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Pandemic management in mountainous regions: challenges and opportunities

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1. Introduction

Mounting fatalities, with mutant varieties of the contagion named COVID-19 being reported from many nations and the potency of the vaccines still not established, have exposed the world community to an unexpected unplanned, uncommon, and fearful situation that has not spared even the largest and most thriving economies and the stress upon administration and health professionals has been on the rise. Like other countries, India is also being severely affected by the pandemic. With its huge population of 1201.1 million (Census of India, 2011) and generally low literacy level (74.0%) as also developing health-care facilities, India has joined the listed of the most affected countries.

Not that India lacks administrative apparatus and organizational structure to tackle the situation; having enacted Disaster Management Act in 2005 India has a 3-tier structure of Disaster Management Authorities at nation, state, and district level, which have been conferred extensive powers and authority. It is, however, a reality that despite being recognized as a distinct category, biological disasters have not been accorded due priority by the disaster managers as these did not cause major losses in recent times (Fig. 17.1). Overwhelmed by the scientific progress in the field of disease control and eradication as also the impact of recurring floods and cyclones together with intermittent huge losses by earthquakes, the disaster managers could hardly visualize a biological disaster of this magnitude.
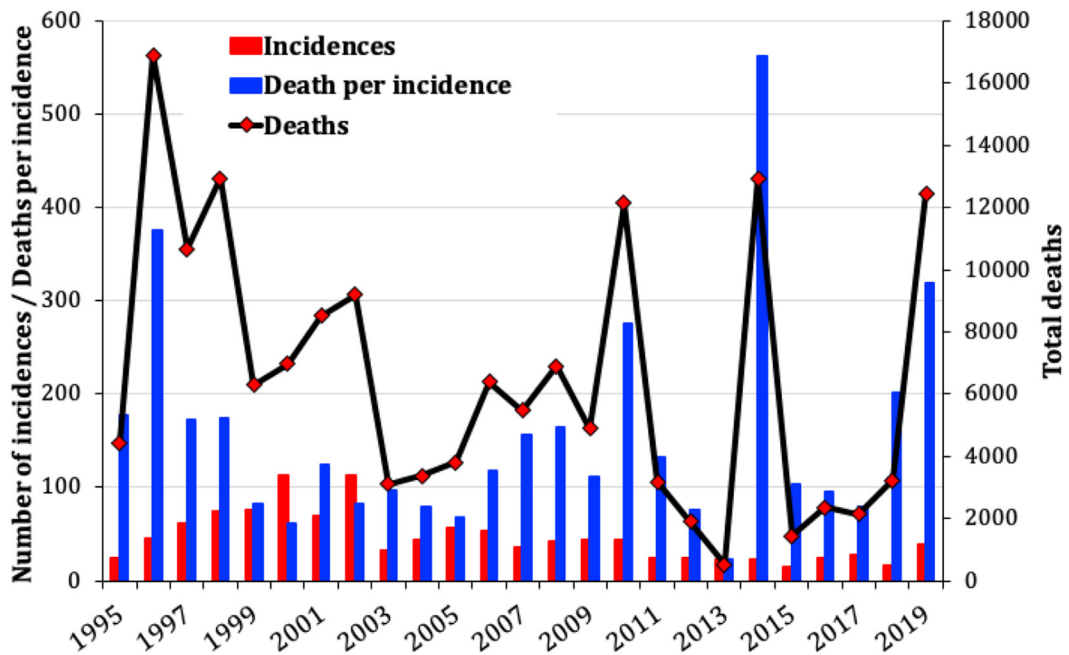
FIGURE 17.1   Global impact of epidemics over previous 25 years, 1995−2019. *Data source: www.emdat.be.*

The medical fraternity has not therefore been in the mainstream of disaster management with their role conceived as being generally restricted to postdisaster casualty management, triage, first aid, medical care, and psychosocial support.

The situation thus warrants putting in place robust operational and well-rehearsed protocols, SOPs, and plans in the realm of disaster management framework to tackle a biological emergency. Moreover, all this needs to be done fast as with low ranking in global health-care access and quality (HAQ) index India is faced with the challenge of restraining spread of COVID-19. The present communication analyzes the scenario in Uttarakhand province of India.

1.1 COVID-19: a new virus and its beginning

In December 2019, a cluster of severe pneumonia cases of unknown cause was reported in Wuhan, Hubei province, China. The initial cluster was epidemiologically linked to a seafood wholesale market in Wuhan, although many of the initial 41 cases were later reported to have no known exposure to the market (Sarkar et al., 2020).

In the beginning the medical fraternity was faced with the challenge of understanding the genesis, mode of spread, and impact of this new virus (Roychowdhury et al., 2020). Analysis of throat swabs of the infected persons confirmed an outbreak and deep sequencing analysis revealed novel coronavirus (CoV) as the cause (Woo et al., 2010). First named 2019-nCoV by the World Health Organization (WHO) this virus was later renamed COVID-19 (WHO, 2020a,b).

On January 30, 2020, the WHO declared that the SARS-CoV-2 outbreak constituted a Public Health Emergency of International Concern (WHO, 2020a,b,c,d,e). The novel coronavirus (COVID) outbreak was declared a global pandemic on March 11, 2020 (Sarkar et al., 2020; WHO, 2020a,b,c,d,e).

COVID-19 is an infectious disease caused by a newly discovered coronavirus (Kuiken et al., 2003) with most infected persons experiencing mild to moderate respiratory illness and recovering without special treatment (Callard, 2020) and only 20% developing serious or critical symptoms. This made the management challenging as people with mild symptoms followed their daily routine creating conducive conditions for the spread of this highly contagious virus among the exposed community. Elderly, as also those with underlying medical history of cardiovascular and respiratory disorders, diabetes, and cancer, however, are likely to develop serious illness (Ntusi, 2020).

With basic reproduction rate which is a measure of transmissibility of the virus ranging between 2.24 and 3.58 COVID-19 spreads through droplets of saliva or discharge from the nose when an infected person coughs or sneezes (Zhao et al. 2020). Public gatherings and social interactions thus have the potential of increasing the transmission and therefore, social and physical distancing was suggested as a preventive strategy. Bringing forth respiratory etiquette was thus emphasized as a mitigation strategy.

1.2 COVID-19 in India

The first case of COVID-19 was reported in India from Kasaragod district of Kerala on February 3, 2020, with the infected individual having traveled from Wuhan and reached Kanhangad on January 27, 2020, via Guangzhou, Kolkata, Bengaluru, Cochin, and Angamaly (Vaman et al. 2020). Most COVID-19 infected persons detected initially in India had a travel history to Italy, China, and Iran and therefore source of the virus was attributed to overseas travel. The data at that juncture showed no signs of the virus being transmitted within the country and therefore authorities focused on tracing persons with travel history, particularly to COVID-19 infected countries. However, on March 10, 2020, of the first 50 COVID-19 positive cases in India 10 did not have any travel history and had come in contact of someone who had traveled abroad. At that time only 01 person had not come in contact with anyone who had traveled abroad.

Since March, the virus started spreading rapidly and nationwide lockdown was imposed from March 25, 2020, and the restrictions therein were eased from June 1, 2020, in a phased manner. With the restart of economic activities as also enhanced testing, there was an increase in COVID-19 cases. The positivity rate (confirmed cases/tests) for India thus increased from 2.5% in the pre-lockdown period to 6.4% in the post-lockdown phase, suggesting increase in positive cases with increased number of tests. The case fatality rate, however, came down from 3.6% in the first phase of lockdown to 1.5% in the post-lockdown period (Table 17.1), which is much lower as compared to other countries including Italy (14.5%), Spain (9.3%), the United Kingdom (14.2%), and the United States (5.5%). The recovery rate also improved significantly from 12.5% in the first phase of lockdown to 101.0% in

TABLE 17.1   Impact of COVID-19 in India during different phases of lockdown and thereafter.

| | | Pre-lockdown | Lockdown | | | | Unlock | | |
| | | | Phase I | Phase II | Phase III | Phase IV | Phase V | Phase VI | |
Sl. No.	Head	January 30– March 24, 2020	March 25– April 14, 2020	April 15– May 3, 2020	May 4–17, 2020	May 18– 31, 2020	June 1– 30, 2020	July 1– December 15, 2020	Total
1.	Number of cases	571	10,914	31,294	52,920	94,949	395,143	9,347,117	99,32,908
2.	Number of tests	22,694	222,199	801,557	11,81,192	1,509,385	48,60,510	14,75,90,107	15,61,87,644
3.	Number of deaths	1	395	1067	1562	2382	12,005	126,721	144,133
4.	Number of recoveries	3	1362	10,398	25,032	55,067	255,979	9,680,241	10,028,082
5.	Positivity rate (%)	2.5	4.9	3.9	4.5	6.3	8.1	6.3	6.4
6.	Case fatality rate (%)	0.2	3.6	3.4	3.0	2.5	3.0	1.4	1.5
7.	Recovery rate (%)	0.5	12.5	33.2	47.3	57.9	64.8	103.6	101.0

Data source: www.covid19india.org.

the post-lockdown phase, which was an encouraging sign amid the continuing coronavirus crisis (Rai et al. 2020).

