PalArch's Journal of Archaeology of Egypt / Egyptology

ASSOCIATION BETWEEN COMMUNITY MOBILITY PATTERNS AND DAILY COVID-19 CASES: SOME PRELIMINARY EVIDENCE FROM PAKISTAN

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Ghulam Mohey-Ud-Din, Sameeh Ullah' Hafiz Muhammad Abubakar Siddique Association Between Community Mobility Patterns and Daily Covid-19 Cases: Some Preliminary Evidence from Pakistan-- Palarch's Journal of Archaeology of Egypt/Egyptology 18(6), 56-61. ISSN 1567-214x

Key Words: Covid-19; Coronavirus; Community Mobility; Pakistan; Effectiveness of Lockdown

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Abstract

The objective of the study is to investigate the association between the community patterns and daily new COVID-19 cases in Pakistan. Statistical analysis of community mobility data from 'Google community mobility reports' and new daily COVID cases (per million population) data from 'Our World in Data' for Pakistan for a period of February 25, 2020 to January 6, 2021. We tried to examine the association and interlinkages between the reduced community mobility patterns with the new confirmed (officially reported) COVID-19 cases (per million population) using the scatter plot diagram and estimation of Pearson's correlation coefficient.

Our analysis revealed that mobility patterns are strongly and positively correlated with the COVID-19 case in the Pakistan, with Pearson correlation coefficients above 0·6 for most of the mobility categories significant at p <0.001. The study found that reduced retail/ recreation, grocery/ pharmacy, parks, transit, and workplace mobility helped decrease the

COVID-19 transmission in Pakistan. Reduced mobility (and social distancing) helped curtail the COVID-19 spread and helped flatten the COVID-19 growth curve in Pakistan. Keeping in view the resurgence or a second wave of COVID-19, it is imperative to avoid the unnecessary movement and there is a need to reduce the community mobility. Thus, the decision of Ministry of Federal Education and Professional Training, Government of Pakistan, and the provincial governments about closing schools (on-campus academic activities) seems quite rational.

INTRODUCTION

The travelling and international mobility was the main source of the transmission of the COVID-19 from Wuhan, China to the rest of the world. Reduced mobility (limiting travel, within and outside city, and reducing social interaction) was the most effective measure of mitigating the spread of the disease. Many studies (for instance, Badr *et al*, 2020; Cartenì, Di-Francesco, & Martino, 2020; Kraemer *et al*, 2020 and Nouvellet, 2021) found that reduced mobility is strongly correlated with decreased COVID-19 case. Pakistan was also amongst the top COVID-19 affected country of the world till May-June 2020. As, in June 2020, the World Health Organization (WHO) ranked Pakistan among the top ten countries in the world in terms of the number of reported new cases of COVID-19 (UN-OCHA, 202). However, in November 2020, WHO admitted that "*Pakistan has fared well in its fight against COVID-19 as the curve of new infections has flattened since its peak in May and June 2020"* (WHO, 2020a).

The success of Pakistan in managing the COVID-19 is due to taking prompt steps for implementing lockdown and other measures to reduce the social interaction and community mobility. Pakistan implemented lockdown on March 23, 2020 and studies (for instance, Saeed *et al,* 2021) found a significant decline in growth rate and doubling rate of the COVID-19 cases in Pakistan after lockdown. The key motivation behind this research is that there is a dire need to validate the effectiveness of lockdown and other such measures and also to empirically examine the association of mobility patterns and transmission of COVID-19 cases in Pakistan. It becomes further significant in the wake of an expected second wave of COVID-19 to justify the need of measures for reducing mobility and social interaction once more.

DATA AND METHODOLOGY

We used the data on community mobility pattern from 'Google COVID-19 Community Mobility Reports' (Google, 2021) and daily new COVID-19 cases data (per million population) from 'Our World in Data' (Ritchie, 2020). We used scatter plot to see the pattern of association between new COVID-19 cases (per million population) and distinct types of mobility patterns and then, to statistically examine this association, we used Pearson correlation coefficient (***r***). The formula for computing the Pearson *r* is as follows:

$$r = \frac{1}{n-1} \sum \frac{(x_i - \overline{X})(y_i - \overline{Y})}{s_x s_y}$$

The value of r ranges between +1 and -1. And, r > 0 indicates a positive relationship between X and Y, r < 0 indicates a negative relationship, and r = 0 indicates no relationship (Uebersax, n.d.).

RESULTS AND DISCUSSIONS

The Google COVID-19 mobility reports data provide insights into the different forms of the mobility patterns (i.e., retail and recreation mobility, grocery and pharmacy mobility, parks mobility, transit station mobility, workplace mobility and retail mobility). It measures the percent change from baseline mobility for diverse categories of community mobility. We assumed the baseline mobility as 100 and added 100 in each daily observation to generate a positive series of mobility pattern. For example, if the value of mobility is -30 (30 percent decline in mobility from the baseline) the adding hundred means the value would be 70 and so on.

According to WHO (2020b), the incubation period of COVID-19, which is the time between exposure to the virus and symptom onset, is on average 5-6 days, so we have taken 5-day lead of daily new COVID-19 cases (per million population) of the data taken from 'Our World in Data' ($NCOVID\text{-}19_{t+5}$). The reason for taking five-day lead is that the any reduction/increase in the mobility pattern today would impact the COVID-19 cases after five days.

