Applied Science & Technology Annals

asta

Research Article

Situation analysis of novel Coronavirus (2019-nCoV) cases in Nepal

Kiran Paudel [1,4, †], Prashamsa Bhandari [1,5,†] and Yadav Prasad Joshi [2,3,6,]*

[1]Institute of Medicine, Tribhuvan University, Nepal
[2]Faculty of Science Health & Technology, Nepal Open University, Lalitpur, Nepal
[3]Department of Public Health, Manmohan Memorial Institute of Health Sciences, Kathmandu, Nepal
[4]Email: kiranpaudel59@gmail.com, ORCID: 0000-0002-5590-4133
[5]Email: prashamsabhandari@gmail.com, ORCID: 0000-0003-2546-1279
[6]Email: yadavjoshi@gmail.com, ORCID: 0000-0002-1578-9775
[†]These authors contributed equally to this work.

Abstract: The Novel Coronavirus (2019-nCoV) is currently a major threat to global health in an unprecedented manner. The global pandemic of COVID-19 has affected 215 countries and territories including Nepal. Until 1st June 2020, altogether 1,811 COVID-19 positive cases were diagnosed using RT-PCR. This study aimed to analyze the status of COVID-19 cases in Nepal and South Asian countries. A retrospective study from 23rd January to 1st June 2020 was conducted using data of the Ministry of Home Affairs, Nepal and Worldometer homepages. The primary case records during the pre and post lockdown periods were examined. Spatial distribution was observed. An exponential trend line was plotted and COVID-19 situation in South Asian countries was assessed. Of 1,811 COVID-19 cases, the highest number (38.3%) was reported in Province 2. Out of 77 districts, 59 were affected. In Fifty-eight districts, primary cases appeared during the lockdown period. The cumulative number of COVID-19 cases showed the exponential pattern of distribution in Nepal. In South Asian countries, India had the highest number of cases and case fatality rate (CFR). There were no cases of CFR in Bhutan. The Novel Coronavirus emergence in Nepal has become a serious challenge to the various sectors including public health. The emergence of primary cases even in the lockdown period needs a detailed study in the future.

Keywords: COVID-19; lockdown; Nepal; situation analysis; South Asian countries

हाल नोभेल कोरोना भाईरस संसारभरी स्वास्थ्य तथा अन्य क्षेत्रकाहरुलागि ठूलो जोखिमको रुपमा देखिएको छ । कोभिड-१९ को विश्वव्यापी महामारीले नेपाल लगायत २१५ देशहरुलाई असर पारेको छ । नेपालमा जुन १, २०२० सम्म १,८११ कोभिड-१९ का विरामिहरु RT-PCR बिधिको प्रयोगगरी पहिचान भई सकेको छ । यस अध्ययनले नेपाल तथा दक्षिण एशियाली मुलुकहरूमा कोभिड-१९ को स्थितीको विश्लेषण गर्ने लक्ष्य राखेको छ। नेपाल सरकार, गृह मन्त्रालय र वर्ल्डोमीटरको वेबसाइटमा उपलब्ध डेटाको प्रयोग गरेर यो अध्ययन गरिएको छ । नेपालमा लकडाउन हुनु पुर्व र लकडाउन पश्चातको अवधिमा पहिलो पटक पोजेटिभ देखिएका कोभिड-१९ का विरामिहरु (primary cases) को रेकर्डलाई विश्लेषण गरिएको थियो। कोभिड(१९ को स्थिती exponential distribution वक्रको प्रयोग गरेर हेरिएको थियो । दक्षिण एसियाली देशहरूको कोभिड-१९ को अवस्था पनि मूल्यांकन गरियो। जुन १ सम्म नेपालमा देखिएका जम्मा १,८११ कोभिड-१९ का विरामीहरु मध्य प्रदेश नं २ मा सबभन्दा धेरै (३८.३५) फेला परेका थिए । प्रदेश नं २ को प्रत्येक जिल्ला कोरोनावाट संक्रमित भएको पाइयो । जम्मा ७७ जिल्लाहरु मध्ये ५९ वटा जिल्लाहरु प्रभावित भएका थिए । ५८ जिल्लाहरुमा, primary case हरु देश बन्दको अवधिमापनि देखिएका थिए । नेपालमा कोभिड(१९ का केसहरु तीब्र तवरले बढेका पाइयो। दक्षिण एशियाली देशहरूमध्ये भारतमा सबैभन्दा बढी कोभिड-१९ का विरामिहरु र 'केस मृत्यु दर' (CFR) रहेको थियो जवकी हामीले अध्ययन गरुन्जेल भुटानमा 'केस मृत्यु दर' (CFR) फेला पारेनौं । नेपालमा नोभेल कोरोना भाईरसको उद्भव, स्वास्थ्य क्षेत्रमा गम्भीर चुनौतीको रूपमा देखिएको छ । लकडाउनको अवधिमा पनि primary case हरु देखिएकाले यसलाई भविष्यमा विस्तृत रुपमा अध्ययन गर्नु आवश्यक छ ।

