

Risk factors for Covid-19 in India

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Abstract

Like many developing countries, India was devastated by the raging pandemic of Covid-19. With the active involvement of the government and the community, the disaster was fought with. However, the impact was uneven across the country. The present study aimed to identify the factors responsible for variation in case burden of Covid-19. Data on demographic factors and co-morbidities were obtained from different sources available in the public domain. Descriptive statistics were used for comparison between states. A total of 30 states were taken into account. Correlation was used to find out association between different factors and the burden of Covid-19. Data on Covid were collected till 9th May, 2021. The burden of Covid-19 was strongly related to the literacy status and economy of the state ($r = 0.574$ and 0.730 , respectively). The burden of self-reported hypertension and diabetes was also statistically linked to the burden of Covid-19 ($r = 0.539$ and 0.721 , respectively). Overweight and obesity were also associated with the burden of Covid-19 ($r = 0.614$ and 0.561 , respectively). Therefore, in areas with a high proportion of patients with co-morbidities, limited resources may be mobilized for a better outcome. As the states with poor literacy and health condition suffered the most, tailored intervention is wanted to reach the poor and vulnerable.

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Introduction

Like many developing countries, India was devastated by the raging pandemic of Covid 19. Till 9th May 2021, India has recorded 22.3 million cases [1]. Even after ongoing vaccination efforts, the cases are rising with the passage of every single day. Non-pharmacological interventions like social distancing, use of masks, personal cleanliness and restriction in people's movement were attempted with variable success across the country. While many medical factors were considered for the spread of the pandemic, socio-demographic factors like age, economic condition and presence of co-morbidities stood crucial at the individual level, rendering some people more vulnerable than others to contact and at times, to succumb to the novel virus [2]. Recent meta-analyses suggested the presence of co-morbidities in Covid patients [3,4]. Identification of such factors is important in public health for mobilizing limited resources to the most vulnerable patients. Without specific drugs for the novel virus, prevention remains the most important strategy for mitigation of the pandemic.

However, as we are gradually expanding our knowledge base about the virus, it has been felt that there is a lack of sufficient literature at the national level from India on the role of underlying diseases in contacting Covid-19. Therefore, an effort was made to understand the relationship between the prevalence of the risk factors and the extent of case burden of Covid-19 in different states in India.

Methods

All 30 states were considered for analysis. The proportion of people above 60 years of age was taken. The presence of risk factors like diabetes, hypertension and chronic lung disease were considered for people above 45 years of age (self-reported). Chronic lung diseases include chronic obstructive pulmonary disease (COPD), asthma and chronic bronchitis (any one or more). Physically active (self-reported) was defined as those who are either engaged in moderate physical activity (at least 75 min throughout the week) or vigorous physical activity (at least 150 min throughout the week) or an equivalent combination of moderate- and vigorous-intensity activity. Overweight and obesity were decided based on body mass index levels (overweight 25.0 to 29.9 and obese ≥ 30.0). The participants were asked about the presence of different co-morbidities during the survey and their responses were not verified clinically. All these factors were taken from the reports on Longitudinal Ageing Study in India (LASI), wave I [5]. It is the largest longitudinal study on ageing in the world. Conducted among the age group of 45 years and older in 2017-18, this study covered 30 states on health, social and economic aspects. Self-reporting data on co-morbidities were considered. *Per capita* net state domestic product, an indicator for the finan-

cial condition, was considered for the states for 2018-19 [6]. The data were taken from the annual financial report published by the Government. Covid tests done per million and confirmed Covid cases per million were considered and data were taken till 9th May, 2021 [1]. Such data were available in *Covid19India*, a website compiling data from the both central and state Government sources. In India, Covid-19 was diagnosed based on RT-PCR or rapid antigen test. Information on hospitalization and/or mortality rate was beyond the scope of this paper. The data on literacy (in people >7 years of age) was taken from National Sample Survey (2017-18) [7]. The survey covered more than 113,000 population from the entire country on different health related aspects.

The required data were entered in the spreadsheet using Microsoft Excel. The correlation coefficient was calculated between different risk factors and Covid-19 case load and tests performed. Scatter plot was used to depict the relationship between the risk factors and burden of Covid-19. $P < 0.5$ was considered significant. PASW for Windows software (version 19.0; SPSS Inc., Chicago, USA) was used. The study did not require an Ethical Committee review as the data were in the public domain and no individual data were handled.

