ACTA SCIENTIFIC MEDICAL SCIENCES (ISSN: 2582-0931)

Volume 4 Issue 9 September 2020

Research Article

Forecasting the Trends and Probable Impact of COVID-19 on South Asian Region Based on the Publicly Available Data

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Received: July 17, 2020

Published: August 26, 2020

Abstract

The COVID-19 pandemic has become a public-health threat globally exerting a devastating impact on patients, healthcare providers, healthcare systems, and the financial health of economy. Undoubtedly, both developed and developing nations are struggling to control the pandemic, the situation is not different in the South Asian Region (SAR). Lack of social-distancing due to higher population, health-inequalities, lack of adequate health infrastructure, and unpreparedness of health-system is placing tremendous challenge to control COVID-19 in these countries. Accurate predictions and forecasting are required for the readiness of healthcare systems for future plan-of-action. The present study was undertaken to forecast the trends in outbreak of COVID-19 in SAR (7 countries) based on the publicly available cases data, drawn from the https://ourworldindata.org/coronavirus-source-data. We used Double Exponential Smoothing Model to predict the trends in the total confirmed and death cases caused by COVID-19. Findings reveal the highest point-forecast for confirmed (2.54%) and death (1.77%) cases in India. Similarly, lowest confirmed case rate has been recorded for nepal (0.71%) and in terms of death rate, Maldives (1.54%) recorded the lowest number of cases across SAR. Keeping in view the limited healthcare resources in SAR, accurate forecasting, strong disease-surveillance, and avoidance of acute-care for infected-cases is vital.

Keywords: *COVID-19; South Asian Region (SAR); Double Exponential Smoothing Model (DESM); Forecasting; Healthcare*

Abbreviations

COVID-19: Coronavirus Disease; DESM: Double Exponential Smoothing Model; DES: Double Exponential Smoothing; MERS: Middle East Respiratory Syndrome; SAR: South Asian Region; SARS: Severe Acute Respiratory Syndrome

Introduction

Worldwide, over the past two decades, a larger number of individuals and animals have been affected with three epidemics caused by the family of coronavirus (Severe Acute Respiratory Syndrome (SARS)-2003, Middle East Respiratory Syndrome (MERS)-2012, and Coronavirus Disease (COVID-19) [1]. However, significant genetic dissimilarities have been documented between pathogens of these three epidemics, particularly amid MERS and COVID-19. Initially, the hotspots for these epidemics were the Middle East, Saudi Arabia, and China. They transmitted from animal to human, and later transmissions of pathogens were reported from humans to humans in other countries as well. Epidemiological evidence of the COVID-19 outbreak began from Wuhan, China from December 12, 2019 [2].

The World Health Organization (WHO) declared COVID-19 a pandemic on March 11, 2020 as more than 118,000 cases had been reported in 110 countries with a sustained worldwide risk of further spread [3,4]. The most common symptoms associated with the COVID-19 are fever, tiredness and dry cough, However, few people may also experience symptoms such as aches and pain, nasal congestion, running nose, sore throat, and diarrhoea which is much similar with the common cold conditions. Symptoms may develop in two days to two weeks period following the exposure to the virus [5-9].

It is argued that developed countries have greater expertise in the investigation and management of such cases than South-Asian Region (SAR). The spread of COVID-19 in SAR is a major concern because of the extreme resource constraints, poor quality of healthcare, lack of awareness, compliance, human resource and expertise, and vulnerable supply chains. Controlling the spread in these countries would be critical as around 1.9 billion people live in these 7 countries. As of May 23, 2020, there were 210,657 confirmed cases which is around 3.89 percent of the global cases and 5,269 deaths which is around 1.53 percent of the global deaths [10]. Many stringent measures were promptly instigated by these countries including lockdown and suspension of travel to contain the spread of the pandemic.

The COVID-19 pandemic continues to create an acute shortage of essential supplies, personal protective equipment, diagnostics, and medical supplies among the SAR. Due to delays in monitoring the symptoms, and need for critical care, the ventilator support required by the patients suffering from COVID-19 has outnumbered the available number of beds in the Intensive care units (ICUs). Further, the health system needs to be provided with accurate expected numbers to meet the demand for healthcare in terms of emergency training and transferring the doctors and nurses along with other healthcare workers to the severely affected areas in these countries [11].