---

* Corresponding author, E-mail: yadavjoshi@gmail.com; Tel.: +977-9851121372

1. Introduction

Coronaviruses (CoVs) are single-stranded, enveloped RNA viruses from the family of Coronaviridae (Yang et al., 2020). They have the potential of interspecies transmission, causing respiratory, enteric, hepatic and neurological disorders in humans. The coronavirus responsible for Severe Acute Respiratory Syndrome (SARS-CoV) and Middle East Respiratory Syndrome (MERS-CoV) are zoonotic and cause fatal respiratory illness in humans (Zhu et al., 2020). The epidemic of COVID-19 is caused by a Novel Coronavirus (2019-nCoV), first detected on 31 December 2019 in Wuhan, China. It also shares the similarities with two other CoVs i.e. MERS-CoV and SARS-CoV (Li et al., 2020).

The Director General of World Health Organization (WHO) declared the COVID-19 outbreak to be a public health emergency of international concern on 30 January 2020 (WHO, 2020). COVID-19 has spread over 215 countries and territories with vividly varying degrees of severity and mortality in different countries. According to Worldometer statistics, more than 6 million confirmed cases with the death of about 370 thousand globally were reported until the end of May 2020. The United States, Brazil, Russia, Spain and the United Kingdom remained the top five countries with the highest number of cases i.e. 1,859,323; 529,405; 414,878; 286,718 and 276,332, respectively (Worldometer, 2020).

In Nepal, the earliest appearance of COVID-19 was reported on 23 January 2020 in a 32 year old Nepalese student of the Wuhan University of Technology, China who had returned to Nepal on 13 January with no previous history of comorbidities (Bastola et al., 2020). In response to the increase of three additional COVID-19 cases, the Government of Nepal imposed its first lockdown on 24 March to curb the spread of 2019-nCoV. Until 1 June, 1,811 persons were confirmed positive by real-time RT-PCR testing in 59 districts (NDRRMA, 2020). The daily COVID-19 infection count has been surging as the testing quickly ramped up. Nepal recorded its largest single-day spikes in COVID-19 infections to date with 239 new cases on 1 June 2020 (HEOC, 2020). Understanding the emergence of COVID-19 and lessons from a spike of cases can be comprehended by situation analysis which can serve in the foundation for setting priorities to address the policies and strategies. This study aims to find out the status of COVID-19 cases in Nepal and their pattern of distribution in South Asian countries.

2. Materials and Methods

Nepal is located entirely in the Ganges basin and is landlocked by India in the East, South and West, and China in the North. It lies between latitudes 26°22' N to 30°27' N and longitudes 80°04' E to 88°12' E. Nepal has five climatic zones, broadly corresponding to the altitudes. Physiographically, the country is divided into three geographical regions: the high Himalayas in the north; the Hill and Mountain slopes in the center where elevations vary between 300 and 700 meters; and the plain in the lowland region called Terai in the south at elevation below 300 meters. Administratively, Nepal is divided into seven provinces and six of them share their borders with India. The open border between India and Nepal remains a unique feature of relation. Frontier without restriction has greatly facilitated the free movement of people to each other's territory and enhanced interactions as a result of the Treaty of Peace and Friendship between the Government of India and the Government of Nepal in 1950 (Treaty of Peace and Friendship, 1950).