1.3 COVID-19-induced restrictions and implications

With rampant poverty, low-income levels, large migrant population, low literacy rate, developing health-care systems, and fragile social security system, lockdown was not an easy decision for the state. However, in view of the global scenario and rapidly increasing number of COVID-19 cases (Table 17.1), the state decided to implement it as a strategy to buy time for putting in place required health-care infrastructure as also to make masses aware of COVID-19 appropriate social behavior.

The lockdown was implemented in a phased manner: Phase I (March 25 to April 14, 2020), Phase II (April 15 to May 3, 2020), Phase III (May 4 to May 17, 2020), and Phase IV (May 18 to May 31, 2020) and gradually lifted from June 1, 2020, with continuing restrictions in containment zones identified by public health authorities. With minor variations suiting local ground realities restrictions imposed in the province have been similar to those in other parts of the country details of which are summarized in Table 17.2.

TABLE 17.2 Summary of restrictions imposed by the government of India to restrict the spread of COVID-19.

Sl. No.	Head	Lock				Unlock	
		Phase I	**Phase II**	**Phase III**	**Phase IV**	**Phase V**	**Phase VI**
		March 25–April 14, 2020	April 15–May 3, 2020	May 4–17, 2020	May 18–31, 2020	June 1–30, 2020	July 1–December 15, 2020
1.	Offices of government of India (GOI), provincial governments, and Union Territories together with their autonomous/subordinate offices and public corporations	Closed	Functional with limited attendance	Functional with limited attendance	Functional with limited attendance	Functional with limited attendance	Functional with limited attendance
2.	Commercial, private, and industrial establishments	Closed	Closed	Operational with restrictions	Operational with restrictions	Operational with restrictions	Operational with restrictions
3.	Air travel	Suspended	Suspended	Suspended	Suspended	Domestic flights allowed	Domestic flights allowed
4.	Metro rail service	Suspended	Suspended	Suspended	Suspended		
5.	Railways	Suspended	Suspended	Suspended	Operational	Operational	Operational

Source: Ministry of Home Affairs, Government of India orders that are available at www.mha.gov.in.

Despite high socioeconomic implications, lockdown and ensuing restrictions helped in restricting the spread of the virus. This situation has been an eye opener for the worst-case scenario planning for future pandemics. Detailed planning for such scenarios is a must for tackling economic uncertainties and ensuring business continuity.

1.4 Uttarakhand: socioeconomic and geographic profile and demography

Shaped largely by socioeconomic profile of the population together with the state of health infrastructure, the problems faced by the constituent provinces while managing COVID-19 were different and diverse. This communication reviews the issues faced by the Himalayan province of Uttarakhand in India that was created by the bifurcation of Uttar Pradesh, in the year 2000, and shares international frontier with Nepal and Tibet (China). The topography of the province is highly rugged with altitudes ranging between 190 m (Sharda Sagar) and 7816 m (Mt. Nanda Devi) above msl. The state does not have good rail and air connectivity which is restricted to the southern and western fringe (Fig. 17.2).

The population density, particularly in the hill districts, is low, and these are plagued with poor health-care infrastructure. The hill districts at the same time have high rate of migration that is reflected in negative population growth of two districts, Almora and Pauri Garhwal, in the previous decade (2001–11) (Fig. 17.3).

FIGURE 17.2   Study area map of Uttarakhand. *Source: Wikipedia.*
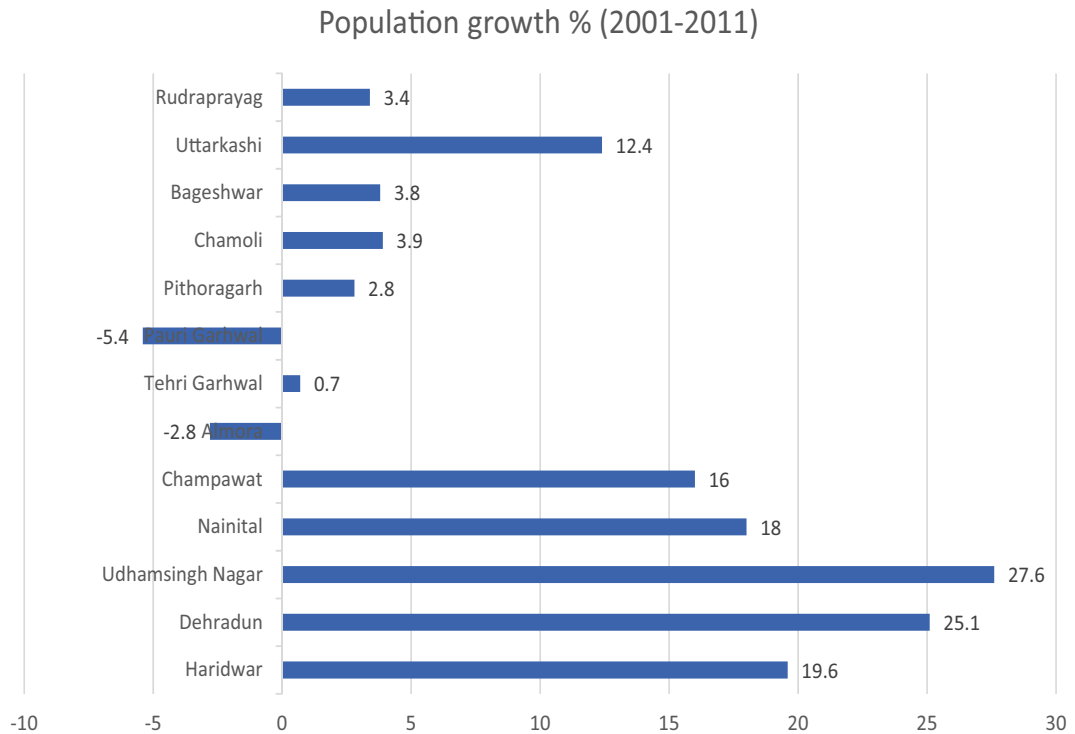
Population growth % (2001-2011)

FIGURE 17.3   Population growth (%) of different districts in Uttarakhand.

The economy of Uttarakhand is largely dependent upon horticulture, floriculture, tourism, and pilgrimage and large proportion of population works outside the province (Chhimwal et al., 2019; Kumar et al., 2015). The problems faced by the province were thus shaped by the geographical conditions, and influx of migrants.

Uttarakhand is a small province ranking 19th and 20th among the provinces of India in terms of geographical area and population, respectively. With almost 70% of the area under forest cover, Uttarakhand is one of India's most remote provinces. The province is sparsely populated with population density of 10 of the 13 districts being below the national average of 382 people per square kilometer (Table 17.3; Census of India, 2011).

Four most urbanized and industrialized districts at the southern and western fringe of the province—Dehradun, Haridwar, Udhamsingh Nagar, and Nainital—account for 61.4% of the population and include 85% of urban and 51% of rural population of the province. Between 2001 and 2011 these districts have witnessed population growth of 31% with urban and rural population registering growth of 27% and 23%, respectively (Census of India, 2011).

This contrasts sharply with demographic changes in the rest of Uttarakhand; the population in the 09 remaining hill districts has increased only by 4% in this period with Almora and Pauri Garhwal registering population decrease of 1.3% and 1.4%, respectively. In both these districts, this decline has been driven by reduction in the number of rural inhabitants, with urban areas experiencing an increase in population (Census of India, 2011) (Table 17.4; Fig. 17.4).

TABLE 17.3 District-wise population density of Uttarakhand.

Sl. No.	District	Population density per km^2 (Census of India, 2011)	Rank among districts (640) in India (1 = lowest population density)
1.	Uttarkashi	41	21
2.	Chamoli	49	26
3.	Pithoragarh	69	32
4.	Bageshwar	116	56
5.	Rudraprayag	119	58
6.	Pauri Garhwal	129	61
7.	Champawat	147	69
8.	Tehri Garhwal	169	83
9.	Almora	198	106
10.	Nainital	225	126
11.	Dehradun	550	285
12.	Udhamsingh Nagar	648	317
13.	Haridwar	817	364
	Uttarakhand	189	-

Source: Census of India. (2011). New Delhi: Office of the registrar general and Censes Commissioner, Ministry of Home Affairs, Government of India.

TABLE 17.4   District-wise demographic profile of Uttarakhand.