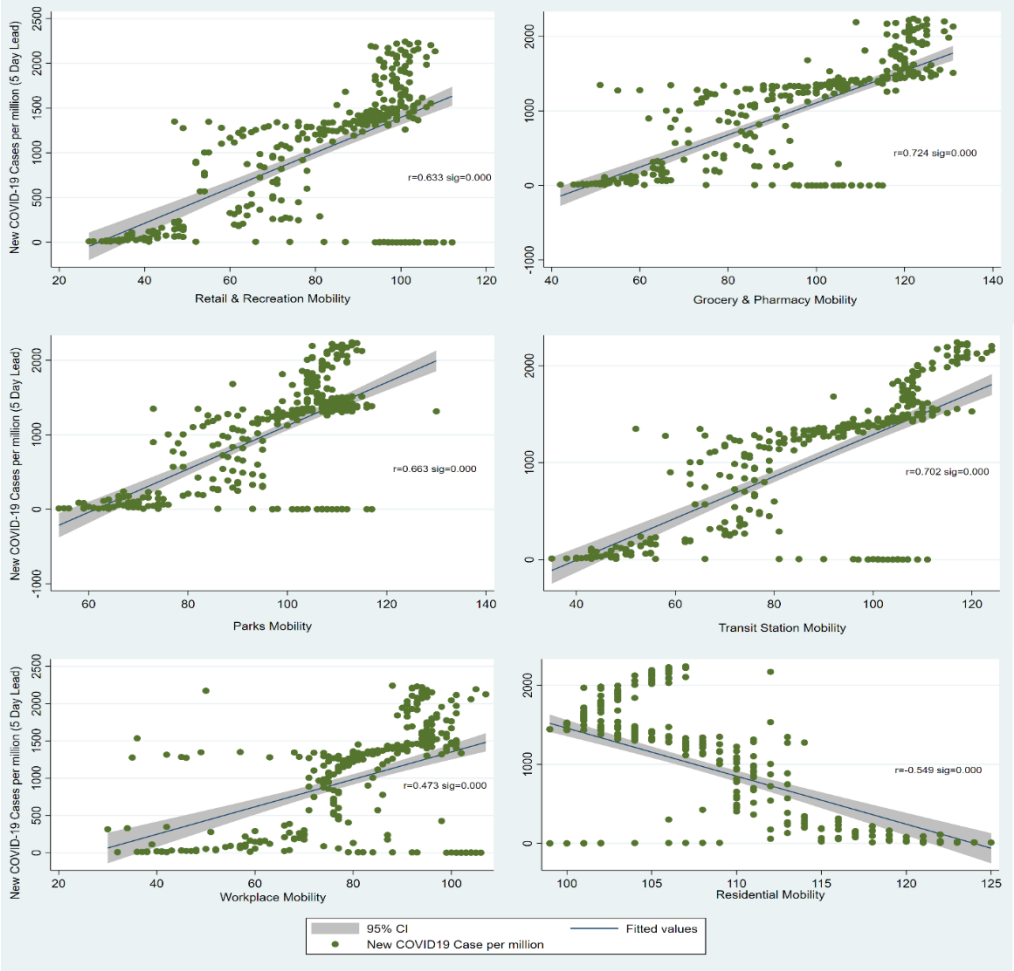

Figure 1: Scatter Plots of New COVID-19 Cases Per Million With 5-Day Lag ($NCOVID\text{-}19_{t+5}$) With Different Type of Community Mobility Patterns

The scatter plot of the 5-day lead series of new COVID-19 cases per million population ($NCOVID\text{-}19_{t+5}$) with each category of community mobility [**Figure 1]** shows that there seems a strong positive relationship between the mobility and daily new COVID-19 cases except the residential mobility.

The relationship of residential mobility found an apparent inverse but when we looked at the scatter plot keenly it became evident that, actually, there was no significant decline of residential mobility after the COVID-19 as it mostly remained above the baseline (i.e., 100). These patterns of positive association between community mobility and COVID-19 cases, as depicted by the **Figure 1**, were also confirmed statistically using Pearson Correlation coefficient. The **Table 1** exhibited that retail and recreation mobility, grocery and pharmacy mobility, parks mobility, transit station mobility, workplace mobility had a significant positive correlation with the reported confirmed COVID-19 cases in Pakistan.

Table 1: Correlations of COVID-19 cases with different type of mobility in Pakistan for a period of February 25, 2020 to January 6, 2021

	Pairwise Pearson's Correlation Coefficient					
	Retail & Recreation Mobility	**Grocery & Pharmacy Mobility**	**Parks Mobility**	**Transit Mobility**	**Workplace Mobility**	**Residential Mobility**
New COVID Cases with 5-Day Lead (t+5)	0.633***	0.724**	0.663**	0.702**	0.473**	-0.549**

** Correlation is significant at the 0.001 level, N=317

Our analysis revealed that mobility patterns were strongly correlated with decreased COVID-19 case in the Pakistan, with Pearson correlation coefficients above 0·6 for most of the mobility categories. And, all correlations were highly significant at $p < 0.001$. Only the coefficient for workplace was as around 0.5 but significant at 99% confidence level. However, the sign of the coefficient of correlation (***r***) for residential is negative, as we previously explained that there was no significant decline in residential mobility after the COVID-19 as it mostly remained above the baseline.

CONCLUSION

Based on our findings, we observed a significant positive association between the decrease in the community mobility patterns with the reduced COVID-19 cases in Pakistan. Actually, the reduced community mobility helped reduce the COVID-19 cases and actually helped flatten the curve of new infections since its peak in May and June 2020. Furthermore, in view of an anticipated second wave of COVID-19, the findings of our analysis justified the need for taking precautionary measures for reducing mobility and social interaction once more. Therefore, the decision of Ministry of Federal Education and Professional Training, Government of Pakistan, and the provincial governments about closing schools for on-campus classes and other academic activities seems quite logical. These are some initial empirical evidences which can further be strengthened in future research.

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