Results

The study found considerable variation in the demographic and health parameters of the states. Poor states like Bihar, Uttar Pradesh and Madhya Pradesh always remained lagging, when it comes to the number of people tested per million. Goa, Delhi and Kerala recorded maximum cases per million (75,463, 6,800 and 53,148, respectively)

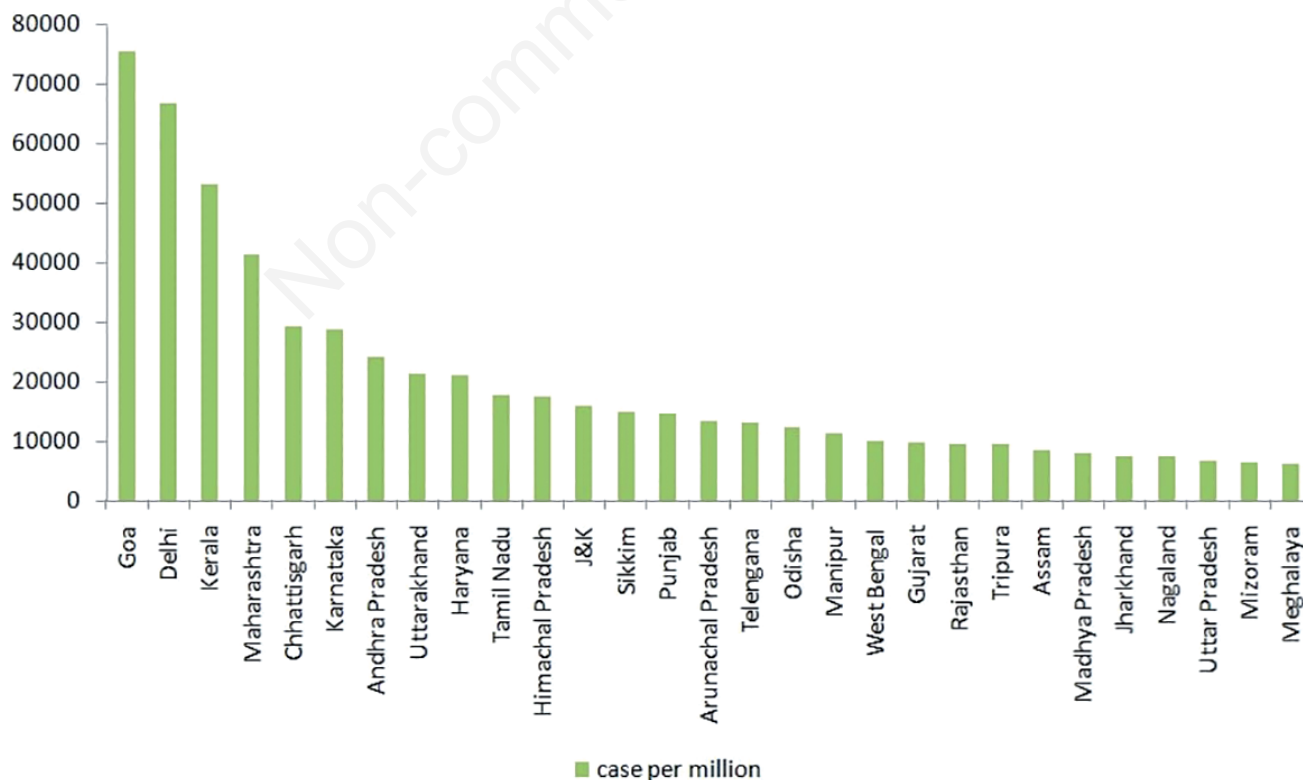


Figure 1. Covid cases per million in Indian states.

(Figure 1). These three states conducted more tests for Covid-19 than most of the other states. Kerala and Goa have a high proportion of elderly people (39.1% and 29.6%, respectively). Goa recorded the highest concentration of hypertensive people (40.8%). When it comes to diabetes, Goa and Kerala topped the list (21.9% and 27.4%, respectively). Rajasthan and Kerala have the highest concentration of patients suffering from CLD (10.3% and 9%, respectively).

