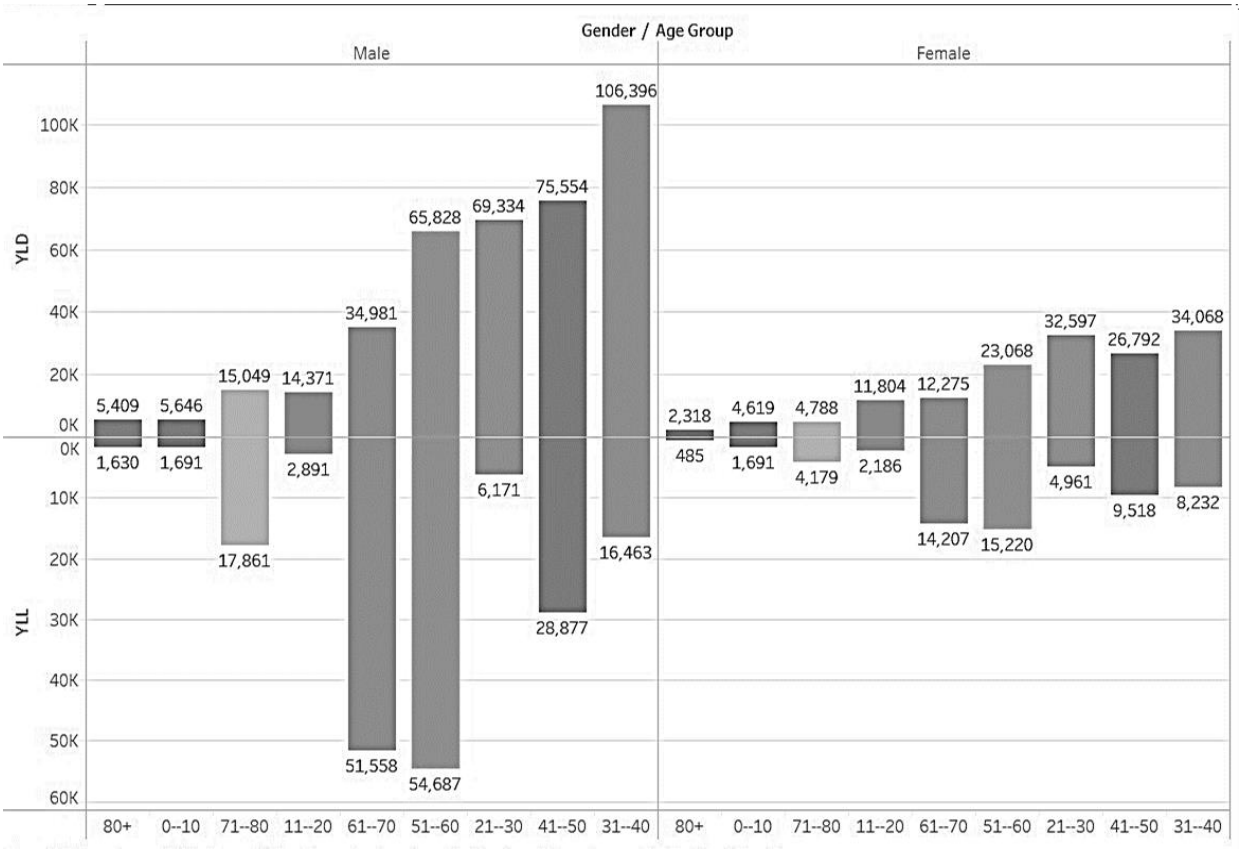

Figure 3: YLDs and YLLs for COVID-19 by sex and age group

The corresponding total DALYs for COVID-19 by gender during the study period was 787,400.8 and 483.4 DALYs per 100,000 population. YLDs and YLLs constituted 69.2% and 30.8% of the DALYs respectively. The relative contribution of YLDs and YLLs to DALYs varied by age – the highest proportion of YLDs was 90.2% for the age group 21-30 years, while the YLLs were 58.2% for the age group 61-70 years. The highest DALYs were observed in the 31-40 years age group for both males (122,859.2) and females (42,299.5), followed by the age groups 51-60 years and 41-50 years. The DALYs per 100,000 population were highest for 51-60 years age group for both males (1,948.3) and females (2,374.2).

