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GEO-SPATIAL BIG DATA ANALYSIS: CROSS-SECTIONAL STUDIES OF COVID-19 AND POPULATION MORTALITY SPECTRUM IN THE SOUTHEAST ASIAN REGION

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Abstract

The outbreak of Covid-19 emerged from China during December 2019, spread geo-spatially in more than 210 countries causing more than 324 million people infected and 5,5 million deaths (as on 15 January 2022), which is still spreading multiple peaks. This has seriously threatened the life of the people posing the challenges to control the severity of Covid-19. The spatial and temporal spreading of covid-19 in the Southeast Asian region between the latitudes 38°N to 6°S, caused marked variations in population mortality between different countries depending on the spectrum and healthcare infrastructure. In this paper, geo-spatial big-data analysis have been carried out based on the covid-19 spectrum, population mortality and healthcare infrastructure based on covid-19 new cases and population mortality data from 15 April 2020 to 30 June 2021 of Hong Kong, Vietnam, South Korea, Singapore, Malaysia, Philippines, Thailand, Taiwan, India, Indonesia and Myanmar in southeast Asian region. This paper carried out cross-sectional studies of the impact of covid-19 spectrum on population mortality between two consecutive dates during the period from 15 April 2020 to 30 June 2021, confirming to the indicator of the severity.

Index Terms: Covid-19, Geo-Spatial Big Data Analysis, Population Mortality, Spectrum Envelope

1. INTRODUCTION:-

The outbreak of the 2019 novel Corona virus disease (Covid-19) spread geo-spatially in more than 210 countries of the globe causing more than 324 million people of the global population infected and 5.5 million deaths (as on 15 January 2022). The exponential increase in spreading of corona virus spectrum in spatiotemporal way to the new geographical locations has seriously threatened the human health and life of the people as well as posed the challenges for countries to control the severity of the outbreak [1-4]. The spatial spreading of corona virus spectrum due to large-scale migration from Hubei province of China caused the outbreak in the Southeast Asian region covering the latitude between 38°N to 6°S. National lockdowns were imposed by the respective governments of the Southeast Asian countries as measures to control the severity of the spectrum of the outbreak [3]. There are marked variations in the spectrum of daily new cases of corona virus between different countries situated at different latitudes below 64°N of the hemisphere [1]. Geo-spatial big data predictive analysis of daily new corona virus cases as knowledge classifier, carried out for 28 countries that lie below the latitudes of 60°N, resulted into the development of spectrum models for six different stages such as complete recoverable stage, recoverable stage, safe stage, stabilizing stage,

critical stage and beyond the critical stage [3]. Higher population mortality observed in northern latitude exhibiting the population mortality with decreasing north south gradient based on mortality data of 02 April 2020 [3]. Further, population mortality between different countries situated at latitudes below 64°N showed marked variations with relatively low population mortality at latitudes below 35°N based on mortality data of 15 April 2020 [3-4]. In this paper, geo-spatial big-data analysis have been carried out based on the covid-19 spectrum, population mortality and healthcare infrastructure based on covid-19 new cases and population mortality data from 15 April 2020 to 30 June 2021 of Hong Kong, Vietnam, South Korea, Singapore, Malaysia, Philippines, Thailand, Taiwan, India, Indonesia and Myanmar in southeast Asian region.

2. HEALTHCARE INFRASTRUCTURE IN SOUTHEAST ASIAN COUNTRIES:-

Covid-19 knows no boundaries and spread by human beings as a carrier in the exponential and random pattern of the spectrum envelope with multiples peaks, which has challenged the existing healthcare infrastructure of the countries. Careful analysis of the corona virus spectrum allows a better understanding of the healthcare system on patient outcomes and the possible steps in evolving quality healthcare delivery system, which depends on the heterogeneous distribution and variability of healthcare system such as doctor to patient ratio, nurse to patient ratio, hospital beds and critical care beds based on population in south east Asian countries than that in continents like Europe. Table 1 explains the details of existing healthcare infrastructure of these countries, which is directly related to availability healthcare resource manpower, as well as healthcare physical infrastructures and supply chain management of for delivering the service [2]. It shows that the best healthcare infrastructure is existing in South Korea, Singapore, Hong Kong and Taiwan, whereas adequate healthcare infrastructure availability in Malaysia, Thailand, Philippines and Vietnam but India, Myanmar and Indonesia lacks in the adequate healthcare infrastructure.

Table -1					
Country	Doctor	Nurse to	Nurse	Hospi	Critical
	to	Patient	to	tal	Care
	Patient	(1000)	Docto	Beds1	Beds
	(1000)		r	000	(0.1
			S	patien	mil
			K	t	pop)
			I		
South	2.4	7.3	3.1	12.27	10.6
Korea					
Singapor	2.3	62	2.7	14.5	11.4
e					
Taiwan	1.7	5.7	13.2	5.7	28.5
Hong	2.0	7.6	3.9	5.4	7.1
Kong			4		DF
Malaysia	1.5	3.5	2.3	1.9	3.4
Thailand	0.8	2.8	3.4	2.1	10.4
Philippin	0.6	4.9	8.2	0.88	2.2
es				L	
Vietnam	0.8	1.1	1.4	2.6	KIN
Indonesi	0.4	1.5	3.6	1.49	2.7
а					
India	0.9	1.7	2.0	0.5	2.3
Myanma	0.7	07	1.0	1.0	1.1
r					