According to real-time data, confirmed cases of COVID-19 are growing exponentially. Therefore, to contain the spread of coronavirus, it is important to forecast the precise increase in the expected number of cases to comprehend what is required to control the perturbing trends in COVID-19. The accuracy in the predictions will play a critical role in managing the health emergency and preparedness of the respective governments of these countries to tackle the COVID-19 situation. . In this paper, we aimed to assess the spread of in these countries by using the Double Exponential Smoothing (DES) Method. We assume that publicly available data of total confirmed cases and deaths is a legitimate subject to certain reporting biases if any. The objective is not to attempt for meticulous precision but to merely provide useful insights on COVID-19 in the SAR.

Materials and Methods

The data was collected from the publicly available sources i.e. Our World in Data (https://ourworldindata.org/coronavirus-source-data) on COVID-19 total confirmed and death cases. The data was collected and analysed from December 31, 2019 to May 26, 2020. We used the DESM a popular statistical method for time series forecasting. DES employs a level component and a trend component at each period. DES uses two weights, (also called smoothing parameters), to update the components at each period. The DES equations are as follows:

$$L_t = \alpha\, Y_t + (1 - \alpha)\, [L_{t-1} + T_{t-1}]$$

$$T_t = \gamma\, [L_t - L_{t-1}] + (1 - \gamma)\, T_{t-1}$$

$$\hat{Y}_t = L_{t-1} + T_{t-1}$$

Where

Lt: Level at time t

α: Weight for the level

Tt: Trend at time t

γ: Weight for the trend

Yt: Data value at time t

$\hat{Y}_t$: Fitted value, or one-step-ahead forecast, at time t.

If the first observation is numbered one, then level and trend estimates at time zero must be initialized in order to proceed. The initialization method used to determine how the smoothed values are obtained in one of two ways: with optimal weights or with specified weights. DES uses the level and trend components to generate forecasts. The forecast for *m* periods ahead from a point at time *t* is as follows:

$$L_t + mT_t$$

Where

Lt: Level at time t

Tt: Trend at time t.

The parameters for the tentative model from the identification step were estimated using the DES module in R Software [12,13].

Results

The base data has been taken from December 31, 2019, to July 15, 2020, for daily confirmed and death cases. Based on this data, these confirmed and death cases have been predicted from July 16 - 25, 2020 and presented in table 1-7. The study estimates the highest point forecast for confirmed cases of COVID-19 in India across SAR. The confirmed cases in India could be around 1230469 (95% CI: 1210278.89, 1250660.58) and death cases could also will be highest in India i.e. around 29427 (95% CI: 28047.18, 30807.95) as on July 25, 2020. As a result, the confirmed rate of disease for India as a whole will increase approximately at the rate of 2.45% for confirmed cases and 1.77% for death cases daily (Table 3). Among these 7 Countries, the lowest number of confirmed cases has been estimated for Nepal while lowest death cases were forecasted in Maldives. The rate of increase in confirmed cases in Nepal was 0.71% (18367 with 95% CI 16803.98, 19930.28) (Table 5) and for death cases in Maldives; it was 1.54% (16 with 95% CI 13.99, 18.89), mentioned in table 4.

Figure 1a and 1b shows the highest number of confirmed and death cases for COVID-19. The figure shows a trend line depicted in black and blue colors, where the black color curve indicates the number of confirmed and death cases from December 31, 2019, to July 15, 2020, based on the actual data. The blue colour curve indicates the predicted values for both confirmed and death cases. The Y-axis represents the number of confirmed cases and the X-axis represents days. This data was the base for the predicted values of confirmed and death cases in India. Similarly, the lowest rate of confirmed cases estimated for Nepal and the lowest rate of deaths in Maldives were depicted in figure 2a and 2b.

Based on the size of the population, India has the highest number of confirmed cases as compared to other SAR Countries. After India, Pakistan may have the highest number of confirmed cases (277686.54 cases). Pakistan is followed by Bangladesh (220766.77 cases), Nepal (18367.13 cases), Maldives (3173.21 cases), Sri Lanka (3159.32 cases), and Bhutan (90.65 cases) as of July 25, 2020.

Similarly, it was estimated that India had the highest number of deaths which will be 29427 (95% CI: 28047.18, 30807.95) by July 25, 2020. India is followed by Pakistan with 6023 (95% CI: 5799.62, 6247.95). Other countries such as the Bangladesh, Nepal, Maldives and Sri Lanka, have total deaths 2802.03, 43.95, 16.44, respectively by July 25, 2020. The tables(1-7) and figures (1-7) shows that the forecasted number of confirmed and death cases for COVID-19 among all the 7 SARs.