A retrospective study was conducted using publicly available COVID-19 data of National Disaster Risk Reduction and Management Authority (NDRRMA), Ministry of Home Affairs (MoFA), Government of Nepal (NDRRMA, 2020). We used the real-world statistics COVID-19 data of the Worldometer homepage to observe the trend in South Asian countries (Worldometer, 2020). Data were compiled, edited and checked to maintain consistency. Data were entered in Microsoft Excel 2013. Duplication in data was corrected. Frequencies and percentages were calculated to identify the spatial distribution of COVID-19 cases in different provinces and districts of Nepal. The emerging trend of primary cases in 59 districts during pre and post lockdown periods was observed to examine the effectiveness of lockdown. An exponential trend line was used to represent a steady increase of COVID-19 in Nepal. In South Asian countries, the severity of the disease that caused mortality was calculated by measuring the Case Fatality Rate (CFR) (Mi et al., 2020). The map was plotted using 'ggplot2', 'dplyr' and 'rgdal' packages in R studio version (RStudio Team (2015).

3. Results

In between 23 January to 1 June 2020, there were 1,811 COVID-19 cases in Nepal. The highest (38.3%) cases were reported from Province 2, followed by Province 5 and Karnali Province that occupied 35% and 10.9% of the national total cases, respectively. Table 1 gives a general overview of the COVID-19 cases.

In confirmed cases (n=1,811) by RT-PCR test kits, the majority (92.7%) were male. About 81.4% were from Terai while 16.9% from Hill region and 1.7% from Mountain region. We found 99.8% of

COVID-19 cases reported from 58 districts of Nepal during the lockdown period. The date specific appearance of COVID-19 cases during pre–and post-lockdown periods in different districts of Nepal is given in Figure 2.

The cumulative trend of COVID-19 confirmed cases after the 13th week of 2020 showed an exponential distribution (figure 3). The coefficient of determination value for the single term exponential model was 0.99.

In South Asian countries, the total number of cases and CFR from the COVID-19 outbreak was highest (cases n=198,706, CFR=2.8%) in India, followed by Pakistan (cases, n=76,398, CFR=2.1%) in cases and CFR. There were no deaths from COVID-19 reported in Bhutan (table 2). In the affected population, the highest median age (33.1 years) was found in Sri Lanka while the lowest median age (19 years) was found in Afghanistan. The CFR was not found absolutely dependent on the median age.
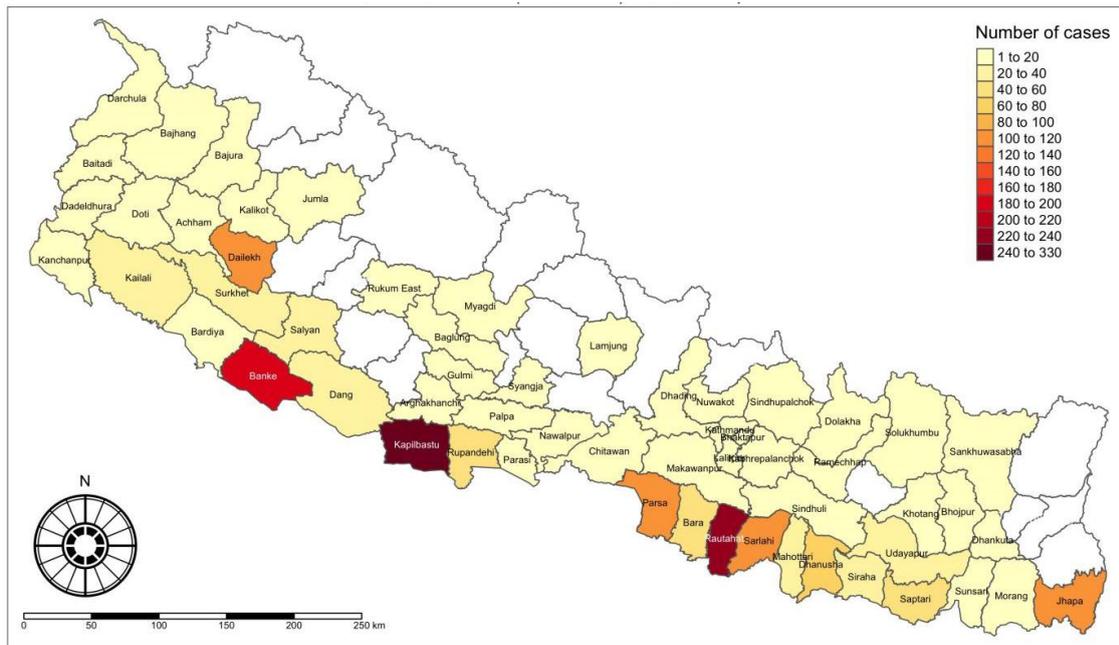

Figure 1. Map of geographical areas of Nepal showing the infected districts with number of cases as of 1 June 2020. The East, West and South borders are connected with India while the northern border is with Tibet, an autonomous region of China.