Sl. No.	District	Total population	Share of state population	Population growth % (2001−11)	Urban population (in %)	Urban population growth % (2001−11)	Rural population growth % (2001−11)
	Plain districts	6,190,623	61.4	30.9	41.9	27.2	22.7
1.	Haridwar	1,890,422	18.7	0.6	36.77	24.7	19.6
2.	Dehradun	1,696,694	16.8	32.3	55.5	43.6	25.1
3.	Udhamsingh Nagar	1,648,902	16.3	33.4	35.6	22.1	27.6
4.	Nainital	954,605	9.5	25.1	38.9	20.8	18.0
	Hill districts	38,95,669	38.6	3.6	11.7	2.2	1.8
5	Champawat	259,648	2.6	15.6	14.8	2.4	16.0
6.	Almora	622,506	6.2	−1.3	10.0	1.4	−2.8
7	Tehri Garhwal	618,931	6.1	2.3	11.3	1.9	0.3
8.	Phauri Garhwal	687,271	6.8	−1.4	16.4	3.8	−5.4
9.	Pithoragarh	483,439	4.8	4.6	14.4	2.4	2.8
10.	Chamoli	391,605	3.9	5.7	15.2	2.7	3.9
11.	Bageshwar	259,898	2.6	4.2	3.5	0.5	3.8
12.	Uttarkashi	330,086	3.3	11.9	7.4	0.5	12.4
13.	Rudrapravag	242,285	2.4	6.5	4.1	3.2	3.4
	Uttarakhand	10,086,292	100	18.8	30.2	13.8	11.5

Source: Census of India. (2011). New Delhi: Office of the registrar general and Censes Commissioner, Ministry of Home Affairs, Government of India.
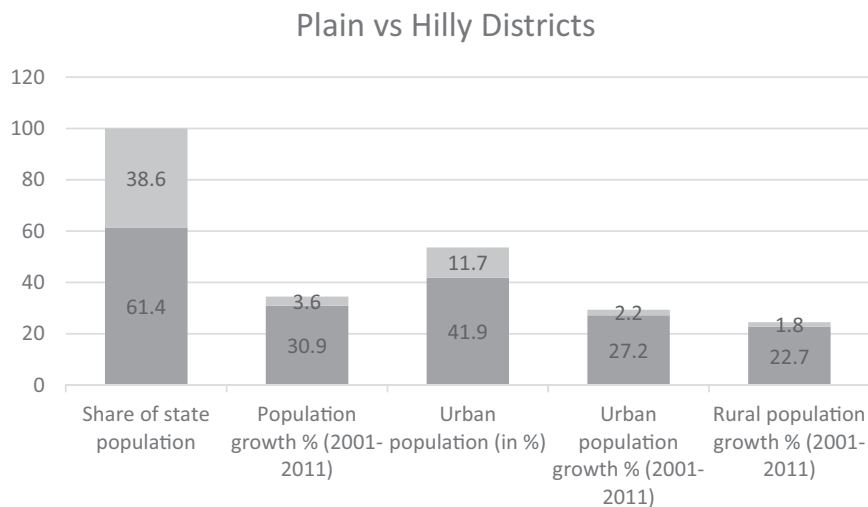

FIGURE 17.4   Plain versus hilly districts.

Despite 70% population residing in rural areas, the province is urbanizing fast, and the share of its urban population has increased from 26% to 30% between 2001 and 11. This correlates with rapid growth of economy, and between 2005 and 12 the Gross State Domestic Product (GSDP) has registered an average growth rate of 12.3% that is higher than national average of 8%. Consequently, the share of poor people in Uttarakhand has reduced from 32% in 2004–05 to 11% in 2011–12 (GOI, 2007, 2013).

It is important to note that demographic changes in the province have been shaped largely by migration with young, educated men constituting major share of migrants from the hill districts (Jain, 2010; Mittal et al., 2008). While seasonal and cyclical migration from the hill districts has been recorded since early 19th century it has acquired permanent nature in recent decades (Jain, 2010; Pathak, 1997). A qualitative study carried out in three hill districts outlines (i) lack of employment opportunities, (ii) declining agricultural productivity, (iii) small and scattered landholdings, (iv) poor power, water supply, and transport infrastructure, (v) inadequate education, health, and marketing facilities, and (vi) aspirations to live in an urban environment as being the main factors fueling migration (Jain, 2010).

1.5 COVID-19: first phase in Uttarakhand

The first case of COVID-19 was reported in Uttarakhand from Dehradun on March 20, 2020. The propagation of the virus was rather slow in the beginning that is attributed to the lockdown and there was significant time lag in the propagation of the virus to the hill districts.

Among the hill districts, it was Pauri Garhwal that shares a long and porous border with Uttar Pradesh where the first COVID-19 case was reported relatively early on March 29, 2020, within 10 days of first case in the province. For more than a month (40 days or till April 28, 2020) except for Pauri Garhwal the spread of COVID-19 was restricted to the plain districts of the province.

In Uttarkashi the first COVID-19 case was reported on May 10, 2020, 52nd day of the first case reported in the province. As for other districts time lag for the spread of COVID-19 was more than 2 months with its being reported in Bageshwar and Chamoli districts on May 19, 2020 (61st day), in Pithoragarh and Almora on May 20, 2020 (62nd day) and in Rudraprayag district on May 29, 2020 (71st day).

Except for Tehri Garhwal and Almora districts initial progression of the contagion was slow and took significant time but thereafter the propagation was quite fast particularly in the plain districts. High fatality rate is a cause of concern for the province (Table 17.5).

1.6 COVID-19: second phase in Uttarakhand

Uttarakhand has two civilian airports at Jollygrant in Dehradun and Pantnagar in Udhamsingh Nagar. The railway connectivity is till Dehradun, Rishikesh (Dehradun), Kotdwar (Pauri Garhwal), Kathgodam (Nainital), and Tanakpur (Champawat). Though interstate borders are also shared by Pauri Garhwal and Uttarkashi, majority of the people coming to the province cross over from Dehradun, Haridwar, Udhamsigh Nagar, Nainital, and Champawat districts. Pithoragarh and Champawat districts also share almost porous international boundary with Nepal.

TABLE 17.5   COVID-19 situation in Uttarakhand till December 31, 2020.

	Samples	Infected	Recovered	Dead	Positivity rate	Fatality rate	Recovery rate
Almora	65,387	3004	2755	24	4.59	0.80	91.71
Bageshwar	41,846	1455	1327	18	3.48	1.24	91.20
Champawat	79,692	1703	1521	8	2.14	0.47	89.31
Chamoli	80,956	4304	3177	24	5.32	0.56	73.82
Phauri Garhwal	112,452	4958	4752	57	4.41	1.15	95.85
Pithoragarh	80,879	3188	2736	38	3.94	1.19	85.82
Rudraprayag	46,936	2202	2111	10	4.69	0.45	95.87
Tehri Garhwal	94,482	3998	3732	16	4.23	0.40	93.35
Uttarkashi	94,688	3543	3292	16	3.74	0.45	92.92
Hill	697,318	28,355	25,403	211	4.07	0.74	89.59
Dehradun	313,246	26,684	24,559	845	8.52	3.17	92.04
Haridwar	252,736	13,013	12,729	147	5.15	1.13	97.82
Udhamsingh Nagar	262,886	10,789	10,713	109	4.10	1.01	99.30
Nainital	169,587	10,976	10,102	206	6.47	1.88	92.04
Plains	998,455	61,462	58,103	1307	6.16	2.13	94.53
State	1,695,773	89,817	83,506	1518	5.30	1.69	92.97

Data source: www.covid19india.org.

    With the lockdown coming to an end on May 3, 2020, the province witnessed massive inflow of its migrant population. With most persons coming from heavily COVID-19 infected cities like Mumbai and Delhi the province witnessed sharp rise in the COVID-19 positive persons and with the passage of time the infection reached remote and far flung districts.