Discussion

Having the highest share of the population, who are struggling for daily sustenance and living in the poor socio-economic environment, the spread of the disease is far easier in SAR than that of the developed countries [15]. The present paper forecasts the spread of COVID-19 among the 7 SAR countries in terms of confirmed and death cases by July 25, 2020. If we go by the highest rate of point forecasts for confirmed cases, India will outnumber other SAR Countries till July 25, 2020 [16]. Though the data was not available on the death-cases among 1 (Bhutan) out of 7 SAR countries, predictions were not possible for them in terms of deaths.

As per the records, Infections have just begun to accelerate in the Asian continent from April. As of July 15 2020, India has recorded 9,64,610 confirmed cases and 24,948 deaths. What makes this pandemic particularly difficult for countries are structural constraints that already exist in their economies; notable socio-economic inequalities, and highest labour force in the informal sector [16,17]. In terms of the highest rate of point forecast for death cases, India may be at the top of the list among these 7 countries. The country is already facing concerns about basic hygiene needs,

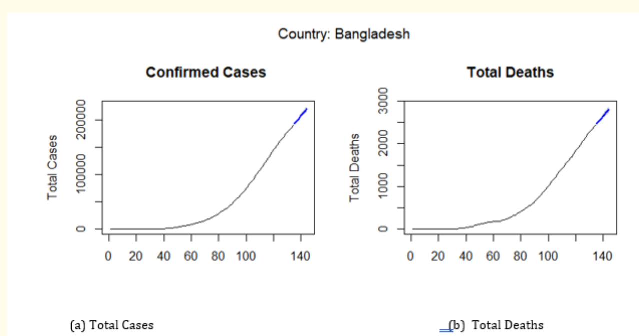

Figure 1: Bangladesh.

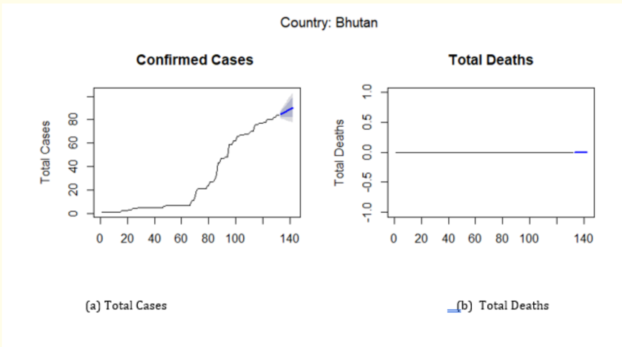

Figure 2: Bhutan.

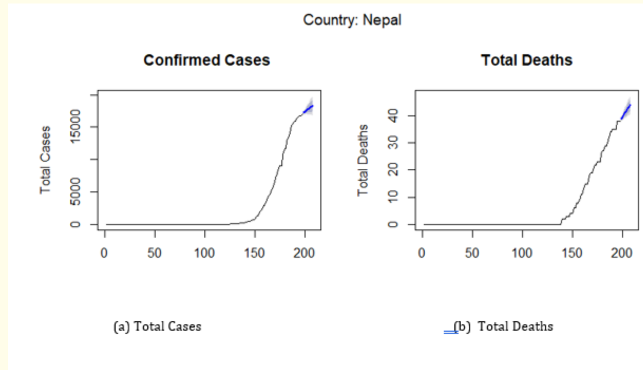

Figure 5: Nepal.

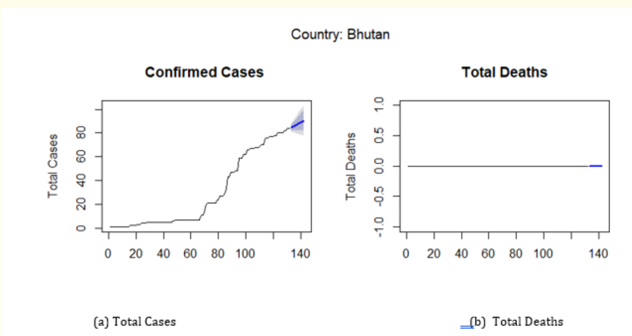

Figure 3: India.

