Bangladesh University of Engineering and Technology

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Links between Transport, Air Quality and COVID-19 Spread in Bangladesh

Summary of Findings

HIGH VOLUME TRANSPORT APPLIED RESEARCH

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UKaid from the British people

What is the policy timeline?

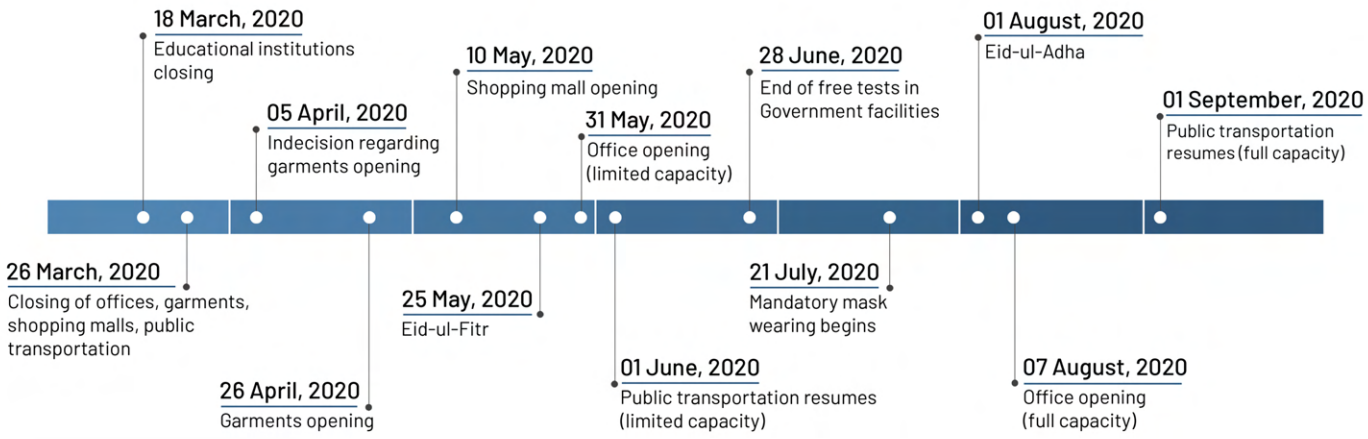

Fig 1 : Timeline of government interventions and events affecting the spread of COVID-19 first wave in Bangladesh

Did COVID19 related policies affect the spread of the pandemic?

Yes they did.

Regression analysis of daily new positive COVID-19 cases in Bangladesh (Fig. 2) reveals that many of the interventions had the desired effects in terms of reducing the spread of the pandemic. Although some of the restrictions were combined together at the beginning, the main interest is on the relative impacts of individual measures, which is presented here. The **largest beneficial impact was derived from the full closure of offices and public transport**. Since these two happened at the same time, their effects could not be estimated separately. The closure of shops at the beginning also had beneficial effects, but the effect was around 70% of the joint effects of full 'office and public transport' closure. This high impact was due to the heavy shopping prior to the Eid-ul-Fitr, when the restriction was lifted. Statistically, the operation of **public transport system and offices at half capacity did not have any impact** on the spread – this is possibly a result of lax implementation. Opening of garment factories earlier than other offices did not have a statistically significant adverse effect, but the large mobilization of people during the indecision of opening garment factories by the business leaders did. Somewhat surprisingly, the mandatory mask use regulation did not have any statistically significant effect. This is possibly because of the lax and inappropriate use of masks, and the risk-compensation due to increased mobility and interactions resulting from a sense of safety due to the mask regulation. Stricter implementations and effective messaging would likely have a significant impact. **Eid-ul-Fitr increased the spread**, likely due to the increased social interactions during the festivities. We did not get statistically significant effects for Eid-ul-Adha, possibly because mobility was already increasing due to the compulsory mask mandate. Fig. 3 on the **relative effectiveness** of different policies can be used for future intervention design, with the caveat that the results are dependent on the quality of the underlying data.

