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CONTENTS

Epidemiological factors of COVID-19

POOJA SINGH, MAANSI, N. K. SINGH, and A. K.UPADHYAY

Department of Veterinary Public Health and Epidemiology, College of Veterinary and Animal Sciences, G.B. Pant University of Agriculture and Technology, Pantnagar-263145 (U.S. Nagar, Uttarakhand)

ABSTRACT: World Health Organization (WHO) China Country Office told instances of pneumonia of unknown etiology found in Wuhan City, Hubei Province of China, thereafter,on seventh January 2020, Chinese specialists recognized another novel strain of Coronavirus as the causative agent of the sickness. The infection agent has been renamed by WHO as SARS-CoV-2 and the disease brought about by it as COVID-19. The virus first identified in China has now spread to more than 210 nations/ domains, with reports of nearby transmission occurring in more than 160 of these nations/regions. According to WHO there has been an aggregate of millions of confirmed cases and a great many passings because of COVID-19 around the world. This study was conducted to determine the determinants of cases, recovered and death of the covid-19 with some demographic and economical factors in Indian states. The correlation analysis showed that total population, male, female, population above 60 , no. of literate, person below poverty and private hospital has significant positive correlation with covid-19 cases, recovery and death whereas population density, public hospital, per capita income, shikhs, Christians, vegetarian- nonvegetarian, tobacco smoker, toddy - country liquor, beer, imported alcohol-wine did not show significance.

Key words: COVID-19, demographic-economic factors, Indian states

Covid-19 (Coronavirus Disease-2019) has spread all through the vast majority of the world about 210 nations and has influenced more than 2.52 million individuals with a high case fatality rate. Other than ferociousness and mortality, the pandemic may prompt a worldwide financial downturn, which will be obvious in the coming months and years, leaving a great many individuals jobless, indigent, and foodless. A few medicines are as of now being tried around the world. Viral contaminations are the most incessant irresistible sicknesses and are normal triggers for comprising major organic, clinical, and financial issues around the world (Cortegiani *et al*., 2020 and Meo *et al*., 2020).Coronaviruses (CoVs) belong to the family *Coronaviridae*, which includes a group of enveloped, positive-sensed, single-stranded RNA viruses. These viruses harbouring the largest genome of 26 to 32 kilobases amongst RNA viruses were termed "CoVs" because of their crown-like morphology under electron microscope. According to presence of protein sequences, CoVs are classified into four genera (alpha-CoV, beta-CoV, gamma-CoVand delta-CoV), among which the beta-CoV genera contains most Human corona virus (HCoVs), Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV-2). HCoV-229E, HCoV-OC43, HCoV-HKU1 and HCoV-NL63 usually cause mild symptoms, like common cold and/or diarrhea. In contrast, SARS-CoV, MERS-CoV and the newly-identified SARS-CoV-2 are highly pathogenic, causing severe lower respiratory tract infection in relatively more patients with a higher chance to develop acute respiratory distress syndrome (ARDS) and extra-pulmonary manifestations. The SARS outbreak occurred in 2003 is one of the most devastating in current history, infecting over 8,000 people with a crude case fatality of approximately 10%. Ten years later, the Middle East respiratory syndrome (MERS) outbreak resulted in a persistent epidemic in the Arabian Peninsula with sporadic spreading to the rest of the world. The 2019 novel HCoV (2019-nCoV), which has subsequently been renamed SARS-CoV-2, is the causative agent of the ongoing epidemic of coronavirus disease 2019(Ye *et al*., 2020). In late December, 2019, the World Health Organization (WHO) China Country Office was informed of cases of pneumonia of unknown etiology (unknown cause) detected in Wuhan City, Hubei Province of China which were epidemiologically associated with the Huanan seafood market in Wuhan, in the Hubei province of China, where a number of non-aquatic animals such as birds, bats and rabbits were also on sale before

the outbreak (Hu *et al.* 2015; Hussin *et al*., 2020 and Lu *et al*., 2020). In India, as on 2nd April, 2020, 1965 confirmed cases (including 51 foreign nationals) and 50 deaths reported from 29 States/ UTs. Large number of cases has been reported from Delhi, Karnataka, Kerala, Maharashtra, Rajasthan, Tamil Nadu, Telangana and Uttar Pradesh (MoHFW, 2020). This study was attemptedto analyse the association of different socioeconomic and population demographic factors with confirmed cases, recovered cases and death due to COVID-19 by using COVID-19 and associated factors data available in the public domain.

