**Mapping Inequity among COVID Cases in Sindh, Punjab and Balochistan: Assessment of Characteristics and associations among COVID-19 Cases to Inform Equitable COVID Response**

**Background**

The *Coronavirus Disease* 2019 (COVID-19) outbreak was declared a Public Health Emergency of International Concern on 30th January 2020 and a pandemic on March 11, 2020. As of May 13, 2020, more than 4.3 million confirmed cases of COVID-19 have been reported globally with more than 293 thousands confirmed deaths in about 213 countries affected by the disease [1]. Emerging evidence indicate that the outbreak has disproportionately affected the most vulnerable populations across China – where it was first emerged, and around the world [2]. In the United States of America (USA), COVID-19 mortality is reported to be disproportionately high among African Americans compared to mortality in non-African Americans [3]. If we assess the pattern and burden of diseases historically, we will notice that diseases do not affect all people in a uniform way. Life expectancy and mortality rates have been disproportionate between the populations belonging to upper and lower wealth quintiles [4]. Moreover, certain underprivileged and disadvantaged population lack an access and affordability to health services that put them at a higher risk of developing underlying health conditions which make them further prone to infections (such as COVID-19) and infections related complications [3]. Other presumed factors associated with this disproportionate burden of disease include race, ethnicity, socio-economic, and demographic characteristics that prevent these populations from practicing social distancing; for e.g. living in closer and densely populated spaces and belonging to occupations that require physical contact [3]. A recent study from US has indicated that people who are working from home are professionals, belong to high-income percentile, and are not affected by economic crises posed by this pandemic compared to people who cannot work from home and cannot go to work and already belong to low income percentile [5]. The recent COVID-19 has also propagated economic crises and weakened social welfare safety nets, which has given rise to more inequity for vulnerable population. Some reports have also pointed out towards the gendered impact of the disease with equal number of cases among men and women; however increased mortality among men compared to women [6]. Subsequently, the population affected by COVID-19 are either more exposed or more prone to severe health consequences of the disease.

In countries like Pakistan, with already prevailing health and socio-economic disparities, brunt of the effects fall on a comparatively larger population groups that are disproportionately disadvantaged. As of May 13, 2020, Pakistan has more than 34000 confirmed cases with 733 deaths and these are rapidly escalating [7][8]. There is a lack of current data on specific socio-demographic factors with a looming concern that specific population groups including disadvantaged and/or marginalized communities might be more vulnerable to the disease compared to others. There is a need to generate robust scientific evidence to highlight the vulnerable population groups in order to best deal with the current COVID-19 pandemic. The disease control efforts can only be directed towards the right path of flattening the curve if we know the vulnerable subgroups to target and accordingly devise the contextually appropriate action plans. This will not only steer the control efforts towards the right path but will also save resources in a country that is already prone to the economic impacts of the pandemic. We intend to map-out the characteristics of the existing COVID-19 cases in select nine rural districts of Sindh, Punjab and Balochistan to identify any association between these factors, and the risk and severity of the COVID-19. This information will aid Pakistan’s country-specific mitigation measures.

**Objectives**

The broader goal of this study is to assess any association between individual and demographic characteristics of the COVID-19 patients and the risk and severity of the diseases. The specific objectives are:

* To assess the characteristics (including socio-demographic status, existing health status and comorbidities) of the existing COVID-19 patients
* To determine any association between the socio-demographic characteristics and the risk and severity of the disease.
* To determine an association between comorbidities and severity/outcome of the disease.

**Study Design**

Cross-sectional study.

**Sampling Methods**

This study will synthesize the COVID-19 surveillance data and actively collect data on additional variables. The sample would comprise of all the reported cases irrespective of age and gender of COVID-19 in Sindh, Punjab and Balochistan. Data on the following variables will be collected from the existing active surveillance system and if they are not available, we would be actively collect them in person (if possible) or by telephone calls. In person interview would only occur when the patient has recovered and in case of death, information would be gathered from the immediate family member.

We will collect the COVID – 19 specific information on

1. Time of onset of symptoms (date)
2. Time of diagnosis
3. Known exposure to infected person
4. Recent travel history
5. Severity of COVID-19 – this would be according to the last information in the records
* *Asymptomatic:* Nasopharyngeal RT- PCR positive for SARS CoV2 but having no symptoms
* *Mild disease:* Upper respiratory symptoms (e.g., pharyngeal congestion, sore throat, and fever) for a short duration or asymptomatic infection; Positive RT-PCR test for SARS-CoV-2; No abnormal radiographic and septic presentation.
* *Moderate disease:* Mild pneumonia; symptoms such as fever, cough, fatigue, headache, and myalgia; no complications and manifestations related to severe conditions.
* *Severe disease:* Mild or moderate clinical features, plus any manifestations that suggest disease progression (Rapid breath (≥70 breaths per min for infants aged <1 year; ≥50 breaths per min for children aged >1 year); hypoxia; lack of consciousness, depression, coma, convulsions; dehydration, difficulty feeding, gastrointestinal dysfunction; myocardial injury; Elevated liver enzymes; coagulation dysfunction, rhabdomyolysis, and any other manifestations suggesting injuries to vital organs)
* *Critical illness:* Rapid disease progression, plus any other conditions (Respiratory failure with need for mechanical ventilation (e.g. ARDS, persistent hypoxia that cannot be alleviated by inhalation through nasal catheters or masks); septic shock; organ failure that needs monitoring in the ICU.
1. Treatment at: isolation centres, a home, hospital, special care, intensive care unit
2. Outcome: duration of illness, cured, death

We would use the modified version of PROGRESS Plus and collect the data on the following variables (9):

1. Place of residence/residency status (e.g. homelessness, number of people living in the house, size of the house and neighbourhood population density - residents per square kilometre (km2))
2. Race/ethnicity (including minorities/traveller)
3. Occupation (place and type of work including specific vulnerable groups)
4. Gender/Sex: gender, age
5. Religion
6. Education
7. Socioeconomic position: any reasonable measure including income, deprivation, wealth, tenure.
8. Social Capital: part of specific social groups
9. Plus: Substance use, imprisonment, migrant status, pregnancy and maternity, pre-existing health condition and co-morbidities
10. We will also include additional social variables that are reported

**Statistical Analysis**

The prevalence of the pre-specified risk factors will be calculated and reported as means and standard deviations for the continuous variables and proportions for dichotomous variables. Proportions for categorical variables will be compared using 2-sided Fisher exact tests with statistical significance set at P < .05.The odds ratio (OR) will be calculated as a comparative effect measure with the 95% confidence interval (CI) for association between the variables and the severity of COVID-19. We will use univariable and multivariable logistic regression methods to explore the associated risk factors and mortality due to COVID-19. We will exclude variables from the analysis if their between-group differences will not be significant and if the number of events will be too small to calculate meaningful ORs. We will adjust for the important confounding factors such as age, sex, smoking status, pre-existing medical conditions and insufficient follow-up.

**Ethics**

We have obtained ethical approval from the ERC, AKU. Informed consent will be obtained and we will keep all personal information and personal identifiers confidential.

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