



# POPULATION MOBILITY AND PUBLIC HEALTH RISK MAPPING

COVID-19 Preparedness and Response Plan in Nepal (2020)

***Bheemdatta Municipality***

**International Organization for Migration**

768/12 Thirbam Sadak, Baluwatar 5 - P.O. Box: 25503, Kathmandu, Nepal

Tel.: +977-1-4426250. Email: [iomnepal@iom.int](mailto:iomnepal@iom.int). Web: <http://www.nepal.iom.int>.

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## I. INTRODUCTION

The Coronavirus disease, hereinafter referred to as COVID-19, is caused by SARS CoV-2Virus and is the third recorded animal-to-animal transmission of a Coronavirus, after Severe Acute Respiratory Syndrome (SARS, 2002), and Middle East Respiratory Syndrome (MERS, 2012). The first COVID-19 case was detected in Hubei Province, China, on 17 November 2019. Since then, the disease has spread throughout the globe to the extent to be declared as a pandemic by the World Health Organization (WHO), on 11 March 2020. As of 4 November 2020, the number of cases stands at 47,059,867, including 1,207,327 deaths worldwide.<sup>1</sup>

In Nepal, the first case of COVID-19 was reported on 23 January 2020. As of 4 November 2020, the total number of confirmed cases in Nepal stands at 179,614 with over 100,000 newly detected cases in five weeks, and 1,004 deaths.<sup>2</sup> Since the detection of the second positive case on 24 March 2020, the Government of Nepal (GoN) has taken several steps to control transmission and mitigate the impact of COVID-19 on the society, including enforcement of nationwide lockdown, closure of international border, testing of suspected cases, isolation, treatment, contact tracing, and management of quarantine centres.

### I.1 POPULATION MOBILITY MAPPING (PMM)

The Population Mobility Mapping was developed through an adaptation of IOM's Displacement Tracking Matrix (DTM) and has been implemented as part of the response and preparedness plan to several outbreaks, specifically the Ebola Virus Disease (EVD) in West Africa (2014-2016), the Democratic Republic of Congo (2017, 2018-2020), Burundi, South Sudan and Uganda (2019), as well as the plague outbreak in Madagascar (2018). The aim of PMM is to understand the dynamics of human mobility and identify the most vulnerable, priority locations within and outside the border. The findings enable the Government, communities and various actors to prevent the introduction or to limit the spread of infectious diseases and other public health threats, directly affected by human mobility. The Population Mobility Mapping was selected by the Ministry of Health and Population (MoHP) as part of the national COVID-19 Response and Preparedness Plan.

Specific locations to conduct the PMM activities were selected. The selection was based on three main criteria; a) existing knowledge on health risks and general epidemiological information, b) population mobility dynamics based on local available information, and c) accessibility and resources availability. Based on this, nine (9) Municipalities were identified in three (3) Provinces in Nepal:

#### I. Sudurpashchim Province

1. Dhangadhi Sub-Metropolitan City (Kailali District)
2. Bheemdatta Municipality (Kanchanpur District)
3. Dasharathchanda Municipality (Baitadi District)

<sup>1</sup> [https://covid19.who.int/?gclid=EAlalQobChMIpu2y9aym6wIVjx0rCh2zNgN6EAAAYASAAEglIzvD\\_BwE](https://covid19.who.int/?gclid=EAlalQobChMIpu2y9aym6wIVjx0rCh2zNgN6EAAAYASAAEglIzvD_BwE)

<sup>2</sup> Ibid

## II. Lumbini Province

4. Nepalgunj Sub-Metropolitan City (Banke District)
5. Krishnanagar Municipality (Kapilvastu District)
6. Siddharthanagar Municipality (Rupandehi District)

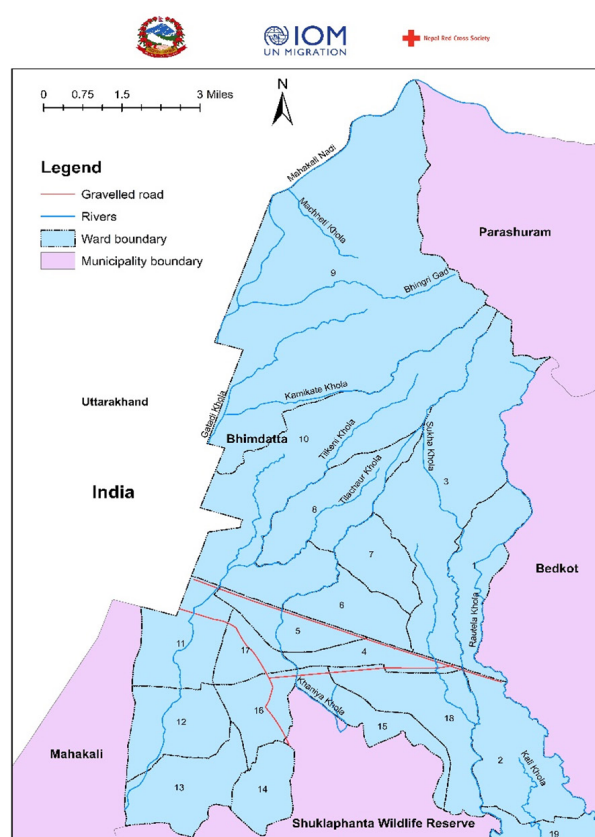
## III. Province I

7. Biratnagar Metropolitan City (Morang District)
8. Mechinagar Municipality (Jhapa District)
9. Suryodaya Municipality (Ilam District)