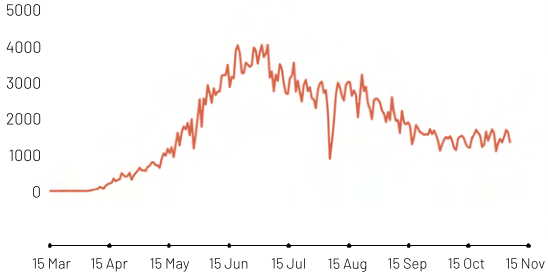

Fig 2 : Daily new COVID-19 cases in Bangladesh during the first wave

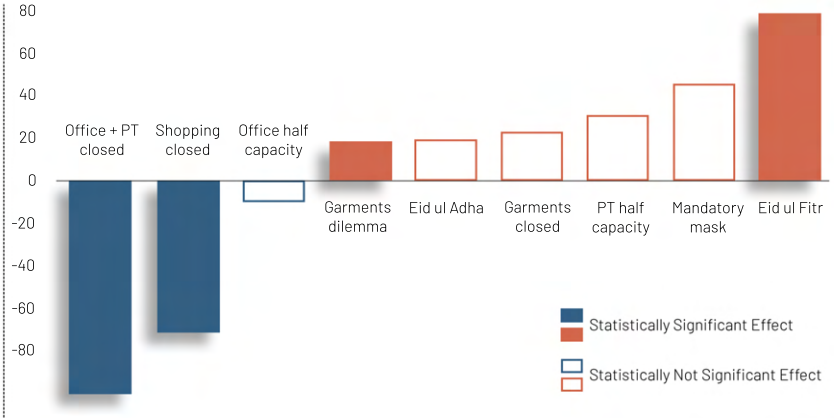

Fig 3 : **Relative** effects of different policies and events on increase or decrease in daily new cases

Did COVID-19 related policies affect mobility?

Indeed they did.

Daily activities and – as such mobility – at different types of locations in Bangladesh reduced dramatically during the COVID-19 related interventions and disruptions (Fig. 4). After an initial rapid reduction, mobility started to recover gradually, and returned to near-normal just before September 2020. Regression analysis shows that most of the policy measures affected mobility in the expected direction, with some differences in the effectiveness in different locations. **Closure of education institutes, offices, public transport and retail and recreation venues have all reduced mobility** at most locations. The closure of garment factories reduced mobility for work and at transit stations only. Office opening at half capacity had a significant effect on office travel, but not at other locations. As mobility at other locations fell, home stays have increased substantially. **Mandatory use of masks increased mobility** at all places (except in residences), suggesting risk compensation and likely explains why this important policy may not have showed a statistically significant reduction in daily new cases (see previous section). The relative contribution of different policy measures on mobility at different locations, can be used to devise future policies (Fig. 5).

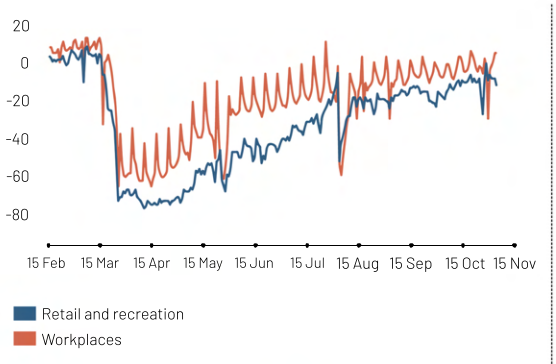

Fig. 4 : Activity index at different locations, relative to a pre-COVID-19 baseline

Fig. 5 : **Relative** effects of policies and events on the increase or decrease in activities at various locations

Did COVID-19 related policies reduce accidents?

It depends.

Accidents and fatalities may appear to have fallen in Bangladesh during a 5-month travel disruption period (April – August 2020) compared to a 19-month normal period (January 2019 – December 2020, barring the disruption), however, statistically **accidents and fatalities in Bangladesh did not fall**. This is because of the large variability in the monthly accident data. More importantly, once the effects of the reduction in mobility are considered, **normalized accidents and fatalities increased in Bangladesh** in a statistically significant manner during the travel disruptions. Increases in speed resulting from reduced traffic on the road is the likely cause of this increase. However, **in Dhaka normalized accidents and fatalities fell** and roads became safer during the disruptions. This was likely driven by a lower number of pedestrians and vulnerable road users in Dhaka during the disruption period and stricter implementation of the policies. This result suggests – a) road safety impacts are **location specific**; b) there should be adequate policy attention on road safety even during the reduced mobility periods, especially outside of Dhaka; c) safer travel option for vulnerable road users has a large role in improving road safety; and d) not controlling for reduced mobility shall provide misleading picture during data analysis.

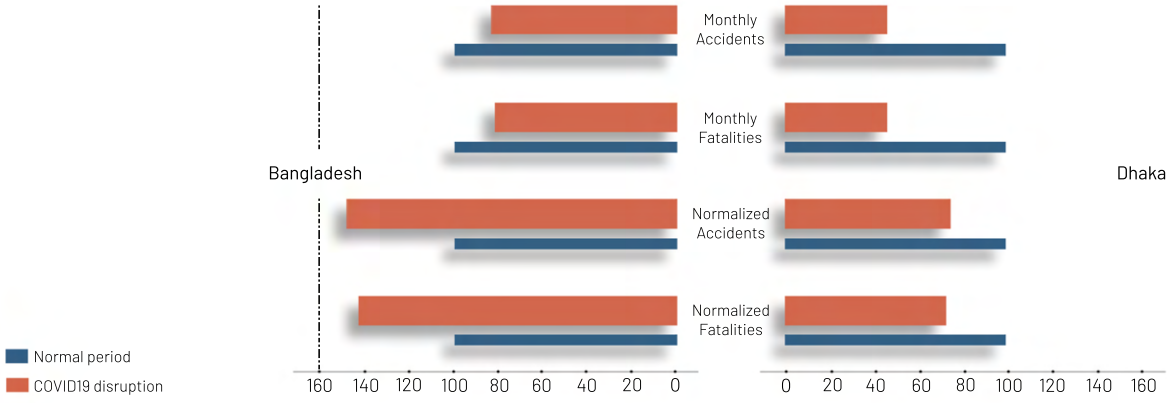

Fig. 6 : Monthly number of accidents and fatalities in Bangladesh and Dhaka

Did COVID-19 related policies improve air quality?