MATERIALS AND METHODS

Data related to COVID-19 pandemic in India was retrieved from Worldometer, covid 19india/ api: Our database- Github, http:// api.covid19india.org/ documentation/csv/, Ministry of health and family welfare, ICMR and NCDC portals and for demographics data (population, population density, male, female and above 60 aged population, no. of literatepersons and no. people below poverty line, no. public and private hospital, percapita income, population of Hindu, Muslim, Shikhs and Christians, vegetarian and non-vegetarian population, consumption of tobacco smoker, toddy - country liquor, beer, imported alcohol-wine) of India from census 2011. These data were entered into a Microsoft Excel2007 spreadsheet for tabulation, analysis, ranking, and other studies.

RESULTS AND DISCUSSION

The factors showing a significant positive or negative correlation with COVID-19 cases, recovered and death (Fig.1) show statistical significance.

Total population, density and COVID-19

The estimated population of India in 2020 is 1,380,004,385 according to UN data. India population is equivalent to 17.7% of the total world population and it is the second most populous country after China. The densely populated cities, with higher proportion of slum population would raise the potential spread of COVID-19 pandemic.The analysis of COVID-19 data from Indian states and union territories with total population and density revealed that cases ($r=0.63$, $p<0.01$), ($r= 0.01$, $p<0.01$), recovered ($r=0.61$, $p<0.01$), ($r= 0.05$, $p<0.01$) and death ($r=0.48$, $p<0.01$), ($r= 0.04$, $p<0.01$) respectively in which total population showed significant positive correlations where population density showed no significant correlation. This observation indicated that higher the population with high density having higher chances of getting infection(Singh and Gandharva, 2020).A similar study conducted by Stojkoski *et al.*(2020)which determine thatthe total population size strongly related to the coronavirus cases, i.e, population size is negatively related to the number of registered COVID-19 cases, which revealed more populated place show greater resistance to being infected by the virus and by Hassan *et al.*(2020)studies outcomes revealed that the correlation of countries' population density with attack rate, case fatality rate, and recovery rate was insignificant negatively associated ($r = -0.0175$, $p = 0.82$; $r = -0.0502$, $p = 0.52$ and $r = -0.0506$, $p = 0.52$, respectively).

Population density refers to the number of people living in an area per square kilometer. India occupies 2.41% of the world's land area but supports approx 18% of the world's population. According to 2011 census India's population density is 382 per.sq. km, i.e, 500 peoples per.sq.km. According to Tarwater and Martin (2001) and Hu *et al*. (2013) in infectious disease epidemiology, population density is the communication mode likely to follow an initial sub-linear density-dependent form until the saturation of transmission rate evolutions (The proven principles indicate that an epidemic of transmissible disease spreads more rapidly and intensely in densely populated areas than in lightly populated areas because of the lower chances of interpersonal contacts or mixing in the lower-population-density countries or areas the low population density was positively associated with mortality. In a study conducted by Singh *et al*. (2020) population density showed no significant correlation with COVID-19 CFR, morbidity, or mortality. This is contrary to the

popular belief that contagious diseases spread faster in densely populated countries because of the greater chance of interpersonal contact. This contradiction may be due to several factors involved in the spread of COVID-19, including national and international travel and social or religious congregations. The similar instances of person-to-person contact and person-to-contaminated-surface contact in closed areas with virus-containing aerosols can result in an increase in disease burden, even in places with a low population density. Goli and James (2020) stated thatdensely populated cities, with higherproportion of slum population coupled with poor health infrastructure, low income level andgreater dependence on informal activities would raise the potential spread of COVID-19 pandemic.

No. of literates, persons below poverty line and COVID-19

The analysis of COVID-19 data from Indian states and union territories with no. of literates and persons below poverty line determines that cases, (r= 0.70, p<0.01), (r= 0.39, p<0.05), recovered (r= 0.68, p<0.01), (r= 0.36, p<0.05) and death (r= 0.57, p<0.01), (r= 0.28, p<0.01) respectively showed significant positive correlations. This observation indicated that COVID-19 infectious disease doesn't differentiate literate- illiterate and poor and rich, as they all depend on the physical health and immune system of persons and prevention-precaution taken by individuals.Singh *et al*. (2020) studies analysisagreeingour study whichshowed that literacy was positively correlated (r= 0.22, p= 0.01) with the number of people testedand the number of people testing positive (permillion) for infection (r =0.21, p = 0.01).