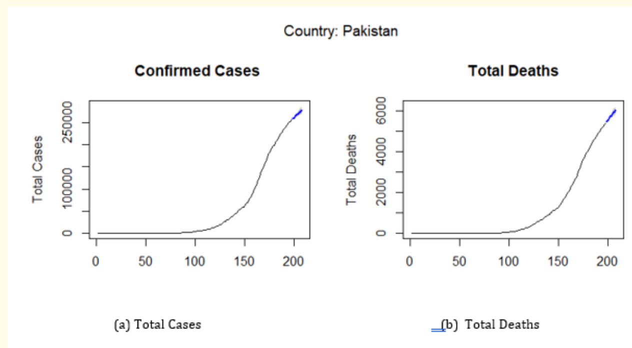

Figure 6: Pakistan.

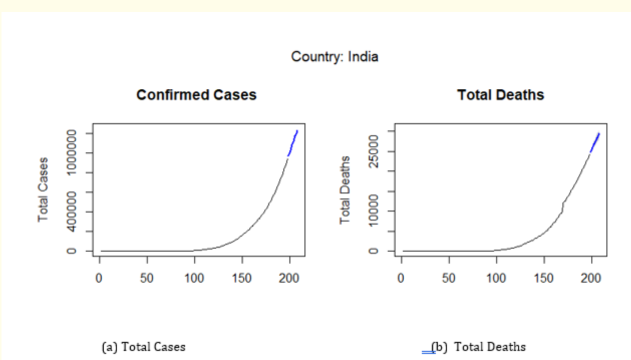

Figure 4: Maldives.

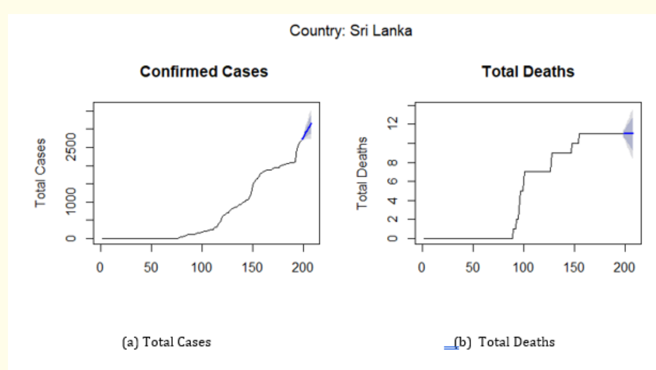

Figure 7: Sri Lanka.

Date	Total cases			Total deaths		
	Point Estimate	95% confidence intervals		Point Estimate	95% confidence intervals	
16 July 2020	193127.96	192655.02	193600.90	2462.01	2451.57	2472.44
17 July 2020	196198.94	195319.69	197078.18	2499.79	2482.53	2517.04
18 July 2020	199269.92	197931.17	200608.66	2537.57	2513.09	2562.05
19 July 2020	202340.89	200490.17	204191.62	2575.35	2543.10	2607.59
20 July 2020	205411.87	203000.27	207823.48	2613.13	2572.57	2653.69
21 July 2020	208482.85	205464.86	211500.85	2650.91	2601.49	2700.33
22 July 2020	211553.83	207886.89	215220.77	2688.69	2629.89	2747.49
23 July 2020	214624.81	210268.85	218980.77	2726.47	2657.80	2795.14
24 July 2020	217695.79	212612.88	222778.70	2764.25	2685.23	2843.27
25 July 2020	220766.77	214920.80	226612.74	2802.03	2712.20	2891.86

Table 1: Bangladesh.

Date	Total cases			Total deaths		
	Point Estimate	95% confidence intervals		Point Estimate	95% confidence intervals	
16 July 2020	84.72	81.58	87.85	0.00	0.00	0.00
17 July 2020	85.38	80.93	89.82	0.00	0.00	0.00
18 July 2020	86.03	80.45	91.62	0.00	0.00	0.00
19 July 2020	86.69	80.04	93.35	0.00	0.00	0.00
20 July 2020	87.35	79.65	95.05	0.00	0.00	0.00
21 July 2020	88.01	79.28	96.74	0.00	0.00	0.00
22 July 2020	88.67	78.92	98.42	0.00	0.00	0.00
23 July 2020	89.33	78.55	100.11	0.00	0.00	0.00
24 July 2020	89.99	78.17	101.80	0.00	0.00	0.00
25 July 2020	90.65	77.79	103.50	0.00	0.00	0.00

Table 2: Bhutan.