It depends.
Statistically, air quality improved at Farmgate, Dhaka – this is likely due to the large contribution of construction pollution at that location. Regression results show that at Baridhara in Dhaka air quality improved immediately in the first month, but over the five months of traffic disruptions, it did not. Air quality did not improve at Darussalam Road in Dhaka either in the first month or longer five months of traffic disruptions. All of these results control for the differences in weather elements over the year, which has crucial role in understanding the impacts. Results indicate – a) air quality impacts and associated health benefits are **location specific** – even within the same city and for the same policy, impacts vary; b) traffic may not be as large a source of air pollution in Dhaka now (as massive reductions in traffic did not improve air quality as much); and c) not controlling for weather shall result in misleading conclusions.

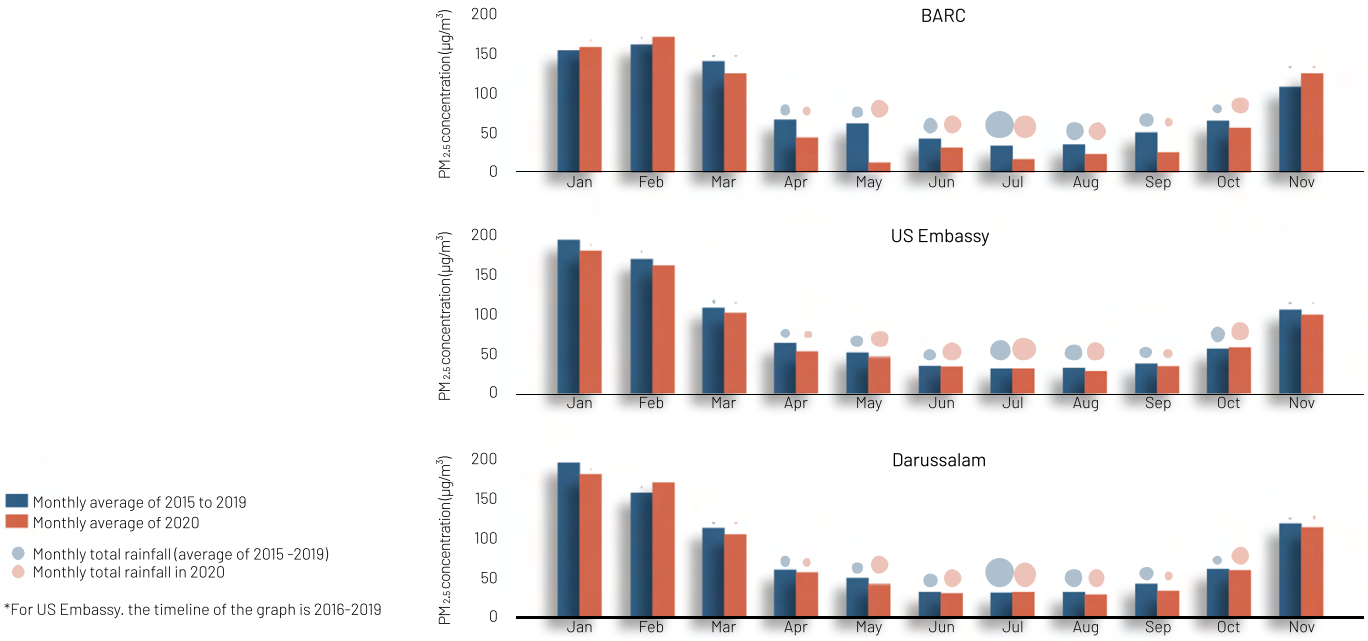

Fig 7 : Monthly average of daily PM2.5 concentration at different locations in Dhaka

Data & Methods

The analysis is based on data on the number of daily new infections in Bangladesh from www.corona.gov.bd and Johns Hopkins University, daily mobility/activity data from Google Community Mobility Report, monthly accident data from Bangladesh Police and Accident Research Institute at BUET, hourly air quality data (converted to daily) from the Department of Environment and hourly weather data (converted to daily) from National Oceanic and Atmospheric Administration and Bangladesh Meteorological Department.
Dynamic time series regression models with indicator variables for interventions and events were applied to understand the impacts of different policies and events for all research questions, except accidents and fatalities, which used simpler descriptive statistics. It is important to note that with aggregated timeseries data, as used here, some of the nuances may not be extracted statistically, and further research and evidence gathering are necessary for understanding the finer details.

About the Project

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