Male, female, population above 60 ages and COVID-19

The analysis of COVID-19 data from Indian states and union territories with male, female and population above 60 ages found, cases (r= 0.62, p<0.01), (r= 0.64, p<0.01), (r= 0.71, p<0.01), recovered (r= 0.60, p<0.01), (r= 0.61, p<0.01), (r= 0.69, p<0.01) and death (r= 0.48, p<0.01), (r= 0.49, p<0.01), (r= 0.57, p<0.01) respectively showed significant positive correlations. This observation indicated that corona virus doesn't differentiate male, female and old people; it attacks equally to all individuals and disease comes out according to the host immunity status. In Banseria *et al*. (2020) study, CaseRecovery Rate was 97.5% which is higher than that of the nationalaverage Case Fatality Rate is 2.4% where male patients have moremortality rate than their female counterparts. This is in accordancewith findings from other countries where males die more often thanfemales. Disease found to be more prevalent in elderly people may simply have weaker defensive health mechanisms to cope with the stress induced by the disease(Singh and Adhikari, 2020).Erkoreka (2010) examined mortality provoked by seasonal influenza in Madrid during 1916 as a function of age, because 34.4% were older than 65 years died due to influenza.

Number of public-private hospital and COVID-19

The analysis of COVID-19 data from Indian states and union territories with no. of public and private hospitals found that cases (r= 0.31, p>0.05), (r= 0.36, p<0.05), recovered (r= 0.28, p>0.05), (r= 0.31, p>0.05) and death (r= 0.16, p>0.05), (r= 0.24, p>0.05)respectively, here only cases showing the significant positive correlations with private hospital and no relation among recovered, death, cases in no. of private and public hospitals. This observation indicated that individual who get positive have fear of public hospital treatment-management, and have showing strong faith towards private hospital. Roy and Khalse (2020) reported the negative correlation between critical care beds and the fatality rate is justified, as intensive care unit (ICU) beds and ventilators are critical elements in the management of complicated cases.

Per capita income at constant-current prices and COVID -19

The analysis of COVID-19 data from Indian states and union territories with per capita income at constant and current prices, cases (r= 0.14, p>0.05),