    There is a marked difference in the trend of COVID-19 infection in hill and plain districts of the province (Figs. 17.5 and 17.6). In the plain districts the trend has been similar to the province and one can logically conclude that the trend of the plain districts has shaped the trend of the province. In the plain districts daily positive cases peaked around the middle of September 2020 and registered a gradual decrease thereafter till the end of October 2020 after which the COVID-19 cases witnessed another wave of increase. The first peak is attributed to ingress of migrants while the second is attributed to festive season in India: Dushehra and Deepawali being celebrated, respectively, on October 25 and November 14, 2020. The latter period also coincides with marriage season in India and it is customary for friends and relatives to gather on these occasions. The trend in the hill districts is, however, different and after attaining a threshold toward the end of August 2020 it has been somehow hovering around the same.
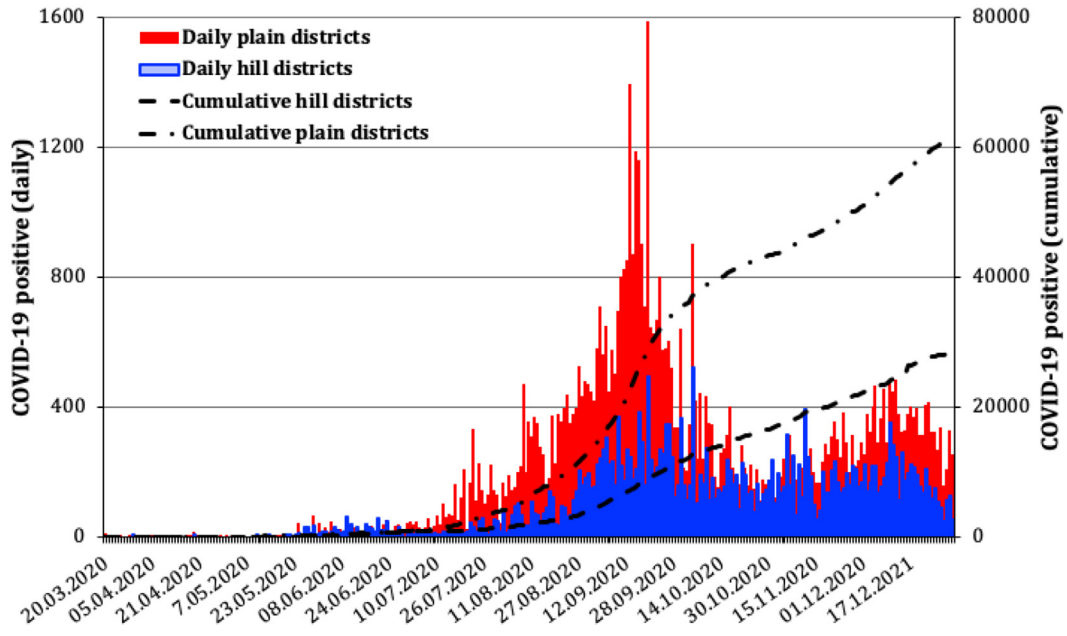
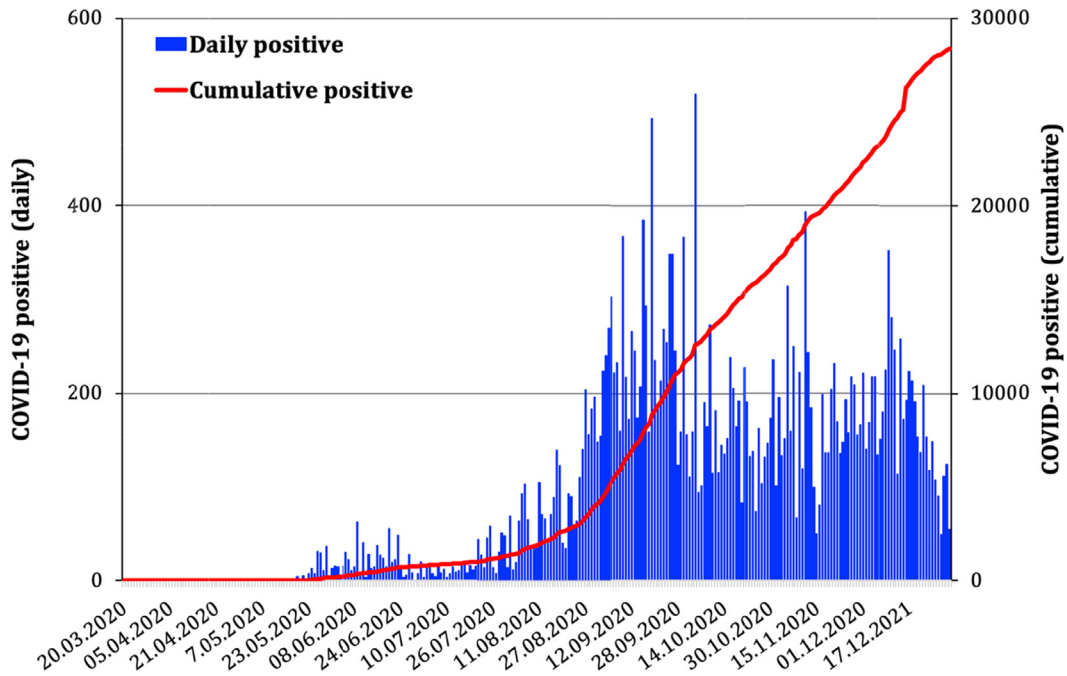FIGURE 17.5   COVID-19 infection trend in the hill and plain districts of Uttarakhand.

FIGURE 17.6   COVID-19 infection trend in the hill districts of Uttarakhand.

II. Capacity and response of local government

1.7 COVID: initiatives of Uttarakhand government

With increase in the number of COVID-19 infected persons the provincial government and district administration initiated a number of proactive measures for restricting mass propagation of the virus. The details of these measures are summarized in the sections below.

1.7.1 Lockdown and the stranded persons

Economic activities of various sort, particularly in the plain districts, routinely support livelihood of large number of persons. With the COVID-19-induced lockdown this population, working largely in unorganized sector, was rendered without means of livelihood.

Dedicated 24×7 COVID-19 helpline was quickly started in all the districts to get to know the problems of various sections of the community and address these, so as to avoid mass discontent and unrest. For this assistance and support of civil society groups and nongovernmental organizations was mobilized. Measures were also put in place for the delivery of cooked food as also dry ration together with other items of daily requirement to the persons identified by the helpline. The demands of the persons requesting medicines, drugs, and other essential items were recorded by the helpline and these items were delivered by the volunteers on payment basis.

1.7.2 Diagnostic facilities

Being highly infectious the COVID-19 positive persons have to be quickly detected and restrained from intermingling with other persons. In March 2019, there existed only one COVID-19 testing and diagnostic facility in the state at Dr. Susheela Tiwari Government Medical College at Haldwani in Nainital district and thus there was general delay in receiving the reports that increased to the burden of isolation facilities besides adding to the trauma of the persons being tested and their family members.

Efforts were therefore made to create COVID-19 testing and diagnostic facilities in both government and private sector. At present COVID-19 related tests of the samples collected by various agencies of the provincial government are thus being carried out at 09 facilities of the government and 08 of the private sector. Apart from this 14 other facilities of the private sector have been allowed to undertake COVID-19 related tests. Rates for these tests have been prescribed by the state for the private diagnostic facilities.

Reports of the tests are being provided through Internet and WhatsApp. Augmentation of testing facility has helped in early detection and isolation of the infected persons.

1.7.3 Public awareness

Spread of COVID-19 being associated with human behavior and personal hygiene the risk of fast transmission of the infection was high in India as physical contact in various forms is a customary, social, and ritualistic requirement. Moreover people generally gather in large numbers on various familial celebrations as also religious and ritualistic occasions. The norms of COVID-19 appropriate behavior not being a habit for large proportion of the population, the district administration started a massive awareness drive to communicate (i) the threat posed by COVID-19, (ii) likely symptoms of COVID-19, (iii) ways of minimizing the risk of infection, and (iv) course of action in case of symptoms.

In this context, a strategic communication approach was adopted and multipronged campaign was carried out by the Information and Public Awareness Department of the provincial government using various tools to ensure voluntary compliance of various safety measures.

1.7.4 Print media

Information on health advisories, do's and don'ts for COVID-19 prevention, government guidelines, management protocols for pandemic situation, and arrangements being made by the state were regularly disseminated through advertisements in both English and vernacular newspapers and magazines.

1.7.5 Outdoor media tools

Outdoor media tools including hoardings and others carrying messages on various aspects of COVID-19 infection were installed at prominent locations, crossroads, highways, near malls, and other places having high footfall.

1.7.6 Electronic media

Innovative and engaging radio jingles, video spots, short films on COVID appropriate behavior, and safety protocols were prepared and disseminated through radio, community radio, FM radio, and cable/satellite channels in electronic media.

1.7.7 Social media

Various social media platforms were utilized for disseminating health advisories, government guidelines, COVID-19 protocol, and related information.

Printed material: Leaflets, pamphlets, and guidelines both in English and vernacular were prepared on health advisories, government guidelines, COVID-19 protocol, and others and disseminated throughout the district with the engagement of civil society groups and nongovernmental organizations.

1.7.8 Health bulletin

Lack of access to authentic and reliable information often causes misinformation and panic among the masses and the chances of the same increased by manifold with the advent of social media. Health bulletins depicting the actual situation were therefore issued by the health department officials and the same were disseminated through media.

1.7.9 Contact tracing

The nature of COVID-19 warrants speedy tracing, surveillance, and testing of all persons who have come in physical contact of the person who has been tested positive. Dedicated unit was therefore established in the province for (i) preparing repository of persons who have been tested COVID-19 positive, (ii) gathering movement details of COVID-19 positive persons, (iii) identifying persons who might have come in physical contact of COVID-19 positive person, (iv) ensuring home isolation of these suspected persons, (v) keeping track of the health condition of home isolated persons, and (vi) testing of persons who show COVID-19 symptoms. Mobile phone records are also being utilized for verifying the movement history of the COVID-19 positive persons and tracing persons who have been in their proximity during previous some days.

1.7.10 Containment zone management

In order to ensure that the persons living in the proximity of COVID-19 positive persons do not intermingle with others and contain themselves within the specified limits,

containment zones were notified by the authorities in accordance with the guidelines of the Ministry of Home Affairs, Government of India, for a duration of 10 days under Uttarakhand Epidemic Diseases, COVID-19 Regulations, 2020, and Epidemic Diseases Act, 1897. Barricading was resorted to at all entry points to the notified containment zone and police personnel were deputed on 24 × 7 basis to ensure that there is no trespassing and punitive measures were initiated against violators.