Table 1. General description of COVID-19 cases from 23 January to 1 June 2020 in Nepal.

Province	Cases (n)	Percentage (%)	Deaths
Province 1	169	9.3	-
Province 2	693	38.3	1
Bagmati	46	2.5	2
Gandaki	27	1.5	-
Province 5	633	35.0	3
Karnali	198	10.9	1
Sudurpashchim	45	2.5	1
Total	1811	100	8
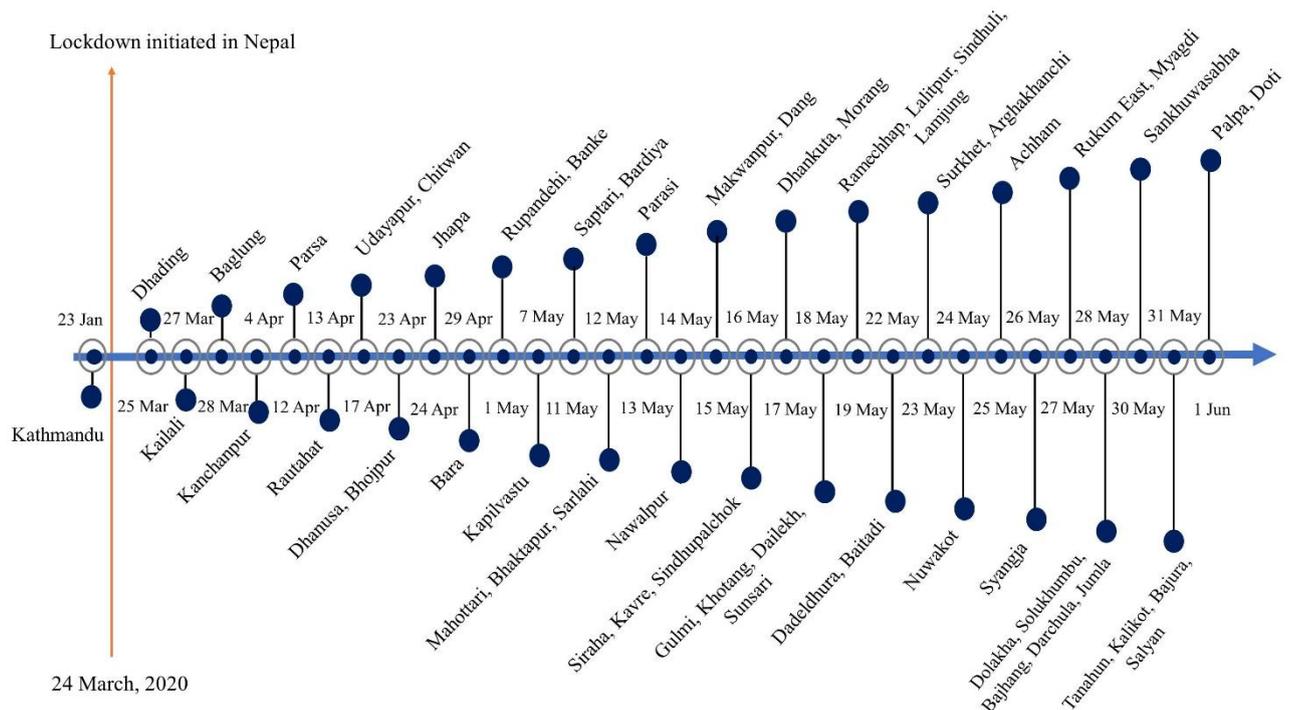
Figure 2. The appearance of COVID-19 cases in the districts during pre-and post-lockdown periods in Nepal.
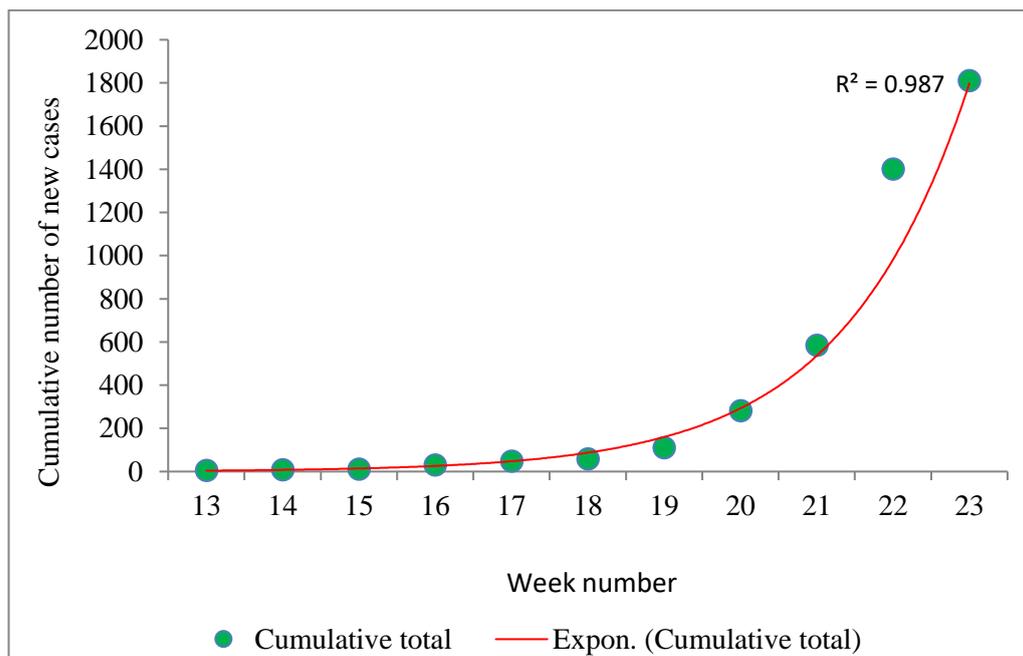
Figure 3. Cumulative number of diagnosed COVID-19 patients in Nepal and their distribution trend.