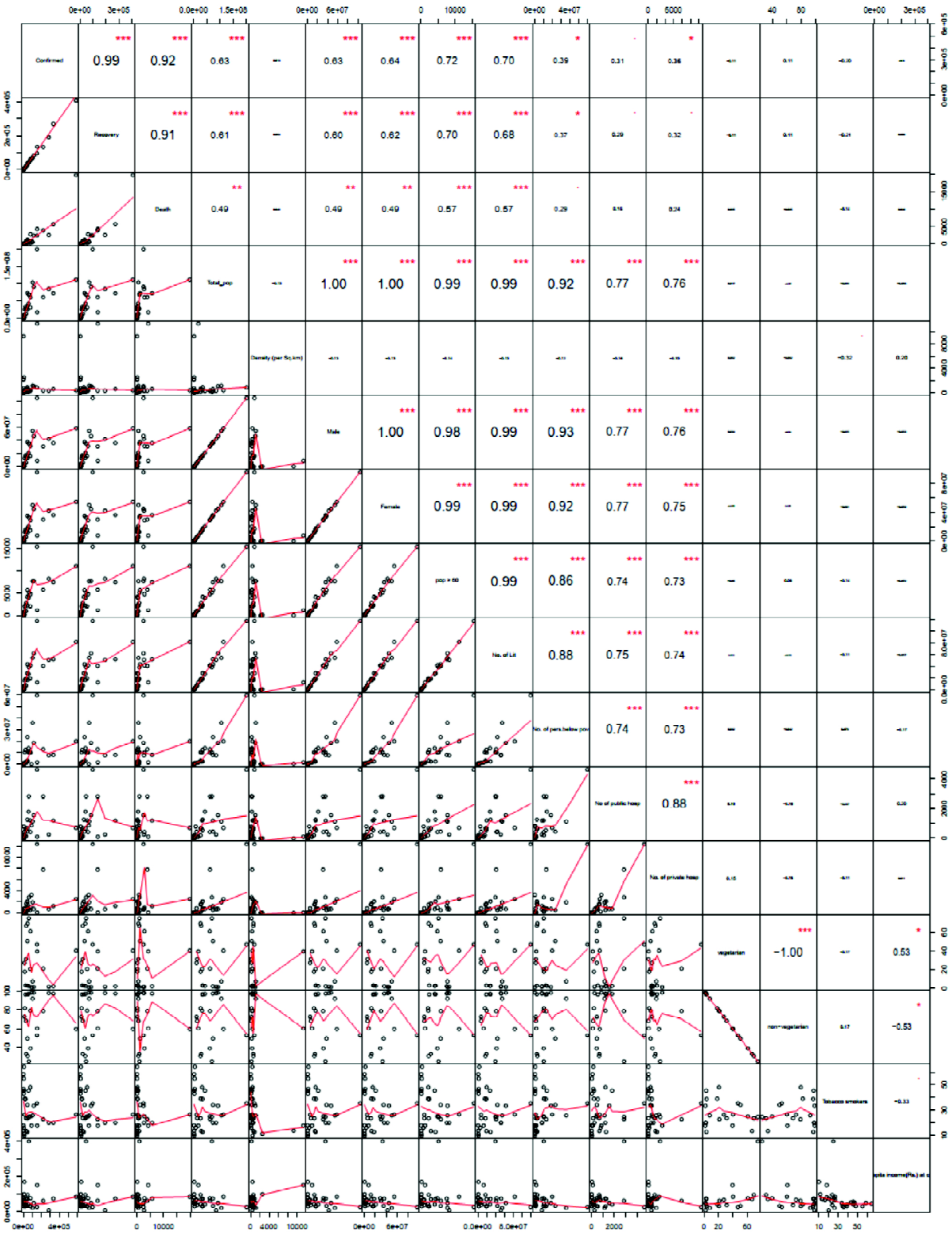

Fig. 1:The Factors Showing a Significant Positive or Negative Correlation with COVID-19 Cases, Recovered and Death

(r= -0.01, p>0.05), recovered (r= 0.18, p>0.05), (r= 0.00, p>0.05) and death (r= 0.23, p>0.05), (r= 0.04, p>0.05) respectively, here no significant correlations among per capita income, cases, recovered and death.This observation indicated that low- and lower-middle-income countries should invest more in health care services and implement adequate COVID-19 preventive measures to reduce the risk burden.Singh *et al*.(2020)classified the countries into high-, low-, or medium-income groups based on per capita GDP to evaluate the effect of per capita GDP on COVID-19- related morbidity and mortality. High PPP showed a strong positive correlation with morbidity (r = 0.47; p<0.0001) and mortality (r = 0.25, p = 0.01); In high-income countries with an optional BCG vaccination policy, the odds of having > 500 COVID-19 cases per million people was 134.6 times higher (99% CI, 8.66-2093.23) and the odds of having > 50 COVID-19 deaths per million people was 12.4 times higher (99%CI, 3.14-48.9) than in high-income countries with a mandatory BCG vaccination policy. Hassan *et al*. (2020) reported lower-middle-income countries had a negative significant correlation with case fatality rate (r= - 0.3310, p = 0.04), which revealed that low-income countries are more likely to have an increased risk of case fatality rate. The lower-income countries are more likely to have a higher risk in case of attack rate (RRR = 0.981, 95% CI = 0.97–0.99, p = 0.00) and recovery rate (RRR = 0.971, 95% CI = 0.96–0.98, p = 0.00). Similarly, upper middle-income countries are more likely to have higher risk in case of attack rate (RRR = 0.988, 95% CI = 0.98–1.0, p = 0.01) and recovery rate (RRR = 0.978, 95% CI = 0.97–0.99, p = 0.00).