Surveillance of the health condition of persons living in the notified containment zones and in the buffer zones around these was resorted to. Besides testing of persons showing COVID-19 symptoms random samples were also collected both from containment zone and buffer zone.

Appropriate measures were put in place by the authorities to ensure unreasonable discomfort to the residents of the containment zone, and routine supply of medical, health, and essential items was maintained.

1.7.11 Mandatory provisions

Wearing of mask in public places and ensuring social distancing has been made mandatory by invoking relevant provisions of Disaster Management Act, 2005, as also Uttarakhand Epidemic Diseases, COVID-19 Regulations, 2020, and Epidemic Diseases Act, 1897, and penal provision have put in place for violators. With the opening of business establishments the responsibility of ensuring COVID-19 appropriate behavior within the business premises and ensuring thermal screening and hand sanitization facility at the entrance has been entrusted upon the management of the business establishments.

Fines are being imposed against persons violating the norms of COVID-19 appropriate behavior (Table 17.6). Till December 31, 2020, fines have accordingly been imposed against 161,860 persons for the violation of social distancing norms while 565,478 persons have been fined for not wearing mask. Those fined for not wearing mask are being provided masks free of cost and thus 939,565 masks have been distributed among the defaulters and the same amounts to 9.32% of the population of the province. 994 persons have been fined for violating norms of quarantine while 86,331 persons have been fined for various other violations while 4712 persons have been fined for violation of lockdown norms. Penal action against; 8.12% of the population 9.57% of the plains, and 5.83% of the hills shows that strict action is being taken against violations of any kind.

A total of Rs. 2672.36 lakh (∼US$ 3.82 million) has thus been recovered in the province from violators of COVID-19 norms: Rs. 246.49 lakh (US$ 0.35 million) for violation of Police Act, Rs. 1387.44 lakh (US$ 1.98 million) for violation of Motor Vehicle Act, and Rs. 1038.43 lakh (US$ 1.48 million) for violation of Epidemic Act (Table 17.7).

1.7.12 Surveillance

For early detection and prevention of community spread of COVID-19 infection telephonic and door-to-door physical surveillance of the health condition of the individuals is also being resorted to throughout the province.

1.7.13 Treatment facilities for COVID-19 patients

Due to highly infectious nature of COVID-19 dedicated treatment facility is required for the patients. Moreover, serious patients have to be provided intensive care with ventilator

TABLE 17.6 District-wise details of punitive measures imposed on the violators of COVID-19 norms (March—December 2020).

District	Violation					Total	Total % of population
	Social distancing	Mask	Quarantine	Lockdown	Others		
Almora	8241	17,884	34	23	3239	29,421	4.73
Bageshwar	3667	13,942	60	164	2058	19,891	7.65
Champawat	1677	16,069	59	199	836	18,840	7.26
Chamoli	2156	8342	15	40	2784	13,337	3.41
Pauri Garhwal	14,208	27,027	20	152	3147	44,554	6.48
Pithoragarh	2790	9555	90	141	5888	18,464	3.82
Rudraprayag	2224	6736	39	13	290	9302	3.84
Tehri Garhwal	24,443	32,554	51	150	1360	58,558	9.46
Uttarkashi	2276	11,027	60	125	1256	14,744	4.47
Hill districts	**61,682**	**143,136**	**428**	**1007**	**20,858**	**227,111**	**5.83**
Dehradun	20,022	187,999	50	817	7584	216,472	12.76
Haridwar	52,415	94,536	214	1002	9580	157,747	8.34
Nainital	22,416	73,554	90	708	27,758	124,526	13.04
Udhamsingh Nagar	5325	66,253	212	1178	20,551	93,519	5.67
Plain districts	**100,178**	**422,342**	**566**	**3705**	**65,473**	**592,264**	**9.57**
State	**161,860**	**565,478**	**994**	**4712**	**86,331**	**819,375**	**8.12**

Data source: State Emergency Operations Centre, Government of Uttarakhand.

support. 11 dedicated COVID-19 hospitals (DCHs) and 27 dedicated COVID-19 health centers (DCHCs) have accordingly been set up throughout the province and the capacity of these has been adequately enhanced in all the districts. Major proportion of these facilities—359 ICU beds (42.9%) and 273 ventilators (39.3%)—are, however, in Dehradun district alone. Nevertheless, as compared to facilities available in the province in March 2020 there is a marked improvement in the facilities that reflects the magnitude of effort put in.

1.7.14 Isolation of COVID-19 patients and suspects

Despite acknowledging the importance of isolating both COVID-19 positive and suspected persons, authorities were finding it difficult to accommodate all positive and suspected cases in designated DCHs and DCHCs with the increase in COVID-19 cases. Separate isolation facilities have therefore created and at present these can accommodate 31,540 patients. The COVID-19 positive persons are being given the option of choosing unpaid institutional or paid isolation facility. The persons opting for paid isolation facility are being provided food and accommodation at the rate of Rs. 1500 ($\sim$US$ 21) per day.

TABLE 17.7   District-wise details of fine imposed (in Rs. lakh) on persons violating COVID-19 related norms (March–December 2020).

District	Fine imposed (in Rs. lakh)			Total (in Rs. lakh)
	Police Act	MV Act	Epidemics Act	
Almora	11.2	77.35	41.06	129.61
Bageshwar	6.92	35.71	27.32	69.95
Champawat	5.42	45.31	23.38	74.11
Chamoli	6.98	41.7	18.45	67.13
Pauri Garhwal	6.28	83.72	64.13	154.13
Pithoragarh	21.16	83.96	14.37	119.49
Rudraprayag	6.02	25.27	14.72	46.01
Tehri Garhwal	4.21	36.38	11.2	51.79
Uttarkashi	10.5	35.7	17.54	63.74
Hill districts	**78.69**	**465.1**	**232.17**	**775.96**
Dehradun	22.7	135.55	319.31	477.56
Haridwar	25.26	197.4	225.24	447.9
Nainital	37.87	361.52	156.2	555.59
Udhamsingh Nagar	81.97	227.87	105.51	415.35
Plain districts	**167.8**	**922.34**	**806.26**	**1896.4**
State	**246.49**	**1387.44**	**1038.43**	**2672.36**

Data source: State Emergency Operations Centre, Government of Uttarakhand.

With most educational institutions being closed the authorities facilitated the support of their management and most institutional isolation facilities were established in their premises.

With the designated isolation facilities becoming overwhelmed the authorities created 422 additional COVID-19 Care Centers (CCCs) for accommodating asymptomatic and suspected persons. A nodal officer was designated for the management of every isolation facility and CCCs, and medical and paramedical staff were deputed in these for regularly monitoring health condition of the inmates.

1.7.15 Registration/travel assistance

Having traumatized by the COVID-19-induced lockdown and ensuing economic uncertainty large population was awaiting relaxation in movement norms so as to move to their native places. With large population of migrants the authorities in the province realized the challenges in store for them well in advance and entrusted the responsibility of organizing planned and accounted movement of persons to Dehradun Smart City Limited. This initiative later helped the authorities in tracing travel and contact history of COVID-19 positive persons.

Online registration on the web portal of Dehradun Smart City Limited together with travel pass issued online were therefore made mandatory for all interstate and interdistrict movement of persons. This measure helped the authorities in restricting the movement of persons in accordance with available transportation, screening, testing, and quarantine capabilities. This together with quarantine of the persons in the border districts delayed the spread of COVID-19 to hill districts of the province.

1.7.16 Travel arrangement for stranded persons

With the federal government easing travel restrictions the migrants stranded in the district as also those coming from adjoining districts were getting impatient to initiate their travel. With public transport not fully operational required travel arrangements for these persons were made by the provincial government.

1.7.17 The returnees

Uttarakhand has a large population of persons working in various states across the country, largely in unorganized sector. Many of these were rendered jobless on the aftermath of COVID-19-induced lockdown and ensuing economic uncertainty. These persons were therefore left with no option but to return to their native places. According to a report of the Migration Commission, Government of Uttarakhand, 2,15,850 persons returned to their native places till the end of June 2020 due to COVID-19 related situation and 82.37% of the returnees were from outside the state. Of these 59,360 returned in the first phase till the end of March 2020.

Most of these persons entered the state through the plain districts where arrangements were made for their screening, testing, quarantine, isolation, and treatment before sending them to their respective destinations.

1.7.18 Screening at the border

As per the directions of the provincial government all the persons entering its geographical limits were quarantined at a place close to the state border for specified duration of 7 days before they could intermingle with others or continue their onward journey. Dehradun, Haridwar, Udhamsingh Nagar, and Nainital districts being major entry points for persons traveling to other districts facility for screening, testing, and quarantine were created by the authorities in these districts.

Interstate and interdistrict boundary Police check points were activated together with the ones at interstate bus terminals, railway stations, and airports on 24×7 basis to register the details of the persons entering the state, undertake preliminary thermal screening, and direct them to the nearest quarantine center. Medical teams were deputed to at these check points for sample collection and isolation of suspected persons. Random sampling of inbound persons was also resorted to at these check points.