This report will present the PMM results conducted in Bheemdatta Municipality, Sudurpashchim Province, between 22 and 28 August 2020.

## 1.2 MUNICIPALITY PROFILE

Bheemdatta Municipality is situated in the Kanchanpur District, in the western part of Nepal. Previously known as Mahendranagar, in 2008 it was renamed Bheemdatta Municipality. At the altitude of 229 m above sea level, the municipality is 700 Km away from Kathmandu, the capital city. It covers a total of 171.8 Sq Km, and borders with Bedkot Municipality in the east, Uttarakhand, India in the west, Dadeldhura District in the north, and Shuklaphanta National Park in the south (see Map I). According to the census in 2011, the population living in the area is 104,599 (51,087 men and 53,512 women).



**Map I:** Boundaries of Bheemdatta Municipality, rivers and roads/paths. The map was used for the focus group discussions conducted as part of the PMM

The main sources of income, in order of relevance, are government services, foreign employment, business, and farming. In Bhimdatta Municipality there are a total of seven (7) urban health centres, including one (1) zonal hospital and one (1) health post, for a total capacity of 100 beds. Registered health workers are 34, with 8 doctors, 10 nurses, 8 auxiliary nursing midwives, and 8 auxiliary health workers.

### **1.3 OBJECTIVES**

The PMM has four main objectives:

1. Identify travellers' profiles and mobility patterns which have health related impacts both within and/or outside the country.
2. Identify vulnerable places where travellers or mobile populations gather and interact with each other or with local communities, which are at risk of both contracting and spreading infectious diseases and other health threats.
3. Identify priority sites with limited capacities to prepare and respond to public health emergencies.
4. Identify priority public health actions and resource allocations, in order to develop action plans aimed at strengthening public health emergency preparedness and response capacities.

## **2. METHODOLOGY**

Nine (9) Municipalities were identified in three (3) Provinces in Nepal as mentioned above. At the initial stage, data collection tools were developed and contextualized to the case of Nepal. Special attention was given to the guides to be used during Phase I and the questionnaires for Phase II. Furthermore, maps of the selected municipalities were created using GIS software (see Map 1), based on available geographical and administrative data, to be later used during the focus group discussions (FGDs).

### **2.1 PREPARATION AND COORDINATION FOR THE PMM**

A two-fold coordination was initiated in June 2020 with the MoHP and the Nepal Red Cross Society (NRCS), the implementing partner. This culminated in the signing of the IOM-NRCS agreement on 30 July 2020 and the obtaining of the official approval from the MoHP on 10 August 2020. Several meetings with NRCS were held to discuss and explore the implementation plan on the ground. Simultaneous coordination was undertaken at the provincial and municipality level to engage with relevant stakeholders and finalise the workplan. Similarly, parallel meetings were conducted with the IOM PMM team to analyse the data collection tools and select the categories of key informants (KIs) according to the local context.

On 3 August 2020, a 1-day training was conducted for the IOM PMM team at IOM premises in Kathmandu (Picture 1 and 2). The training had three key objectives:

1. Learn about the concepts at the basis of the PMM, such as human mobility, and its relationship with the Displacement Tracking Matrix (DTM) and the Health, Border, and Mobility Management (HBMM) framework.
2. Understand the structure of the PMM methodology, and its key components.
3. Learn about the implementation of the PMM activities on the ground through a practical simulation of the PMM Exercise and examination of questionnaires in KoBo Collect, to be used during Phase II.



The same training was conducted in Dhangadhi Sub-Metropolitan Municipality on 14 and 15 August 2020 for the NRCS staff (15 people), who have supported the IOM PMM staff in the implementation of field activities (Picture 3 and 4). Standard Operating Procedures (SOPs) and Infection Prevention and Control (IPC) measures were observed by all participants and trainers throughout the sessions, which were also attended by Government representatives.



**PMM Training:** The PMM expert explaining the methodology (left) and the PMM team listening to the training (right)



**GPS & KoBo Training:** GPS coordinate training (left) and trainer translating in Nepali (right)

## 2.2 DATA COLLECTION

The method implemented in Bheemdatta Municipality involves two different phases.