Table 2. Characteristics of COVID-19 cases in South Asian countries.

Country	Deaths	Cases	CFR (%)	95% CI	Median age (in years)
India	5608	198706	2.8	2.7 to 2.9	28.1
Pakistan	1621	76398	2.1	2.0 to 2.2	24.1
Bangladesh	672	49,534	1.4	1.3 to 1.5	27.1
Afghanistan	265	15,750	1.7	1.5 to 1.9	19
Nepal	8	1811	0.4	0.09 to 0.8	24.5
Sri Lanka	11	1643	0.8	0.4 to 1.4	33.1
Maldives	6	1829	0.3	0.08 to 0.7	28.6
Bhutan	0	47	-	-	28.1

Data Source: Worldometer (https:/worldometers.info/coronavirus/)

4. Discussion

As the world is enduring an alarming level of spread and severity imposed by the COVID-19 pandemic, its public health threat is experienced in Nepal as well. South Asia remained the least affected by 2019-nCoV until January 2020. However, the virus has now spread to all the South Asian countries with differing severity and fatality. In Nepal, the appearance of COVID-19 cases continues to rise rapidly mostly in bordering districts with India (NDRRMA, 2020).

We found that COVID-19 cases diagnosed in Nepal until the first half of April 2020 had abroad travelled history from the countries China, France, United Arab Emirates, Belgium, United Kingdom, and India. A previous study has found that transportation is the most critical mode for promoting the risk of spreading the infectious agent (Wu et al., 2020). The Government of Nepal implemented possible effective measures for 2019-nCoV control such as controlling reservoir, interruption of transmission and country lockdown.

According to Roy (2020), lockdown measures can suppress the primary infection peak. Any level of reduction in transmission over a sufficiently long lockdown period will lower the peak of infection. Similarly, Wu et al suggested that quarantining infected people and isolation of the possible source were found effective to control infectious diseases including China H7N9 (Wu et al., 2020). In contrast, our study found the frequent reporting of primary cases in 58 districts even during the lockdown period. There was a dramatic increase in COVID-19 cases mostly in the bordering districts with India. Hundreds of Nepalese were stuck at the Indian border amid COVID-19 lockdown and the local government had permitted them to return to their home country (The New Indian Express: 30 April 2020).