1.7.19 Quarantine of the returnees

Quarantine centers were organized by the authorities for the returnees, largely in the plain districts. Paid quarantine facilities were also created whereby hotels were acquisitioned under relevant provisions of the Disaster Management Act, 2005. The persons opting for paid quarantine facility were charged Rs. 1500 ($\sim$US$ 21) per day.

Many instances were reported from across the state whereby the local residents fearing spread of COVID-19 did not allow returnees to enter the village boundary and intermingle with the residents. The village headmen (Gram Pradhan) were therefore provided resources for organizing quarantine facilities for the returnees in the community-owned facilities in and around the village for the stipulated duration and were entrusted responsibility of reporting COVID-19 symptoms to the health authorities.

1.7.20 Home quarantine

Certain categories of persons coming to the province were exempted from institutional quarantine, and permission was accorded for their home quarantine. A system was put in place to monitor movement details, health condition, and compliance of COVID-19 appropriate behavior by home quarantined persons through COVID-19 helpline with the support of citizen groups, housing societies, civil society, and nongovernmental organization and volunteers. Movement of the home quarantine persons was also tracked using the location of their mobile phone and the defaulters were penalized.

1.7.21 Home isolation

With increase in active COVID-19 cases the provincial government has allowed home isolation of asymptomatic patients in case they have adequate facilities at home to abide by social distancing norms. These persons are being provided a home isolation kit containing (i) a fingertip pulse oximeter, (ii) a thermometer, (iii) 50 triple layer masks, (iv) 100 mL hand sanitizer, (v) 15 tablets of Vitamin C, (vi) 2 tablets of Vitamin D3, (vii) 10 tablets of paracetamol, 500 mg each, (viii) 01 red BMW bag, and (ix) COVID-19 related awareness material. The authorities are regularly monitoring movement details and health condition of the home isolated persons through COVID-19 helpline and have mobilized support of citizen groups, housing societies, civil society, and nongovernmental organization and volunteers for the same. The movement details of the home isolated persons is also being tracked using the location of their mobile phone and the defaulters were penalized.

1.7.22 Comorbidity surveillance center

With high risk of COVID-19 to comorbid persons data pertaining to these were collected from the chemists as also state treasury. Health condition of the persons so identified is being regularly monitored over telephone and medical advice and assistance is being provided as and when required.

1.7.23 Travel arrangements for returnees

After completing the stipulated quarantine period arrangements were made by the authorities for the onward journey of the returnees. For this staging area was set up at a suitable place in the plain districts. Public transport not being operational, authorities mobilized vehicles for the onward journey of these persons.

1.7.24 Corona warriors

In view of high risk to which medical and paramedical personnel, particularly those engaged in various COVID-19 related duties, are exposed the federal government has provided special insurance cover to them. On its part the provincial government has declared

all personnel engaged for various COVID-19 related duties as Corona Warriors and pledged to cover the entire cost of their COVID-19 treatment, if required, together with an assistance of Rs. 10 lakh (∼US$ 14,286) to their next of kin in case of death out of Chief Minister Relief Fund.

Treatment expenses of all Corona Warriors infected by COVID-19 are being quickly reimbursed while next of kin of Corona Warriors who lose their lives are being provided the pledged assistance.

1.7.25 Logistics support for medical and paramedical staff

The medical and paramedical personnel engaged in COVID-19 related duties often desist intermingling with their family members due to the fear of possible transmission of COVID-19. Taking cognizance of their concern the authorities are arranging logistic facilities for medical and paramedical personnel. Hotels have been accordingly directed under relevant provisions of Disaster Management Act, 2005, to resume operations and cater to the logistics requirements of the medical and paramedical personnel. This decision of the authorities has boosted the morale of the health practitioners and motivated them to undertake their duties with full dedication.

1.7.26 Sanitization of public places and offices

Regular sanitization of all public places including government offices and private establishments, particularly in all urban areas, is being ensured on weekly public holiday. Urban local bodies have been specifically instructed to undertake dedicated sanitization drives on regular intervals and separate financial assistance has been provided for the same.

1.7.27 Last rites

Last rites of an individual, particularly among Hindus that constitute the majority in India, hold special ritualistic and religious significance. Due to the fear psychosis even family members and close relatives of COVID-19 infected persons often do not attend the last rites. Moreover the management of the cremation sites also resists last rites of the COVID-19 patients.

Taking cognizance of this situation the authorities have notified sites for the last rites of COVID-19 patients and are ensuring compliance of costmary religious rites and rituals in case relatives of COVID-19 patients are not present. All protective measures are being ensured and all persons engaged in last rites are being provided protective gear.

1.7.28 Vulnerable population

In view of high risk of COVID-19 to certain group of persons, particularly children, aged, pregnant women, and ones suffering with comorbid conditions, the authorities have issued special advisories appealing these groups of persons to stay indoors to the extent possible, follow COVID-19 appropriate behavior, and not intermingle with other persons. The provincial government has also exempted this category of persons, where engaged in service, from attending the office and continue working from home.

1.7.29 Containment of the contagion

The measures put in place by the authorities to restrict and discourage free movement of persons and quarantining the returnees in the district of their entry for a specified duration

delayed the spread of COVID-19 to hill districts and the same is evident from the time lag observed in the spread of COVID-19 to the hill districts of the province (Fig. 17.7).

With first COVID-19 cases being reported from the province on March 20, 2020, there was a distinct time lag in the spread of COVID-19 to the hill districts of the province. Among the hill districts it was Pauri Garhwal that shares a long and porous border with Uttar Pradesh where the first COVID-19 case was reported relatively early on March 29, 2020, i.e., within 10 days of the first case being reported in the province. However, no COVID-19 case was reported from any other hill district for more than a month and the spread of COVID-19 was restricted to the plain districts of the province.

It was on May 10, 2020; i.e., on 52nd day of the first case being reported in the province that a COVID-19 case was reported from any other hill district, i.e., Uttarkashi. As for other hill districts the time lag was more than 2 months. COVID-19 was reported from Bageshwar and Chamoli on May 19, 2020 (61st day), from Pithoragarh and Almora on May 20, 2020 (62nd day), and from Rudraprayag on May 29, 2020 (71st day).

Except for Tehri Garhwal and Almora districts the spread of the contagion in the province was rather slow and took significant time but after the initial threshold, the spread was relatively fast, particularly in the plain districts.

Being transmitted from outside and largely contained at the border districts geographical remoteness delayed the spread of the contagion. This provided time to the health department authorities to gear up their preparedness for facing the situation. This is substantiated by the very fact that despite witnessing relatively high rate of infection Champawat, Chamoli, Rudraprayag, Tehri Garhwal, and Uttarkashi districts have recorded a low case fatality rate.
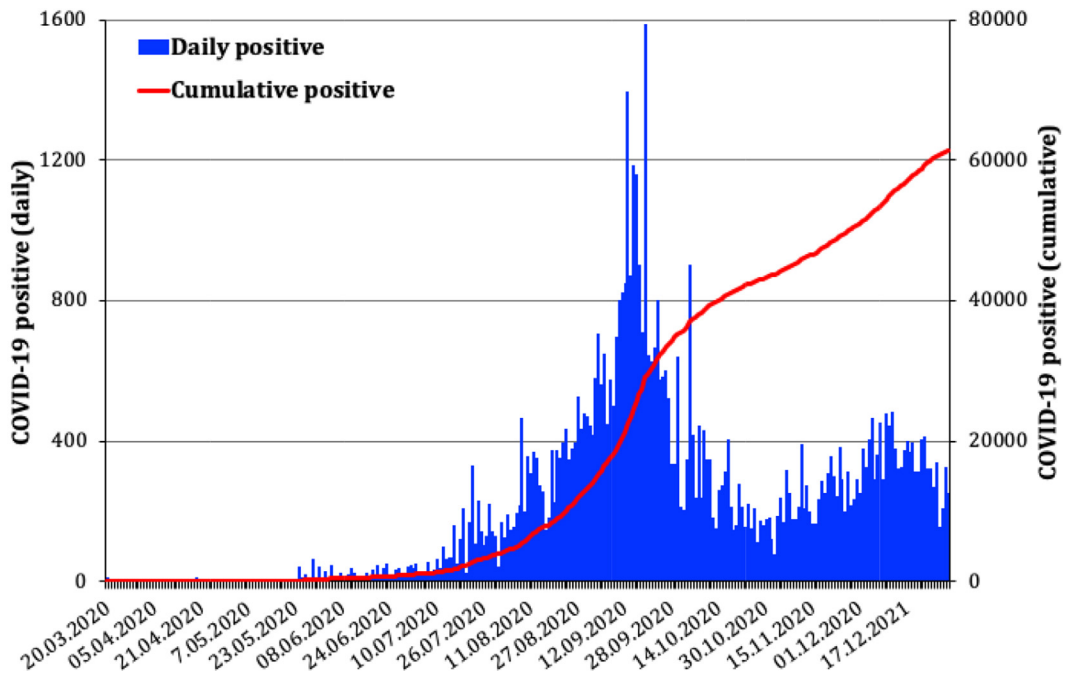

FIGURE 17.7   COVID-19 infection trend in the plain districts of Uttarakhand.