Religion and COVID-19

The analysis of COVID-19 data from Indian states and union territories with Hindu, Muslim, Sikhs and Christians cases (r= 0.61, p<0.01), (r= 0.46, p<0.01), (r= -0.01, p=0.01), (r= 0.27, p>0.05) recovered (r= 0.59, p<0.01), (r= 0.43, p<0.01), (r= -0.02, p>0.05), (r= 0.29, p>0.05) and death (r= 0.47, p<0.01), (r= 0.34, p<0.05), (r= -0.002, p>0.05), (r= 0.15, p>0.05) respectively. Result revealed Hindu and Muslim have positive significant correlations while Sikhs and Christians shows no significant correlation. This observation indicatedthat spirituality can be one of the useful methods to create mental relaxation during havoc pandemic conditions. Mishra *et al*. (2015) found in their research that religiosity is a factor involved in the management of health and diseases/ patientlongevity. It's multidimensional in nature and ultimately associated with inherent protection againstdiseases and overall better quality of life. And has been found to have a great rolein health promotion and disease prevention, in addition to its' defensive role against anumber of diseases like hypertension, psychiatric illness, suicide, AIDS and several otherdiseases. In addition, it has an important role in the treatment of various physical and mental illnesses.

Ali *et al*. (2017) analyzed the reason why many infectious diseases are rarely represented within the overall spectrum of infectious diseases in particular regions. Public Health National Service with local hospitals, volunteers and doctor re-ligion organizations is one of the positive examples how we can effectively run a large religious event without danger to health or other nonreligious citizens and to other religious pilgrims during KumbhMela. Vac-cinating and religious visa policy of Saudi Arabia is another example of the effective minimizing risk ofdisease for e.g. Meningitis transmis-sion during Hajj and Influenza transmission after the event. Religion per se and religion driven family models are the evident and clear component against the spread of sex-ually transmitted infectious diseases such as hepatitis and HIV, as well as the zoonosis. Fardin (2020) review studies indicated that spirituality could aid people to have mental relaxation in times of crisis and dangerous diseases. Some of the religious solutions proposed against the COVID-19 prevalence could be helpful.Since a long time ago; religions have attempted to provide behavioral pieces of advice in times of crisis to help humankind spiritually. Dein *et al*. (2020) determine the implications of the COVID-19 pandemic for religion and mental health. The evidence base for this largely derives from newspaper articles on the internet rather than scientific empirical studies and examined some factors- religious doctrinal

responses, religiously related behavior, prejudiced attitudes and behavior towards religious groups, tensions, strains, and conflicts about religious matters which reflected on some of the possible implicationsof COVID-19 for religion and mental health.

Vegetarian, non- vegetarian and COVID-19

The analysis of COVID-19 data from Indian states and union territories with vegetarian and non-vegetarian cases (r= - 0.11, p>0.05) (r= 0.11, p>0.05), recovered (r= - 0.11, p>0.05), (r= 0.11, p>0.05), and death (r= 0.08, p>0.05) (r= - 0.08, p>0.05), respectively. Here no significant correlations were found among vegetarian and non-vegetarian, cases, recovered and death. These observations indicated that vegan or non-vegan food is not responsible for corona virus infection. Currently, there is no evidence to prove that any particular food or diet pattern can prevent or control COVID-19. Eating a healthy and balanced diet including fruits and vegetables, staying physically active, taking proper sleep and keeping stress free lifestyle help in strengthen immune system to combat deadly corona virus disease.

Tobacco smoker, toddy - country liquor, beer, imported alcohol-wine and COVID-19

The analysis of COVID-19 data from Indian states and union territories with tobacco smoker, toddy - country liquor, beer, imported alcohol-wine cases (r= - 0.20, p>0.05), (r= -0.12, p>0.05), (r= -0.17, p>0.05), recovered (r= - 0.21, p>0.05), (r= -0.12, p>0.05), (r= -0.17, p>0.05), and death (r= - 0.14, p>0.05), (r= -0.12, p>0.05), (r= -0.13, p>0.05), respectively. Here no significant correlations among tobacco smoker, toddy - country liquor, beer, imported alcohol-wine cases, recovered and death due to COVID 19. This observation indicated that narcotics had not direct relation with COVID 19 disease, it's totally depends upon the host immune system The relationship between alcohol consumption, tobacco smoking and infectious diseases can be explained by two causal pathways, First, alcohol consumption and smoking impairs the immune system, which make individual more prone or susceptibility for infection and secondly, decreased or stop the ability of alveolar macrophages to fight and kill the newly introduced pathogens.

CONCLUSION

By analyzing the COVID-19 data with demographic and economic status of India we foundthat total population, male, female, population above 60 ages, no. of literate, person below poverty and private hospital had a significant influence on COVID-19 cases, recovered and death.These analyses discuss the overview of various epidemiological determinants possibly contributing to the spread of COVID-19 and help us to improve our knowledge to develop a plan of action for effective control and prevention measures in the future.

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