Cost-effectiveness of COVID-19 vaccination program

By implementing the COVID-19 vaccination program, a total of 787,400.8 DALYs could have been averted during this period of more than one year. Figure 4 depicts the scenario of cost per DALY averted for different vaccines in Bangladesh, where C4 and C8 denote the deployment of the COVISHIELD vaccine with administrative cost of US $4 and $8, respectively. Similarly, S4 and S8 show a scenario where the Sputnik V vaccine is used with the same administrative costs of $4 and $8, respectively. This figure elaborates that when administrative costs are US $4, if 70% population of Bangladesh are vaccinated by AstraZeneca (or COVISHIELD), the estimated cost per DALY averted would be US$ 1,737.6. The cost figures would be doubled to US $3,475.2 if the vaccine is changed to Sputnik V. On the other hand, if administrative costs are US $8, or equal to 100% of the procurement cost of COVISHIELD vaccine, the aversion cost ranges from US$ 2,316.8 to US $4,054.4 for Sputnik V, a figure that is more than 1.5-fold higher than that with lower administrative costs. Additionally, if the cost of the vaccine surges to US $20 per dose, the cost per DALY averted will increase to 71% (US $6,950.5). This, combined with the maximum administration cost, is presented as S204 and S208 in Figure 4. For each case, the minimum cost per DALY averted would be lowest for the 51-60 years age group, followed by 61-70-, and 71-80-years age groups (Figure 4).

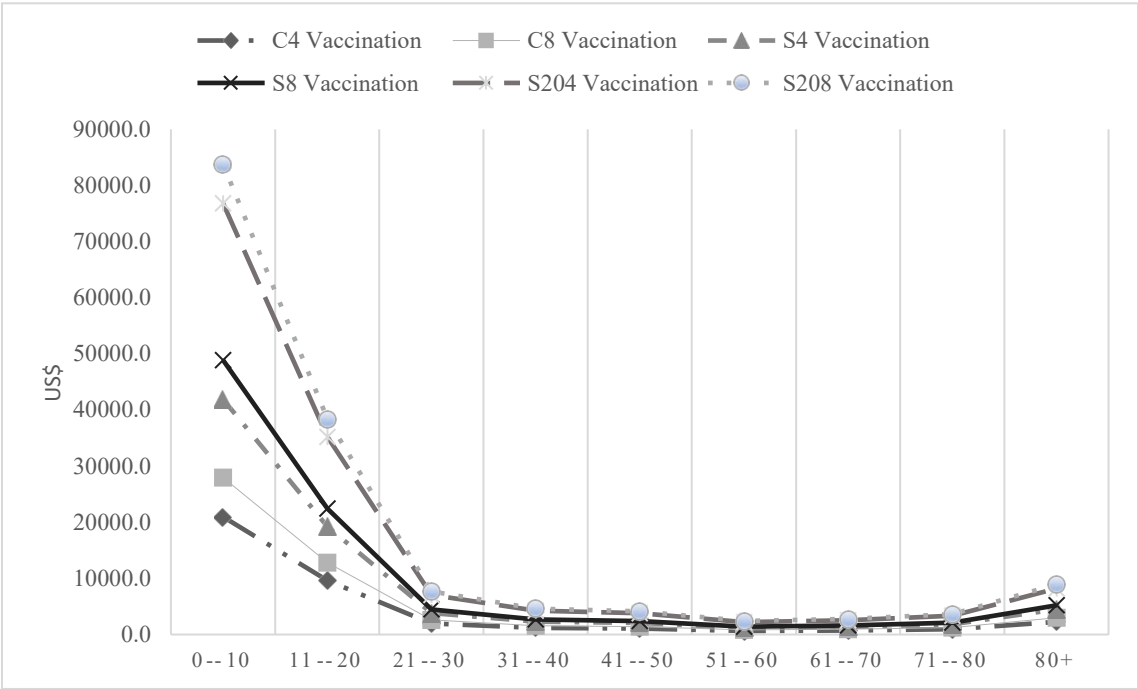

Figure 4: Cost per DALY averted of COVID-19 Vaccination

The above results demonstrate that the COVID-19 vaccination is a cost-effective investment, given that the incremental cost effectiveness ratios (ICERs) for both vaccines fall below three times of the national annual per capita GDP, which is US $2,227 in Bangladesh in 2020-2021 (Dhaka Tribune, 2021). In addition, applying thresholds to determine the cost effectiveness of an intervention, the COVID-19 vaccination program with the COVISHIELD vaccine appears to be "very cost-effective" while the Sputnik V appears to be "cost-effective". Therefore, according to the criteria laid out by the WHO, Bangladesh employed a "very cost-effective" to "cost-effective" approach when implementing the COVID-19 vaccination program.