Date	Total cases			Total deaths		
	Point Estimate	95% confidence intervals		Point Estimate	95% confidence intervals	
16 July 2020	965609.79	964580.66	966638.92	24818.03	24565.57	25070.49
17 July 2020	995038.67	992737.66	997339.68	25330.20	24951.18	25709.23
18 July 2020	1024467.55	1020617.28	1028317.83	25842.37	25344.90	26339.84
19 July 2020	1053896.44	1048260.24	1059532.64	26354.54	25739.47	26969.62
20 July 2020	1083325.32	1075693.88	1090956.76	26866.71	26132.35	27601.08
21 July 2020	1112754.20	1102937.96	1122570.45	27378.88	26522.42	28235.34
22 July 2020	1142183.09	1130007.54	1154358.63	27891.05	26909.15	28872.96
23 July 2020	1171611.97	1156914.61	1186309.33	28403.22	27292.26	29514.19
24 July 2020	1201040.85	1183668.98	1218412.73	28915.39	27671.62	30159.17
25 July 2020	1230469.74	1210278.89	1250660.58	29427.57	28047.18	30807.95

Table 3: India.

Date	Total cases			Total deaths		
	Point Estimate	95% confidence intervals		Point Estimate	95% confidence intervals	
16 July 2020	2838.22	2789.86	2886.58	14.24	13.63	14.85
17 July 2020	2875.44	2800.99	2949.89	14.49	13.60	15.38
18 July 2020	2912.66	2813.93	3011.40	14.73	13.61	15.85
19 July 2020	2949.88	2827.03	3072.73	14.98	13.65	16.30
20 July 2020	2987.10	2839.76	3134.45	15.22	13.69	16.74
21 July 2020	3024.32	2851.87	3196.77	15.46	13.75	17.18
22 July 2020	3061.54	2863.27	3259.82	15.71	13.81	17.61
23 July 2020	3098.77	2873.88	3323.65	15.95	13.87	18.03
24 July 2020	3135.99	2883.70	3388.27	16.19	13.93	18.46
25 July 2020	3173.21	2892.71	3453.70	16.44	13.99	18.89

Table 4: Maldives.

Date	Total cases			Total deaths		
	Point Estimate	95% confidence intervals		Point Estimate	95% confidence intervals	
16 July 2020	17199.38	16920.58	17478.18	38.71	37.82	39.59
17 July 2020	17329.13	16947.94	17710.32	39.29	38.08	40.49
18 July 2020	17458.88	16962.71	17955.04	39.87	38.37	41.37
19 July 2020	17588.63	16966.53	18210.73	40.45	38.66	42.24
20 July 2020	17718.38	16960.46	18476.30	41.03	38.96	43.11
21 July 2020	17848.13	16945.28	18750.98	41.62	39.26	43.97
22 July 2020	17977.88	16921.60	19034.16	42.20	39.56	44.84
23 July 2020	18107.63	16889.89	19325.37	42.78	39.85	45.71
24 July 2020	18237.38	16850.57	19624.19	43.36	40.14	46.59
25 July 2020	18367.13	16803.98	19930.28	43.95	40.42	47.47

Table 5: Nepal.

Date	Total cases			Total deaths		
	Point Estimate	95% confidence intervals		Point Estimate	95% confidence intervals	
16 July 2020	257960.76	257190.30	258731.22	5449.79	5425.07	5474.51
17 July 2020	260152.51	258671.48	261633.55	5513.57	5473.90	5553.24
18 July 2020	262344.27	260044.54	264644.00	5577.34	5520.48	5634.21
19 July 2020	264536.02	261316.01	267756.04	5641.12	5565.09	5717.15
20 July 2020	266727.78	262494.37	270961.18	5704.90	5607.94	5801.86
21 July 2020	268919.53	263586.86	274252.20	5768.68	5649.15	5888.21
22 July 2020	271111.28	264599.41	277623.16	5832.45	5688.84	5976.07
23 July 2020	273303.04	265536.94	281069.14	5896.23	5727.10	6065.37
24 July 2020	275494.79	266403.61	284585.97	5960.01	5764.00	6156.02
25 July 2020	277686.54	267202.97	288170.12	6023.79	5799.62	6247.95

Table 6: Pakistan.