Lacking their effective quarantining, immediate diagnosis and routine follow-up might have transmitted the virus. The Government of Nepal permitted the import of daily most-essential goods such as fuel, LP gas, food items and grocery items from India. India had the highest COVID-19 cases and CFR in South Asia. The COVID-19 infection to Indian Driver and Car owners who travelled Nepal could have transmitted the virus in wider geographical areas of Nepal. According to Nepal Traveller magazine published on 14 May 2020, 300 people entered Nepal from Kapilvastu Indo-Nepal border (Nepal Traveller, 2020). In Province 5, Kapilvastu and Rupandehi districts had the highest number of cases (The Kathmandu Post: 21 May 2020). The information supports our study. Thus, effective implementation of lockdown during the COVID-19 outbreak in Nepal is questionable. This might be one of the potential research topics for further study.

Moreover, we reported the highest number of cases from Terai Nepal where the population density is comparatively higher than other regions (392 persons per square kilometer). According to Sjödin et al, in COVID-19, higher population densities facilitate more intermixing within the population, so higher numbers of secondary cases are expected (Sjodin et al., 2020). An exponential increase in the cumulative number of COVID-19 cases was observed from the 13th week. The exponential increase of cumulative cases is associated with the formation of secondary cases during an outbreak. The previous study by Bi and colleagues in Shenzhen, China found that COVID-19 has a higher (11.5%) secondary attack rate (Bi et al., 2020). It was marked that during the lockdown situation, migrant and permanent populations were intermixed. Virus transmission is possible in both conditions if effective preventive measures are not followed.

Local transmission from imported cases has also already been established in Nepal, which might be another reason behind the increase in cases. As seen in China, local transmission had increased the number of cases very rapidly (Li et al., 2020). The mentioned causes might have brought the exponential increase of COVID-19 cases in Nepal although the lockdown is implemented. The situation of an exponential increase in cases is difficult, given that the number of patients who will need to be admitted to the intensive care unit is predicted to further increase (Remuzzi & Remuzzi, 2020; Nelson et al., 2014).

Among South Asian countries, the highest CFR was reported in India, followed by Pakistan. However, South Asian countries have noticeably lower CFR than the global statistics of 6.07% (Worldometer, 2020). South Asian countries had significant differences in CFR which suggests considerable uncertainty over the exact reason for CFR. Multiple factors might have influenced the case fatality rate of COVID-19 across different countries (Marahatta et al., 2020). Nepal has reported 8 deaths from COVID-19 as of 1 June 2020 (NDRRMA, 2020). So, a rapid increase in the number of cases and fatalities reflects the requirement of immediate and effective implementation of appropriate measures against 2019-nCoV transmission.

5. Conclusions

The COVID-19 progression trend in Nepal has become a serious challenge to the public health system. The exponential increase of COVID-19 cases and transmission of the outbreak in 59 districts until this study have alarmed the country for an immediate action of disease prevention to prevent the transmission. Multisectoral collaboration in the support of a multi-disciplinary team could become an effective approach to find out the immediate solution for the COVID-19 outbreak.

Abbreviations
CFR: Case Fatality Rate
CoV: Coronavirus
COVID: Corona Virus Disease
MERS: Middle East Respiratory Syndrome
MoHP: Ministry of Health and Population
nCoV: novel coronavirus
NDRRMA: National Disaster Risk Reduction and Management Authority
RNA: Ribonucleic Acid
RT-PCR: Reverse Transcription Polymerase Chain Reaction
SARS: Severe Acute Respiratory Syndrome
WHO: World Health Organization

References

Bastola A, Costello A, Chu DKW, et al. The first 2019 novel coronavirus case in Nepal; 2020, (3): 279-80. DOI: 10.1016/S1473-3099(20): 30067-0.

Bi Q, Wu Y, Mei S, et al. Epidemiology and transmission of COVID-19 in 391 cases and 1286 of their close contacts in Shenzhen, China: a retrospective cohort study. The Lancet Infectious Disease; 2020. DOI: 10.1016/S1473-3099(20)30287-5.

HEOC (2020). Health Emergency Operation Center (HEOC), Ministry of Health and Population, Nepal. [Accessed on 15/05/2020]. Available from: https://heoc.mohp.gov.np/update-on-novel-corona-virus-covid-19/.