Discussion and Conclusion

In this study, the burden of the COVID-19 pandemic for over one year in Bangladesh has been measured using the incidence-based DALYs. It was found that YLLs were higher in males than those in females, supporting similar findings from South Korea and Italy (Jo et al., 2020; Nurchis et al., 2020). YLDs were also higher in males compared to females across all age groups, which is also consistent with the findings from Italy (Nurchis et al., 2020), but inconsistent with the findings from S. Korea (Jo et al., 2020). This scenario can partly be explained by sex-based differences in genome sequences, which lead to differences due to immunity, pre-existing diseases, high-risk behaviors (such as smoking and alcohol consumption), and exposure to the virus (Sharma, Volgman, and Michos, 2020). Similar to the study of Jo et al. (2020) in S. Korea, YLDs in this study were found to be highly sensitive to disability weights.

In terms of age distribution, people aged 31-40 years contributed to the highest number of DALYs, accounting for around 21% of the total DALYs, incorporating the higher contribution of YLDs rather than YLLs. Previous studies (Jo et al., 2020; Nurchis et al., 2020) have demonstrated that DALYs were higher for the people aged more than 70 years which can be explained by the association between age and prevalence of co-morbidities and co-morbidity conditions (Wolff, Starfield, and Anderson, 2002). The context of our study can also be informed by findings from the previous studies where comparatively lower knowledge of the disease and lesser response in practicing social distancing have been identified as the reasons for a higher prevalence of COVID-19 among younger groups of people (Rahman et al., 2020). This finding can also be explained by another study where the association between prevalence of COVID-19 and obesity is noted (Zhang, Lewis, Moley, and Brestoff, 2021). Bangladesh is facing a growing prevalence of obesity among people aged 30-50 years (Banik and Rahman, 2018).

In this study the total DALYs per 100,000 population was maximum among the 51-60 years age group for both males and females, which is slightly different from the study of S. Korea (Jo et al., 2020). DALYs per 1,000 population for Bangladesh was around 5 which is similar to that found in Maharashtra, India (6.1), USA (4), and Italy (6); whereas for Germany and Sweden the corresponding number is 1 (Vasishtha, Mohanty, Mishra, Dubey, and Sahoo, 2021; Mohanty, Dubey, Mishra, and Sahoo, 2020).

Total burdens of COVID-19 in Bangladesh are expected to be greater than these estimates, as it is an ongoing outbreak. There could be more confirmed cases and undetected deaths in the study period. Moreover, Bangladesh is at high risk to witness the third wave of this pandemic, as restrictions on social gatherings have been relaxed (The Business Standard, 2021). Detecting the fast spreading and deadlier Indian variant of the coronavirus and black fungus among the COVID recovered patients have triggered a new concern about COVID-19 (The Dhaka Tribune, 2021; Molla, 2021).

As a response to the growing concern over COVID-19, vaccination should be implemented nationwide on a broader scale. This study showed that implementing the COVID-19 vaccine is "highly cost-effective" when the price of the vaccine is lower than US $10; while the price less than US $20 makes it "cost-effective". However, if the price of the vaccine increases to US $30, it is no longer cost-effective. Studies of different countries demonstrate that vaccination appears to be cost effective in Turkey even when the price varies from US $10 to $30 (Hagens et al., 2021), in the US even if the price is US $35 (Kohli, Maschio, Becker, and Weinstein, 2021), and in Pakistan if it is below US $3 (Pearson et al., 2021). If the death case doubles, given the 54% mortality rate of black fungus, vaccination programs prove to be effective in Bangladesh when the price is bounded by US $20; otherwise, it is established as ineffective on a larger scale. When the age-wise break down is taken into account, vaccination is found to be the most cost-effective option for people above 50 years (Hagens et al., 2021).

The analysis presented in this paper is novel in that it estimates the burden of COVID-19 using a scientific method. The study is based on the epidemiological and socio-economic data retrieved from official and government sources of Bangladesh and from reputed international sources. In earlier studies of other countries that focused on this topic, disability weights were assumed for different health states. However, the disability weights used in this study were obtained from a protocol developed by burden-eu for COVID-19 DALY calculation (2020).

This study offers some policy recommendations, but it is important to note the restrictive assumptions on which the conclusions are made. For instance, projected cases and deaths are estimated using an epidemiological model with historical data. This trend may not remain the same in the future. In this study, the vaccines which provide full protection against the first generation of the coronavirus have been assessed. However, if the vaccines have a lower efficacy against any new variants of the pandemic, the entire scenario could be altered. For instance, if COVISHIELD is less effective in controlling any new variants, the confidence ratio will decline. Along with unpredictability regarding efficacies, other uncertainties such as a mutation of the virus, human responses to such mutation, invention of drugs, etc. can also alter the cost-effectiveness conclusions.