It was noted that with literacy, the case burden ($r = 0.574$, $p=0.005$) was correlated significantly but not the number of tests done ($r = 0.410$, $p=0.058$). Economy was also associated with case burden and the number of tests done ($r = 0.730$ and 0.510 , respectively). When the relationship of Covid-19 burden was tested with self-reported hypertension and diabetes, both were found to be strongly positive. ($r = 0.539$, $p=0.003$ and $r = 0.721$, $p=0.000$, respectively). Overweight and obesity were also associated with the burden of Covid-19 ($r = 0.614$, $p=0.000$ and 0.561 , $p=0.002$, respectively) (Figure 2). CLD, physically active people and the proportion of people >60 years of age were not significant.

Discussion

The present study is an effort to understand the risk factors for Covid-19 from the Indian perspective. By adopting an ecologic approach, the study focused on possible population level interventions. Along with certain co-morbidities, demographic factors like literacy and the proportion of elderly people have been considered here. Although age was not a risk factor for the present paper, literacy was associated with the Covid burden. It may determine the individual exposure to Covid-19, as there is less need for a higher

educational qualification for frontline and manual workers [2]. Besides, literacy may impact the adherence to public health guidelines for prevention and the decision to go for testing. Illiterate people are more likely to have less knowledge on Covid-19, making them vulnerable to the pandemic [8]. In places with a higher literacy rate, people are willing to get themselves tested because of higher consciousness. The same attitude may decide people's willingness to a vaccine in the future.

Economy is another important factor. High mortality from areas with low socio-economic status (SES) has been reported earlier [9]. People in these areas are more often unemployed or engaged in informal work. In our set up, states with poor economic condition always lagged behind, in terms of testing rate for Covid and expanding surveillance activities. Better testing rate in affluent areas are a known finding during Covid pandemic [10].

Co-morbidities were seen earlier to put people at higher risk for developing Covid [3,4]. Covid-19 burden was strongly associated with tested the burden of diabetes, as found by the present paper. Kerala, Goa and Delhi - three states worst hit by diabetes – also suffered the maximum impact of Covid-19. Diabetes mellitus is thought to be a risk factor associated with acute respiratory distress syndrome in patients with Covid-19 [11,12]. Dysregulated glycemia may lead to hypercoagulable state through the activation of plasmin, thrombin and monocytes/macrophages [13]. Diabetics suffer from a continuous low-grade inflammation which plays an important role in cytokine storm, an event implicated for the severity of Covid-19 [14]. Higher ACE2 expression in the lungs, as found in diabetics, has also been linked to increased susceptibility to SARS-CoV-2 infection and diabetes [15]. Certain drugs used for the treatment of diabetes may increase the level of ACE2 further

[16]. The states with high burden of diabetes recorded high caseload of Covid-19. Previous studies from India also found diabetes as a risk factor for infection [17,18].

The present study found a significant association between Covid-19 and hypertension. It is in accordance with the previous findings [17,18]. Elevated troponin T seems to be a common factor for patients succumbing to Covid-19 [19]. A meta-analysis suggested that underlying cardiovascular diseases including hypertension could render anyone susceptible to Covid infection [3]. The relationship between cardiovascular pathologies and Covid-19 may be the factor that determined the caseload in individual states. Goa, Kerala and Delhi are examples of such relationship. Clinically severe patients were more prone to have complications and comorbidities including hypertension and other cardiovascular diseases [20]. Covid-19 seems to play a crucial role in the development of cardiovascular disorders including myocardial injury, arrhythmias, acute coronary syndrome (ACS) and venous thromboembolism [19,21]. Another study from Germany indicated that cardiac involvement was found in 78% patients while ongoing myocardial inflammation in 60% patients [22].

Some studies found obesity as the most common co-morbidity in Covid-19 patients [23-25]. The present study also found an association of Covid burden with overweight and obesity. It was one of the risk factors responsible for sub-national heterogeneity, as evident by its prevalence in high-burden states. It may be mentioned that obesity could change immune responses and is associated with dyslipidemia [26]. It could be one possible mechanism in Covid-19 for posing a higher risk.