SPECTRUM OF DAILY NEW CORONAVIRUS AND POPULATION MORTALITY: Fig -1 to Fig -5 depicts the spectrum of the daily new corona viruses based on 5-days moving average, population mortality and population mortality between two consecutive dates from 15 April 2020 to 26 June 2021. Figure 1 (a) to Figure 5(a) shows different peaks of the spectrum for Hong Kong, Vietnam, Taiwan, Myanmar, Malaysia, Thailand, Singapore, South Korea, Philippines, Indonesia and India and characteristics of multiple peaks such as spectrum peak factor and peak height/ width ratio. It is observed that for countries like India, Indonesia, Myanmar and Philippines, ratio factor of spectrum becomes critical around 0.1, whereas, countries like Hong Kong, Singapore, South Korea and Taiwan, this ratio factor of spectrum becomes critical after 2.0, but countries like Malaysia, Thailand reaches the same critical stage beyond the ratio factor 0.5 of spectrum. It shows that if the spectrum peak height and peak width ratio is more than 0.5 then the impact of mortality will be higher. However the countries having non-adequate healthcare infrastructure, this peak height and peak width ratio is effective from 0.1. It shows that the country having quality healthcare infrastructure is able to control the outbreak during the sharp rise of the spectrum of 1st and 2nd peak









Figure 1(b) to Figure 5(b) depicts the variation of the spectrum of population mortality and population mortality between two consecutive dates from 15 April 2020 to 30 June 2021 for Southeast Asian countries. Figure 1 shows that the increase of population mortality between two consecutive dates increases sharply with the increase of new covid-19 cases for the second and third peak of the spectrum for Hong Kong and second peak of Taiwan, whereas it decreases very sharply with decrease of the second peak spectrum for Taiwan, compared to moderate decrease of population mortality during second and third peak spectrum for Hong Kong. The sharp decrease of the slope of population mortality between two consecutive dates confirms the availability of adequate healthcare delivery system including the supply chain management for Hong Kong, Taiwan and Vietnam.





Fig-2: Spectrum of Covid-19 and Population Mortality The slope of the spectrum of population mortality and population mortality between two consecutive dates is an indicator of the healthcare delivery system to control the outbreak. Further, Figure 2(b) depicts the different decreasing slope angle of the spectrum of population mortality between two consecutive dates for Malaysia, Thailand and Myanmar, which depends on the healthcare infrastructure and healthcare delivery system responsible for the slope angle of population mortality between two consecutive dates. Figure 3(a) depicts multiple peaks of daily new Covid-19 spectrum for Indonesia and Philippines, whereas, population mortality (death per million) steadily rises with increasing slopes for both countries due to inadequate healthcare infrastructure as shown in Figure 3(b). Further, Figure 3(b) explains very slow decrease of population mortality between two consecutive dates, with the sharp decrease of the peak spectrum of new Covid-19 cases for Indonesia and Philippine, whereas, sharp decrease of population mortality between two consecutive dates is observed for Indonesia in comparison to Philippines.







Figure 4 (b) depicts the very sharp decrease of the slope of the spectrum of population mortality between two consecutive dates for Singapore and South Korea due to the availability of the best healthcare infrastructure and healthcare delivery system, whereas the slow decrease of the slope of the spectrum of population mortality between two consecutive dates observed for India due to inadequate healthcare delivery system as explained in Table-1 and also depicted in Figure 5(b). People do not receive adequate sunlight to maintain vitamin D levels during winter in countries situated beyond the latitude of 35°N. All countries that lie below the Latitude of 35°N showed relatively low population mortality [3-4].







Fig-5 : Spectrum of Covid-19 and Population Mortality

Figure 6 depicts the variation of population mortality for the Southeast Asian region that lie between latitudes 38°N and 6°S based on population mortality data from 15 April 2020 to 30 June 2021. There are significant variations in population mortality for Malaysia, Myanmar, Hong Kong, whereas other countries showed non-significant variations in population mortality. Further, a sudden rise of population mortality observed for Myanmar and Hong Kong, in addition to the continuance of the rise of population mortality for Indonesia, Philippines, Malaysia and India.







Fig-6 : Population Mortality for Southeast Asian Region

5. CONCLUSION:

This present cross-section study of covid-19 spectrum describes the impact of spectrum peak and width ratio of Covid-19 and the quality of healthcare infrastructure as well as healthcare delivery system on the population mortalities and population mortality between two consecutive dates for Southeast Asian countries. The slope of the spectrum of population mortality between two consecutive dates of population shows marked variations amongst the countries of the southeast region depending on the existing healthcare delivery system. The sharp decrease of the slope of population mortality between two consecutive dates confirms the availability of adequate healthcare delivery system for countries like South Korea, Singapore, Taiwan and Hong Kong, whereas Malaysia, Thailand, Philippines and Vietnam struggled to control the outbreak due to inadequate healthcare infrastructure. Further, India and Indonesia struggled more to control the Covid-19 outbreak due to inadequate healthcare delivery system, resulting into slow

decrease of population mortality spectrum between two consecutive dates. This present study of spatial big data analysis of spectrum of population mortality provides the clear picture of the severity of the outbreak for countries that lie between the latitudes 38° N and 6° S.

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