Based on the results presented in this study, it appears that vaccination is a cost-effective intervention. However, the costs of running vaccination campaign can be challenging if no further data of administration is available. Moreover, different vaccines have different supply chain requirements which may further complicate the administration of vaccines. With various sensitivity analysis, this study shows that vaccination program is not only cost-effective, but also is the only viable option for curbing infection.

Endnotes

[1] BDT 3,300 crore which is almost US $39 million/day [US $1 =BDT 84.84]

[2] In DALY calculation the "ideal" life expectancy (maximum life expectancy possible across the globe) is used instead of the country-specific actual life expectancy. The notion is that everyone deserves the highest level of life expectancy in the world, regardless of their actual country of residence.

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Appendix

Table 2A: Effect of increase in severe cases on YLDs

Age Group	S1 Male	S10 Male	S20 Male	S30 Male	S1 Female	S10 Female	S20 Female	S30 Female
0-10	5,645.9	5,651.4	5,656.9	5,662.5	4,619.1	4,623.6	4,628.1	4,632.7
11-20	14,370.7	14,384.8	14,398.8	14,412.9	11,804.4	11,816.0	11,827.6	11,839.1
21-30	69,334.1	69,457.5	69,581.0	69,704.4	32,597.5	32,655.5	32,713.5	32,771.5
31-40	106,396.2	106,719.1	107,042.1	107,365.1	34,068.0	34,171.5	34,274.9	34,378.3
41-50	75,553.9	75,943.5	76,333.1	76,722.7	26,792.2	26,930.3	27,068.5	27,206.6
51-60	65,828.4	66,465.2	67,102.0	67,738.8	23,068.2	23,291.3	23,514.5	23,737.6
61-70	34,981.4	35,582.8	36,184.1	36,785.5	12,274.7	12,485.7	12,696.7	12,907.7
71-80	15,049.0	15,435.8	15,822.7	16,209.5	4,787.9	4,911.0	5,034.1	5,157.2
80+	5,409.2	5,594.4	5,779.6	5,964.8	2,318.1	2,397.4	2,476.8	25,56.2
Total YLD	392,568.7	395,234.5	397,900.3	400,566.1	152,330.0	153,282.3	154,234.6	155,186.9

Table 2B: Effect of Disability Weight on YLDs

Age Group	S1 Male	S2 Male	S3 Male	S1 Female	S2 Female	S3 Female
0-10	5,645.9	3,552.9	8,180.0	4,619.1	2,906.7	6,692.3
11-20	14,370.7	9,043.2	20,820.8	11,804.4	7,428.3	17,102.8
21-30	69,334.1	43,734.6	100,332.7	32,597.5	20,561.9	47,171.4
31-40	106,396.2	67,362.5	153,672.9	34,068.0	21,569.5	49,206.0
41-50	75,553.9	48,135.2	108,775.6	26,792.2	17,069.2	38,572.9
51-60	65,828.4	42,495.3	94,123.9	23,068.2	14,891.6	32,983.7
61-70	34,981.4	23,074.1	49,442.9	12,274.7	8,096.5	17,349.1
71-80	15,049.0	10,166.2	20,990.2	4,787.9	3,234.4	6,678.2
80+	5,409.2	3,740.4	7,443.8	2,318.1	1,602.9	3,190.0
Total YLD	392,568.7	251,304.5	563,782.7	152,330.0	97,361.0	218,946.4

Table 2C: Effect of morbid duration on YLDs

Age Group	S1 Male	S4 Male	S5 Male	S1 Female	S4 Female	S5 Female
0-10	5,645.9	5,611.7	5,717.5	4,619.1	4,591.1	4,677.7
11-20	14,370.7	14,283.6	14,553.0	11,804.4	11,732.9	11,954.2
21-30	69,334.1	68,569.8	70,933.6	32,597.5	32,238.1	33,349.4
31-40	106,396.2	104,396.2	110,581.4	34,068.0	33,427.7	35,408.2
41-50	75,553.9	73,141.2	80,602.9	26,792.2	25,936.6	28,582.6
51-60	65,828.4	61,885.0	74,080.7	23,068.2	21,686.3	25,960.0
61-70	34,981.4	31,257.3	42,774.5	12,274.7	10,967.9	15,009.2
71-80	15,049.0	12,653.4	20,062.1	4,787.9	4,025.7	6,382.9
80+	5,409.2	4,262.3	7,809.2	2,318.1	1,826.6	3,346.6
Sub total	392,568.7	376,060.4	427,114.9	152,330	146,432.9	164,670.7