Li Q, Med M, Guan X, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus–infected pneumonia. The New England Journal of Medicine; 2020; 382:1199-1207. DOI: 10.1056/NEJMoa2001316.

Li X, Wang W, Zhang D, Zhu N. A novel coronavirus from patients with pneumonia in China, 2019. The New England Journal of Medicine; 2020; 382:727-33. DOI: 10.1056/NEJMoa2001017.

Marahatta SB, Aryal N, Paudel S. COVID-19 Pandemic: what can Nepal do to curb the potential public health disaster? Journal of Karnali Academy of Health Sciences; 2020 3(1): 1-13. DOI: 10.3126/jkahs.v3i1.28374.

Mi YN et al. Estimating instant case fatality rate of COVID-19 in China. International Journal of Infectious Diseases; 2020 (24): S1201-9712. DOI: 10.1016/j.ijid.2020.04.055.

NDRRMA (2020). National Disaster Risk Reduction and Management Authority (NDRRMA), Ministry of Home Affairs, Nepal. [Accessed on 13/05/2020]. Available from: https://covid19.ndrrma.gov.np/.

Nelson KE, Wiliams CM. Infectious disease epidemiology: Theory and practice (3rd edition). Burlington: Jones & Bartlett Learning; 2014.

Nepal Traveller. Three thousand people illegally enter Kapilvastu. Published on: 14/05/2020. Available from: http://nepaltraveller.com.

Remuzzi A, Remuzzi P. COVID-19 and Italy: what next? Health Policy; 2020, 395(10231): P1225-1228. DOI: 10.1016/S0140-6736(20)30627-9.

Roy S. COVID-19 pandemic: impact of lockdown, contact and non-contact transmissions on infection dynamics. Journal of Medical Internet Research; 2020. DOI: 10.1101/2020.04.04.20050328.

Sjödin H, Wilder-Smith A, Osman S, et al. Only strict quarantine measures can curb the coronavirus disease (COVID-19) outbreak in Italy, 2020. Eurosurveillance; 2020 2; 25(13): 2000280. DOI: 10.2807/1560-7917.ES.2020.25.13.2000280.

The Kathmandu Post. Province 2 teeters on edge with the highest number of Covid-19 cases in the country. Published on: 21/05/2020. Available from: https://kathmandupost.com/.

The New Indian Express. COVID-19 lockdown: around 2,000 Nepalese stranded near Indo-Nepal border return home. Published on: 30/05/2020. Available from: https://newindianexpress.com/.Nepal Traveller.

RStudio Team (2015). RStudio: Integrated Development for R. RStudio, Inc., Boston, MA, USA. Available from: http://rstudio.com/. Version: 3.6.1.

Treaty of Peace and Friendship (1950). Ministry of External Affairs, Government of India. [Accessed on: 17/05/2020]. Available from: https://mea.gov.in/bilateral-documents.htm?dtl/6295/Treaty+of+Peace+and+Friendship.

WHO (2020). Rolling updates on coronavirus disease (COVID-19). [Accessed on: 15/05/2020]. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen.

WHO (2020). WHO Director-General's opening remarks at the media briefing on COVID-19. [Accessed on: 11/05/2020]. Available from: https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-may-2020.

Worldometer (2020). Coronavirus/Countries. [Accessed on: 14/05/2020]. Available from: https://worldometers.info/coronavirus/.

Wu et al. Does Wuhan need to be in lockdown during the Chinese Lunar New Year. International Journal of Environmental Research and Public Health; 2020, 17(3): 1002. DOI: 10.3390/ijerph17031002.

Yang Y, Peng F, Wang R, Guan K, Jiang T, Xu G, Sun J, Chang C. The deadly coronaviruses: The 2003 SARS pandemic and the 2020 novel coronavirus epidemic in China. Journal of Autoimmunology; 2020, 15:102487. DOI: 10.1016/j.jaut.2020.102487.

Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, Zhao X, Huang B, Shi W, Lu R, Niu P. A novel coronavirus from patients with pneumonia in China, 2019. The New England Journal of Medicine; 2020; 2020 Feb 20;382(8):727-733. DOI: https://www.nejm.org/doi/full/10.1056/nejmoa2001017.