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Quantifying the COVID Clean-up of Air Quality in Colombo

Increased exposure to healthier air is a positive note among the many tragic consequences of the COVID-19 pandemic. As movement was restricted to prevent the spread of the disease, air quality in Colombo drastically improved leading to a 60% reduction in the average duration that people in Colombo were exposed to unhealthy air.

53
PERCENT
Avg. time spent breathing unhealthy air during peak periods pre-Covid

22
PERCENT
Avg. time spent breathing unhealthy air during peak periods post-Covid

60
PERCENT
Drop in avg. time spent in unhealthy air between pre-covid & post-covid

Among the many tragic consequences of the Covid19 pandemic, there have been some positive offshoots as well. One of them being the improvements to air quality in Colombo – as movement was restricted to prevent the spread of the disease.

This *Insight* quantifies the improvements in air quality in Colombo during periods of Covid19 related restrictions. The data in Exhibit 2 shows that air quality in Colombo saw a marked improvement throughout the year and was especially improved during the normal four-month period of peak pollution connected to the Northeast monsoon from November to February. Monsoon patterns can dramatically improve air quality by sweeping away air pollution (Southwest monsoon – currently experiencing) or bring stable air masses (Northeast monsoon), which allows air pollution to remain in the atmosphere over Colombo.

During this period, the duration of unhealthy air quality (or hours spent breathing air categorised as unhealthy) in Colombo reduced from an average of 53% to 22%. This equates to a 60% reduction in the time during which the air is unhealthy. Furthermore, the air quality improvement was especially

significant during the daily periods of rush hour traffic.

To explain the data and the findings, it is first necessary to set out how air quality is measured, and how these measures are categorised.

Measuring and categorising air quality

Many adverse health effects have been directly linked to air pollution consisting of fine inhalable particle matter that are 2.5 micrometers or smaller in diameter. This is what is referred to as PM2.5, which is the most widely measured air pollutant worldwide. (An average human hair is about 70 micrometers – about 30 times larger than PM2.5)

Exhibit 1: sets out the standard air quality index, which categories air quality in terms of related health warnings based on the density of PM2.5 (micrograms per cubic meter -- $\mu g/m^3$).

Quantifying the improvement in air quality

Monthly average duration for each category of air quality that was observed is set out in Exhibit 2. Sensors provide data on an hourly basis as micrograms per cubic meter - $\mu g/m^3$ - which is then translated into a (colour coded) health index – AQI (see Exhibit 1 below). Exhibit 2 presents this data as the four colour coded bands for each month. The pre-Covid19 average (years 2017, 2018 and 2019) is presented in graph 1 and graph 2 presents it for the following calendar year, 2020, capturing the commencement of the Covid19-led slowdown in activity from March 2020. Most notable is the significant improvement in the percentage of 'Good' air quality (category A) in 2020, in the months of the Southwest Monsoon, when Colombo typically enjoys cleaner air.