As regards the returnees (215,875), hill districts account for 82.86% of which Pauri Garhwal and Almora, respectively, have 33.79% and 24.48%. Of the 17.14% returnees to the plain districts Udhamsingh Nagar and Nainital account for 59.35% and 26.08%, respectively.

Infection rate as a function of the population is observed to be slightly higher in the plain districts (Fig. 17.8); 0.99% as against 0.73% for the hill districts. Uttarkashi (1.07%) and Chamoli (1.10%), however, show relatively higher infection rate among the hill districts. Among the plain districts Dehradun has the highest infection rate of 1.57% followed by Nainital (1.15%). High infection rate in the plain districts of the province is attributed to the fact that almost all the returnees, except for a proportion of those coming to Champawat and Pauri Garhwal, traveled through the plain districts which resulted in higher exposure level of the population of these districts to the contagion.

Despite health-care infrastructure being better developed in the plain districts case fatality rate in these is observed to be significantly high (2.13%) as compared to hill districts (0.74%).

Case fatality rate being an indicator of the success of the measures taken by the authorities shows different trend for hill and plain districts of the province (Fig. 17.9). After an initial peak in the middle of June 2020 in both plain and hill districts, there is a gradual decrease, particularly in the hill districts. Case fatality rate trend for the plain districts remains above 1.5 all through and shows two phases of resurgence at the end of July and September 2020. The first peak as also first resurgence in the plain districts is attributed to the ingress of the returnees (Fig. 17.10).

The case fatality rate in the plain districts correlates positively with infection rate (confirmed cases/population) but that same does not hold good for hill districts (Fig. 17.8).
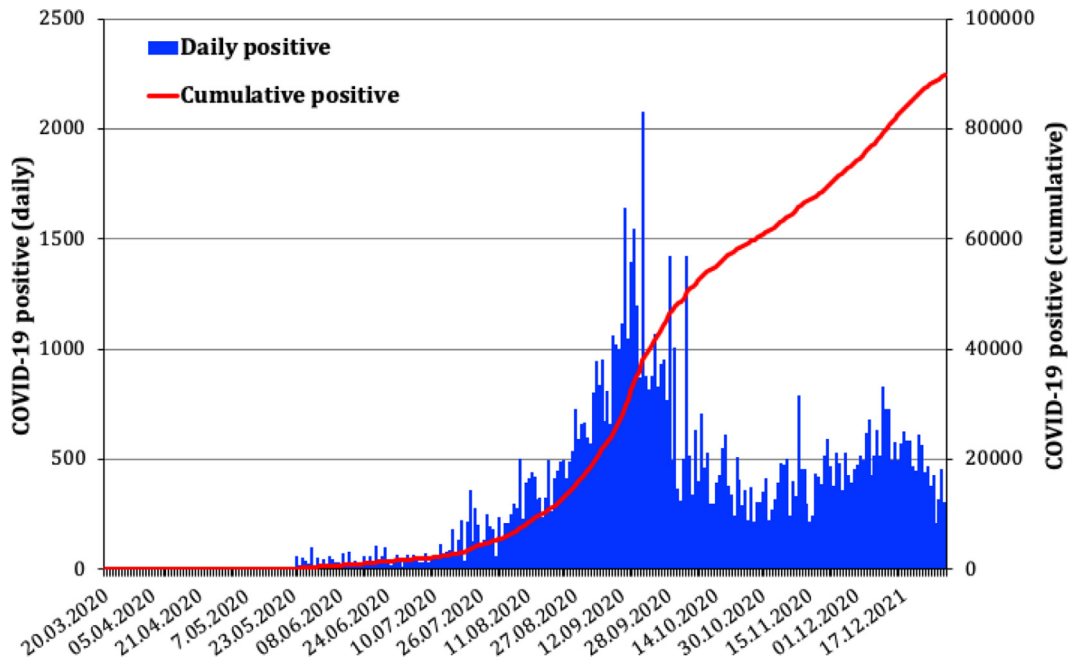

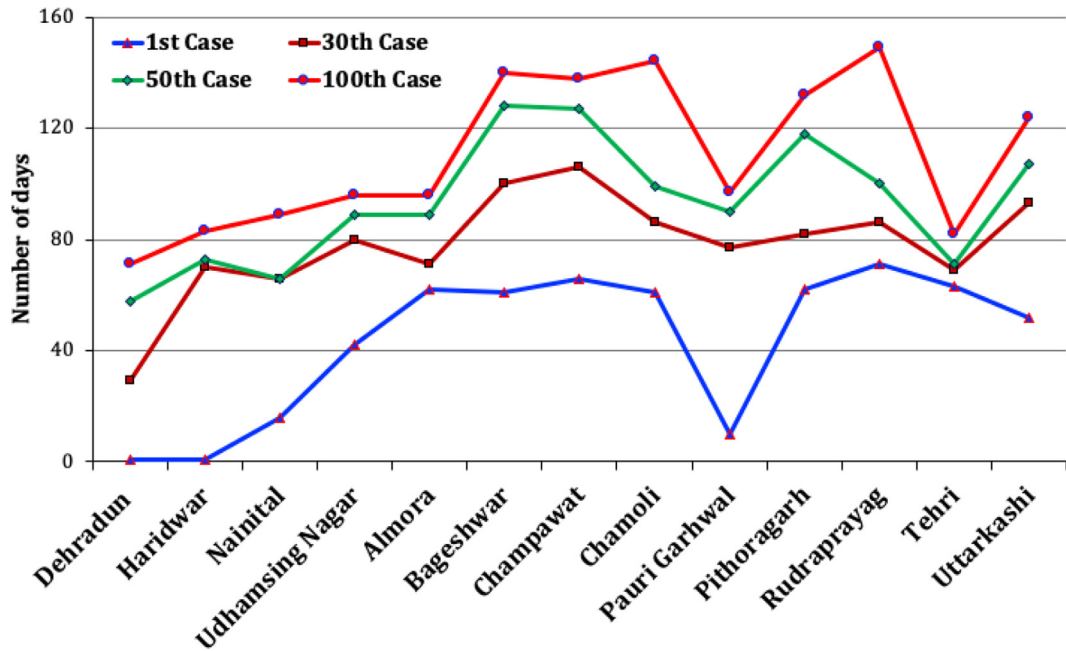FIGURE 17.8   COVID-19 infection trend in Uttarakhand province.

FIGURE 17.9 Time lag in reporting of COVID-19 cases in the districts of Uttarakhand. *Data source: www. covid19india.org.*
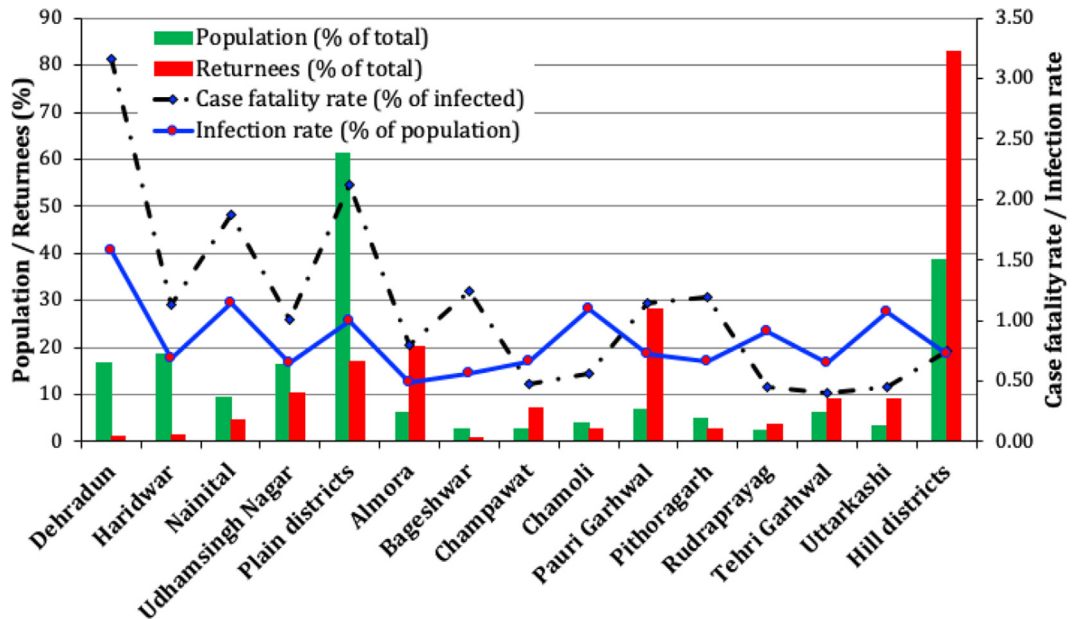