A meta-analysis indicated asthma as the most common lung morbidity with Covid-19, followed by COPD and lung cancer

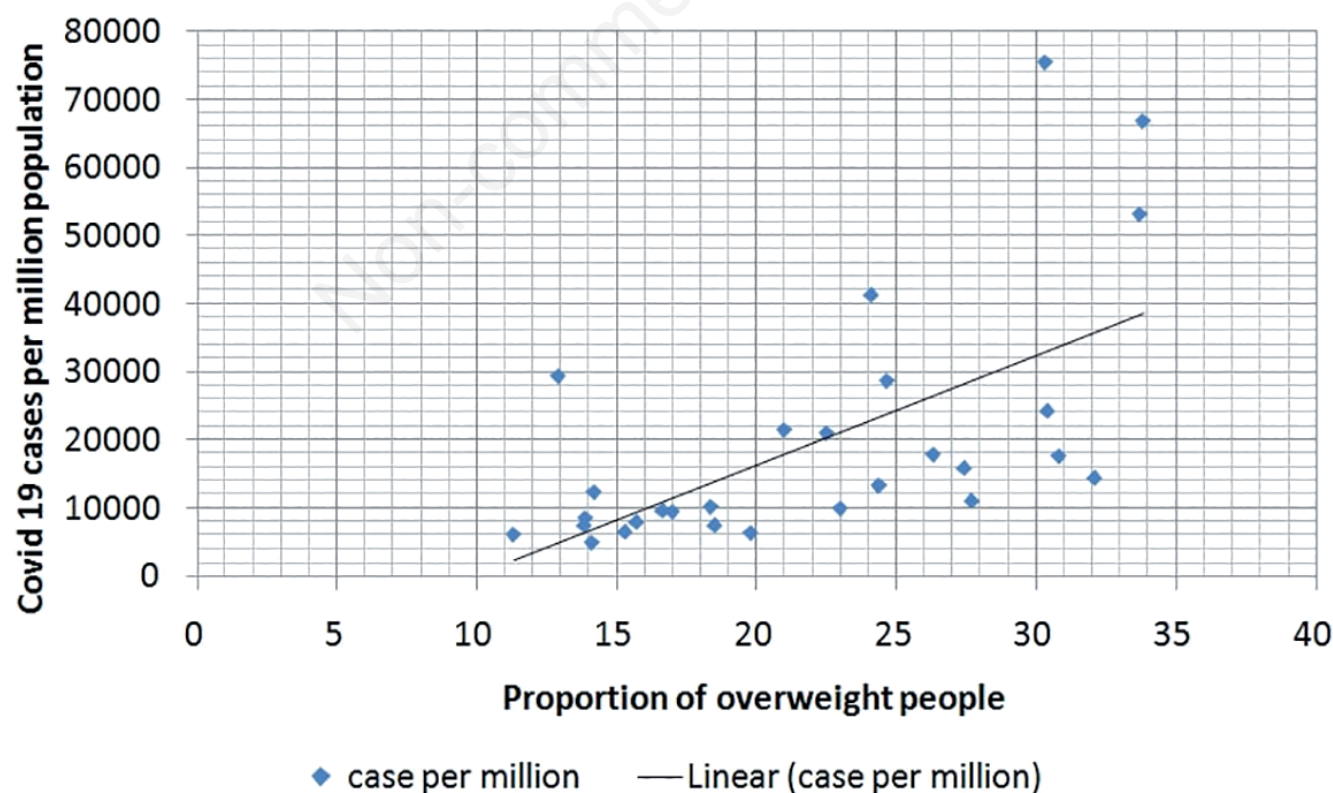


Figure 2. Relationship between overweight and Covid 19 cases per million in India.

[27]. The present study could not find any correlation between the prevalence of CLD and the burden of Covid-19.

Limitations

Being ecological and self-reported data on co-morbidities are two limitations of this study. As there is no national registry with individual data on co-morbidity in India, LASI report plays the role of a surrogate databank. Use of individual records would have improved the scope of extrapolation of the analyzed report of the present study. The prevalence of co-morbidities was considered for people >45 years. No data were available on delay in getting test reports for Covid, a factor that could have influenced the further spread of the infection, particularly from asymptomatic cases. Use of multiple regression would have addressed the issue pertaining to confounders, as Covid burden could be best described by an outcome of complex interplay several known and unknown factors. However, putting data from different sources for building a national perspective for Covid is not very common in India. From that point of view, this study stands unique.

To sum up, the burden of Covid-19 was associated with the presence of co-morbidities and demographic factors. The states with poor literacy and health condition bore the brunt of the pandemic. Tailored intervention is wanted to reach the vulnerable and alleviate their sufferings. The findings may help tailor public health strategies for mitigation of the burden of Covid-19.

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