Box 1: Understanding air quality - the basic pointers

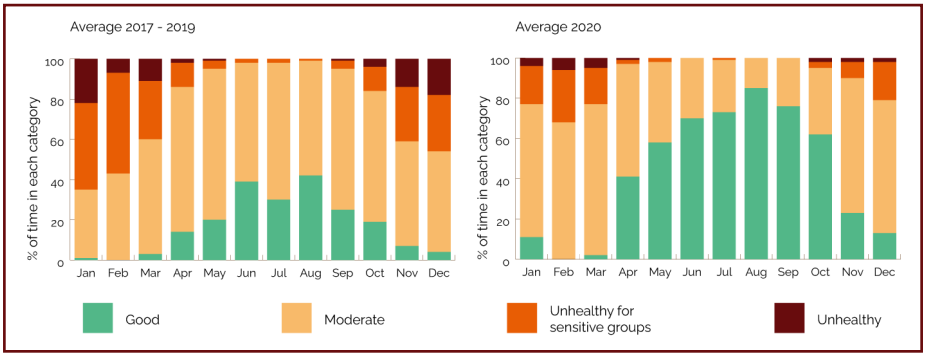
1. Air quality is driven by two main factors in Sri Lanka
   a) The level of emissions from various source points. For example, the more fossil fuels are burined for transport or energy, the more emissions in the air. To improve air quality, we need to target source points and present alternative policy solutions, which are already available but not effectively implemented.
   b) The shift in the monsoon. The public is provided a reprieve from otherwise high levels of air pollution thanks to monsoon conditions. This is clearly demonstrated in Exhibit 2, where a significant improvement in Colombo's air quality is seen between April/May and Septemeber/October each year. As such, the monsoon does help mask the air pollution.
2. What does the public need to know when interpreting air quality data?
   a) The Air Quality Index (AQI) measured ±$\mu g/m^3$ translates into a (colour coded) health index, sivgnifying the potential adverse impact to an individual's health (see Exhibit 1.)
   b) The safeguard measures are relatively simple behavioural changes such as avoiding outdoor activity, closing the windows and wearing an approved mask, e.g. N95. Additional measures can be taken in situations where air quality is in the unhealthy category or worse for prolonged periods. For example, in the United States, measures such as setting aside a room in the home with an air purifier is recommended during bushfire season, so that occupants may retreat into the safe space until air quality improves.

Many adverse health effects have been directly linked to air pollution consisting of fine inhalable particle matter that are 2.5 micrometers or smaller in diameter

Exhibit 1: Air quality index based on the density of particulate matter

Category	PM2.5 NowCast, (µg/m3)	Air Quality Index	Actions to protect your health from air pollution
A	0 - 12	Good 0-50	None
B	12.1 - 35.4	Moderate 51-100	Usually sensitive people should consider reducing prolonged/heavy exertion
C	35.5 - 55.4	Unhealthy for sensitive groups 101-150	Following groups should reduce prolonged/heavy exertion: People with heart or lung disease Children and older adults
D	55.5 - 150.4	Unhealthy 151-200	Following groups should avoid prolonged/heavy exertion: People with heart or lung disease Children and older adults Everyone else should reduced prolonged/heavy exertion
E	150.5 - 250.4	Very Unhealthy 201-300	Following groups should avoid all physical activity outdoors: People with heart or lung disease Children or older adults Everyone else should avoid prolonged/heavy exertion
F	>250.5	Hazardous >301	Avoid all physical activity outdoors Sensitive groups: remain indoors and keep activity levels low. Follow tips for keep particle levels low indoors.

Exhibit 2: Monthly % of time spent in each level of air quality: pre- and post- Covid-19



Comparing the peak air pollution period – November to February

To quantify the Covid-19 clean-up of air quality in Colombo, we have focused on comparing the average air quality in the months of November to February (usually the worst months for air quality in the city) from 2017 to 2020, against the air quality observed in November 2020 to February 2021.

The results are set out in Exhibit 3. In the pre-covid period, the air was classified as unhealthy for 53% of the time - falling into categories C and D (unhealthy for sensitive people, and all people, respectively). In contrast, during the period of covid restrictions, the air quality fell into these unhealthy categories for only 22% of the time. This is a 60% reduction in the average time that air quality was unhealthy.

Exhibit 3: Comparison of % of time spent breathing by each category over the peak period