FIGURE 17.10 COVID-19 infection (infected/population) and case fatality rate (dead/infected) along with population and returnees. *Data source: www.covid19india.org.*
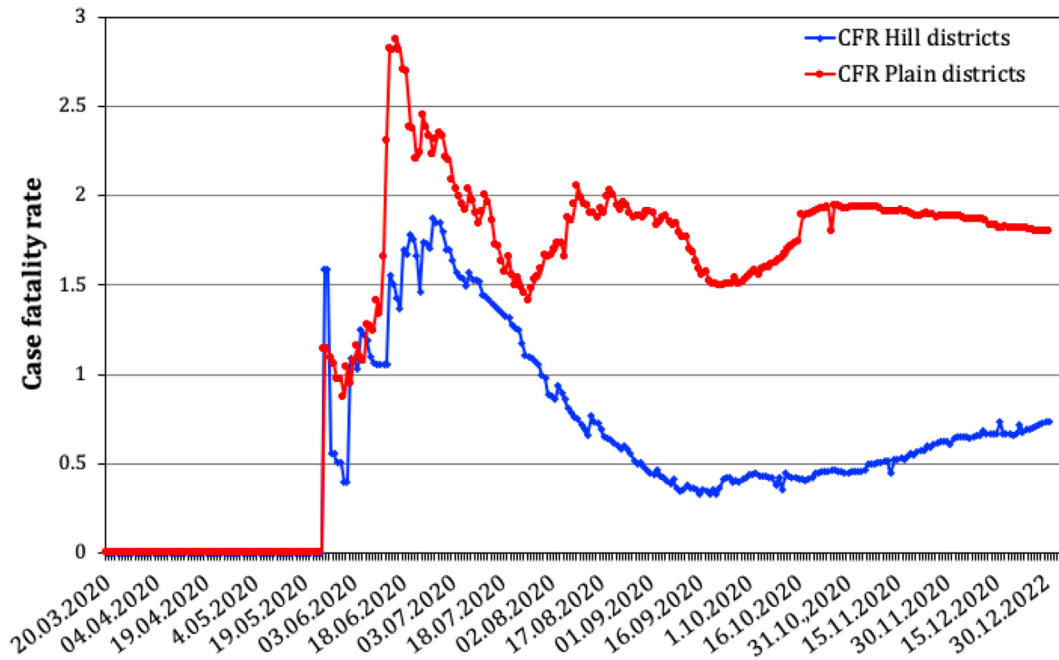
II. Capacity and response of local government

FIGURE 17.11   Case fatality rate in the hill and plain districts of the province. *Data source: www.covid19india.org*.

Bageshwar (1.24%), Pithoragarh (1.19%), and Pauri Garhwal (1.15%) show relatively high case fatality rate among the hill district and the same is comparable to Udhamsingh Nagar (1.01%) and Haridwar (1.13%) districts in the plains. In the plains Dehradun (3.17%) and Nainital (1.88%) have the highest case fatality rate as also general fatality rate (death/population) despite having relatively better health-care facilities. This is a cause of concern and reasons thereof are required to be probed in detail (Fig. 17.11).

Case fatality rate is observed to be lower than infection rate in Champawat, Chamoli, Rudraprayag, Tehri Garhwal, and Uttarkashi. Together with all the plain districts death rate is higher than infection rate in Almora, Bageshwar, Pauri Garhwal, and Pithoragarh districts.

Though the returnees are often blamed for the spread of COVID-19 to the remote hilly districts there exists no correlation to prove the same. Almora and Pauri Garhwal with maximum number of returnees do have relatively high infection rate and case fatality rate but this does not hold good for all the districts.

1.8 The spread at the remote location and its mediums

The news about the spread and the severity of the virus was rampant across the television and other social media platforms and everyone became aware about the grim situation. The visuals through news channels and social media were scary which forced people to return to their home in such vulnerable time. The way mortality occurred was scary as this generation

don't had such kind experience in the recent past. Everyone was destined to stay with the families for emotional, physical, and financial support. Subsequently, the residents of the state living in the other parts of the country as well as abroad started moving to the state. Since the symptoms take time to appear, so even if someone was infected, unknowingly they were traveling and moreover a big percentage of the victims were asymptomatic. Symptoms also take a few days to appear so if someone was traveling in the initial days of their exposure, it was difficult to catch the infected person. This was one of the possible cause behind the spread of the virus in the state.

1.9 Stabilization and spread

Any disaster or pandemic situation creates panic in the initial stage when everyone is aware about the deadly consequences of such viruses. None of us was unaware by the current public health crisis and everyone become frustrated being isolated for a long time which severely impacted the mental health of the people (Chaturvedi, 2020). However, humans learn to deal with the situation by the means of adaptation and management toward the pandemic. The COVID-19 is a long-term situation which impacted the humans significantly in many ways, i.e., mentally, physically, and financially (Chaturvedi, 2020). In state like Uttarakhand, people are closely bonded because of cultural practices and being isolated for a long time it was difficult to being unsocial for a long time. The outbreak has disrupted nearly every aspect of our social lives (Centers for Disease Control and Prevention, 2020; Dhanani et al., 2020). As highlighted by Dodds et al. (2020) "in many countries there is an urgent and ongoing discussion about the fate of vulnerable and elderly communities and the longer term restrictions they face on their social relationships and physical movements." The other age groups of the society also have similar conditions. This may stoke extreme resentment about unequal mobility, prolonged isolation, and fuel mental and physical crises (Brooke & Jackson, 2020). Being socially active was an important aspect to avoid such consequences. Mountainous people are not much handy with the technology and the web-based tools, i.e., WhatsApp, Facebook, etc. The traditional means of communication are more preferable by the mountainous communities. Communicating on social media can't be the effective alternate for the face-to-face communication and emotional touch. After the immediate family members, people were also interested to meet their relatives and friends to know their well-being. This is one of the possible reasons for the wider spread of the virus in remote locations. Indian societies believe and practice the concept of "atithi devo bhava" which means that the guests are considered equivalent to God. No matter what the situation is, it is difficult to say no to any visiting relative, friend, or anyone because of the traditional and cultural practices of welcoming all the guests.

High number of mortalities happened in the state with many affected. In case of death, administration has taken care of the crimination of the COVID-19 patients with proper safety measures. However, after the crimination, it was difficult to stop people to meet the family members of the victims. This may be also one of another reason for the wider spread of the virus among the remote communities. Generally also people were exhausted because of the long traumatic situation and started taking risk to maintain the normalcy.

1.10 Important issues for management and gap analysis

Contact Tracing is considered as the first and the most effective step toward containing an outbreak, as resources for mass testing and large quantity of vaccines are highly unlikely available for immediate utilization. Effective contact tracing can allow societies to reopen from lockdown even before availability of vaccines (Dar et al., 2020). Tracing the contact was one of the challenges because of the geography of the state. The other aspect is to understand these underlying causes to better respond and react in future. Normally such major pandemics don't occur that frequently so often there are issues with the management of the learnings as humans have the tendency to forget. The last major pandemic (Spanish flu) happened before 100 years approximately and how much learnings we have captured from the event is always a gray zone. The same sort of scenarios happens with each disaster situation as managing the knowledge is a challenging issue and it is connected with the number of other factors which either support or hinder the knowledge management. The Sendai Framework for Disaster Risk Reduction (SFDRR, 2015—30) highlighted the importance of knowledge management as an important aspect of the DRR. Considering the current vulnerabilities, the worst-case scenario planning is the need of the hour. A **worst-case scenario** is a concept in risk management wherein the planner, in **planning** for potential disasters, considers the most severe possible outcome that can reasonably be projected to occur in a given **situation**. This is not more less than a severe disaster or World War II situation where things are beyond the coping capacity (Mitra, et al., 2020). Country like India is already exposed to various types of risk which makes the situation more vulnerable for the COVID-19 situation. Managing COVID-19 is itself a challenge and same time if any other disaster emerge that could be the worst situation. Against the backdrop of natural hazards and disaster risks, the Sendai Framework already highlighted the need for the improved understanding of disaster risk in all aspects including vulnerability, exposure, hazard, and strengthening of disaster risk governance (UNISDR, 2015). Consequently, it is important to understand the risk compressively and plan for the worst-case scenarios to deal with the future pandemic situations (Friga, 2020).

2. Conclusions

The chapter highlights the challenging situation associated with this new virus of the corona family. COVID-19 is an infectious disease caused by a newly discovered coronavirus which shocked the world community due to unexpecte unplanned, uncommon, and fearful situation that has not spared even the largest and most thriving economies. Both administration and health professionals are thus exposed to extreme stress. Situation requires mainstreaming the management of biological emergencies in the into disaster management framework so as to effectively manage such situations in the future. The situation in the state of Uttarakhand has been complicated by both terrain characteristics and migration. The state however resorted to phased lockdown despite high socioeconomic impact, which helped in restricting the spread of the virus. Low population density, particularly in the hill districts, and poor health-care infrastructure were the major challanges faced by the state. However, with increase in the number of COVID-19 infected persons the provincial government and

district administration initiated a number of proactive measures for restricting mass propagation of the virus. State has done tremendous work for the COVID-19 management. However, worst-case scenario planning and harmonization of biological disaster with the disaster management framework is the need of the hour so as to better manage similar situations in future.

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