Date	Total cases			Total deaths		
	Point Estimate	95% confidence intervals		Point Estimate	95% confidence intervals	
16 July 2020	2714.44	2667.23	2761.64	11.00	10.56	11.44
17 July 2020	2763.87	2683.19	2844.55	11.00	10.31	11.69
18 July 2020	2813.30	2697.09	2929.51	11.00	10.08	11.92
19 July 2020	2862.73	2708.19	3017.27	11.00	9.83	12.17
20 July 2020	2912.16	2716.45	3107.88	11.00	9.58	12.42
21 July 2020	2961.59	2721.94	3201.25	11.00	9.33	12.67
22 July 2020	3011.02	2724.78	3297.27	11.00	9.06	12.94
23 July 2020	3060.46	2725.08	3395.83	11.00	8.78	13.22
24 July 2020	3109.89	2722.96	3496.81	11.00	8.49	13.51
25 July 2020	3159.32	2718.50	3600.13	11.00	8.19	13.81

Table 7: Sri Lanka.

health infrastructure, and people living in unfavourable conditions [17]. If the pandemic spreads to these areas, then not only the host nation but also the other international agencies need to take serious measures.

In terms of the size of the population, India will outnumber other countries in terms of both confirmed and death cases. The country is accommodating the second-largest share of the population, having varied socio-economic and demographic conditions, facing tremendous challenges in terms of the COVID-19 outbreak [18]. Further, the health system readiness and other challenges in terms of required health infrastructure, and health-seeking behaviour of its population are among the few mentioned factors which are posing it at the risk of the higher burden of the disease. The confirmed and death cases by the numbers indicate that Nepal may record the lowest numbers of confirmed cases and Maldives will have lowest number of deaths. There was a lack of massive testing and official records released by the country officials. However, no community transmission has been reported to have taken place, which can be a reason for lower reporting for COVID cases. There has been not a single death in Bhutan due to COVID-19 as of July 15, 2020. And that's why predictions are showing that there will be no deaths till July 25, 2020.

The health information system in the majority of the SAR countries is underfunded and weak. There is a need to improve the decision support system in these countries by using digital tools to manage real-time data. The available data needs to be strongly representative of any application-based analysis and taking adequate actions based on them. If the data is representative and strong, it could be used to send communication messages and prepare for rapid response. The organizations managing the data in SAR countries need to focus on improving data governance, real-time analysis, data analytics, modelling support and accurate forecasting's by using various technologies. Forecasting and accurate predictions by using the publicly available daily and weekly data for quick action to predict potential coronavirus outbreaks may limit the spread of COVID-19 and associated illnesses and deaths. This information can be used to plan and direct resources for updating the health professionals and community workers in identifying the population at risk, availability of medical supplies, manpower, health infrastructure and analysis of localized outbreaks in managing the spread of the virus. The private sector can be actively involved along with the government organization in managing the spread and any corrective action.

The insufficient healthcare resources, inadequate financing mechanisms, and constrained health infrastructure in SAR have resulted in the escalated rate of infections followed by a higher incidence of mortality. These countries understand the association between the healthcare resources and any possible fatalities resulting due to any medical emergencies, which should be used in the future for addressing any local outbreaks. Historical data can be also used from past outbreaks such as severe acute respiratory syndrome coronavirus (SARS-CoV) outbreak, 2003 for strengthening the public health systems. The SAR countries must prioritize evidence-based preventive measures in the pre-crisis phase and require preventive measures along with treatment and counselling during and after the crisis. It needs to be recognized that prevention and overall management of such health crises may be more difficult in SAR than in developed countries.

Conclusion

This forecasting provides additional evidence for the preparedness of the healthcare system is placing tremendous challenge to control COVID-19 and future plan-of-actions in these countries. Our results support current proposals for the active monitoring of persons potentially exposed to COVID-19, although longer monitoring period's strength for extreme cases.

Declarations

Ethics approval and consent to participate: N.A, Ethical approval was not required for the present study protocol.

Consent for Publication

Not Applicable.

Availability of Data and Material

Mentioned datasets, we generated data and analysed during the current study will be available from the corresponding author on reasonable request.

Competing Interests

The authors declare that they have no competing interests.

Funding

No funding will be received for the proposed study.

Authors' Contributions

RA and RD developed and piloted the data extraction form also search strategy for the proposed study and drafted the manuscript. RA, RD, and SKYP have written the manuscript with the contribution of RH, VA and SM. Comments, suggestions and revisions have been done by RA and RD. All authors reviewed the manuscript and approved the final manuscript.

Acknowledgements

The authors highly acknowledge the encouragement from Indian Institute of Information Technology, Dharwad, Karnataka, India for carrying out this study.

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