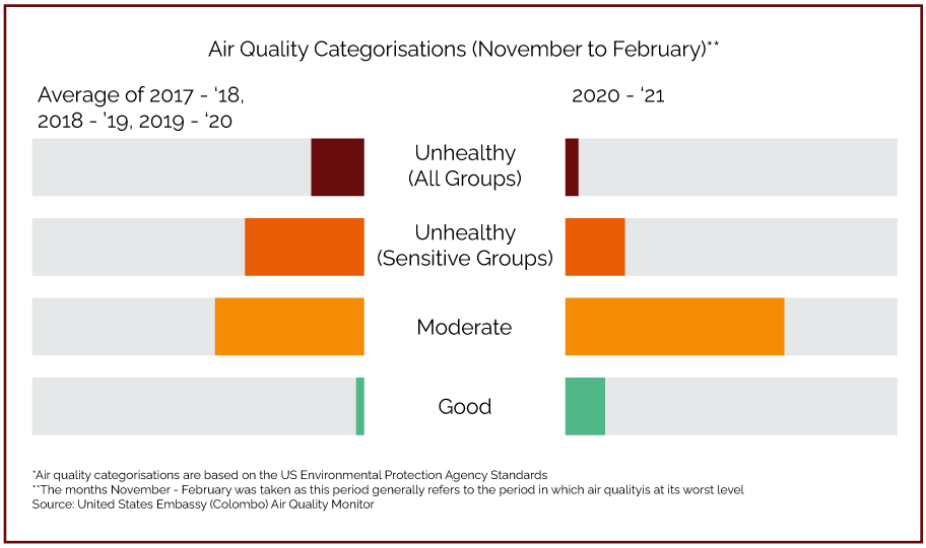
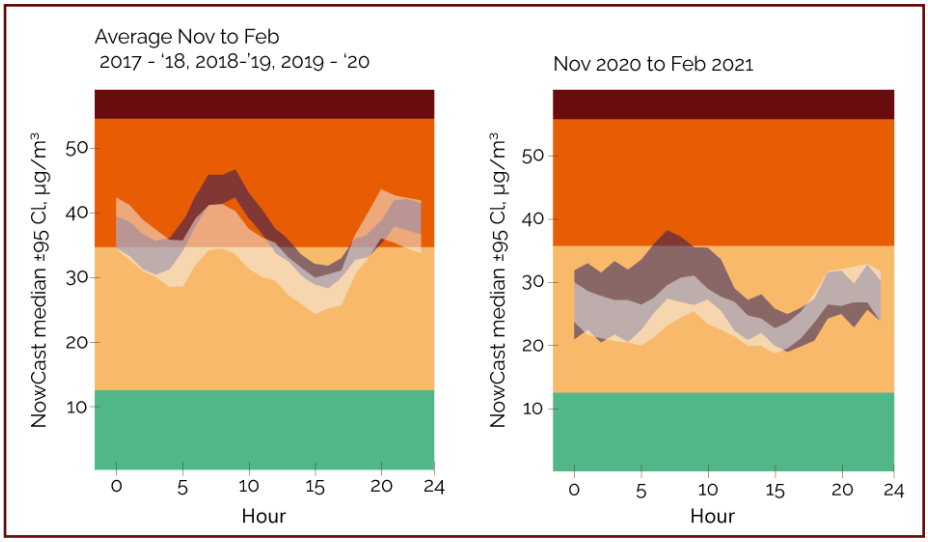


Exhibit 4: Normal NowCast range ovr 24hr period - reflecting rush hour consequences



..air quality in Colombo saw a marked improvement throughout year and was especially much improved during the normal four-month period of peak pollution connected to the northeast monsoon from November to February

Alternatively, from the perspective of the public that is breathing the air, this could be read as the probability of breathing unhealthy air in Colombo having reduced by 60% during the period of covid restrictions.
This improvement was seen to be greater among the categories of unhealthy air. Furthermore, during the period of covid, a person was 4 times more likely to be breathing good quality air than in the pre-covid period.

Did traffic times drive the improvement?

It is likely that the main contributor to air pollution in Colombo is the emissions from vehicles. Exhibit 4 shows the average air quality, measured by the density of PM2.5 in the air, for specific times of the day in a 24-hour period, for both prior-to and during Covid19 restrictions. This exhibit suggests that the air quality improved the most during weekday rush hour periods during Covid19 restrictions. The improvement in air quality during these same times in the weekends were very much less.

Conclusion

The *Insight* reveals the result of what was effectively a natural experiment – evaluating if the reduction of traffic could lead to improvements in air quality, and by how much? The Covid19 related movement restrictions allowed the collection of data to quantify the change in air quality in Colombo to evaluate the question of a Covid-clean up. Overall, the Covid19 restrictions seem to have led to a 60% reduction in the average duration of time that people in Colombo were exposed to air that was unhealthy. ◆