### 2.2.a PHASE I

Phase I is referred to as 'Participatory Mapping Exercise' and includes facilitated focus group discussions (FGDs) with key informants (KIs), who are knowledgeable of patterns of people's movement in the specific area under consideration. Through this exercise, information is collected on the type and exact locations where people gather and travel to/from, as well as the most used routes, reasons to travel, and size of people's flow.

The PMM Exercise in Bheemdatta Municipality was conducted on 23 and 24 August 2020 and was comprised of 5 FGDs. A total of 25 KIs participated in the discussions, according to their respective category; 1) government representatives, 2) agency (specifically NGOs/INGOs) representatives, 3) community workers, 4) drivers, and 5) vendors.

The discussions were facilitated in Nepali by trained moderators, whereas the information was entered in English by the trained note takers. Prior to the start of the FGDs, KIs were informed about IOM's mandate, the scope of the project and the partnership with GoN and NRCS, as well as IOM's experience in the PMM acquired in other countries. All participants were asked to sign a consent form if they agreed to participate in the PMM study. The information was collected using two main tools – the note taker's guide and a map of the municipality (see Map 1). In terms of the process, the note taker would write down the answers provided by the interviewees, while simultaneously the mapper would locate on the map the exact locations of the mentioned sites (Picture 5 and 6).



**Mapping:** Participatory mapping exercises during FGDs at Bheemdatta Municipality

The collected data from the FGDs is later entered in a matrix. The matrix is a set of questions with parameters highlighted by medical officers in IOM to determine places that are more vulnerable. Specific scores are allocated to different sites, such as points of entry (POEs), border crossing points (BCPs), health centres, traditional healers, market centres, migrant worksites, entertainment centres, schools and colleges. The weight scores are selected according to the potential risk of transmission and infection during an emergency or disease outbreaks of international concern (see Annex I). The matrix analysis allows to identify the sites with the highest population mobility and the specific localities where these are located. The locations at the topmost layer in the matrix are selected and evaluated in Phase II.

## 2.2.b PHASE II

Phase II involves direct observations and individual interviews with KIs at the specific sites identified in Phase I. In particular, GPS coordinates of the priority sites are collected using a GPS device, together with estimations of travellers' volume, information on accessibility, and existing public health measures and capacities. The data is collected through KoBo Collect, a tool for mobile data collection which allows to create digital surveys and store submissions.



## 2.3 CHALLENGES

1. Discrepancies in names of locations and information provided by different KIs create confusions and delays, especially during Phase II. This is enhanced by the lack of official names of various sites, including POEs. The issue of locality/site duplicates was mitigated by checking names prior to field observations, though final validation happened exactly when physically visiting the sites.
2. The questionnaires uploaded in the software used for data collection during Phase II, KoBo Collect, were not fully adequate for Nepal's context, despite initial preparatory work and analysis of available contextual data. As a result, questionnaires were updated and revised in order to better reflect the national situation.
3. Some priority locations identified for field observations were not accessible by vehicle due to the rough geographical terrain in the municipality, worsened by heavy rains during monsoon season. Long distances were often covered by foot by the enumerators, despite high weather temperatures (Picture 7 and 8).
4. Due to restricted movement and lockdown, KIs were harder to reach and continuous coordination was necessary to utilize time efficiently and arrange dispatchment of enumerators to priority sites.
5. Despite the enforcement of SOPs and reminders for IPC measures, participants were often inattentive, especially during FGDs. A great deal of attention was put by the field team to make sure physical distancing was respected, people were wearing masks adequately and were using hand sanitizer frequently. Gloves, masks and hand sanitizer were provided by IOM to both the NRCS collaborators and KIs.



**Challenges:** Example of road infrastructure (left) and IOM enumerator walking to reach the priority site (right)

### 3. RESULTS

#### 3.1 PHASE I

Following the data entry and consequent matrix analysis (see Annex II), a total of 58 sites with high population mobility were selected for further assessments for Phase II. In particular, these are; 6 POEs, 9 Health Centres, 6 Traditional Healers, 3 Schools and Colleges, 6 Entertainment Centres, 7 Market Centres, 9 Migrant Worksites, 6 Transport Stations, and 6 Places of Worship (see Table I.I).

**Table I.I:** Full names and localities of vulnerable sites identified within the municipality

POEs		
<i>n</i>	Name Site	Locality
1	Bhujela Ghat POE	Bhujela
2	Bramhadev POE	Bramhadev
3	Gaddachauki POE	Gaddachauki
4	Khalla POE	Khalla
5	Musetti POE	Musetti
6	Pipariya POE	Pipariya

Health Centres		
<i>n</i>	Name Site	Locality
7	Ananda Polyclinic	Mahendranagar Bajar
8	Bhageshwor Health Clinic	Mahendranagar Bajar
9	Bhujela Health Post	Bhujela
10	J. K. Medicare Hospital	Mahendranagar Bajar
11	Jimuwa Health Post	Jimuwa
12	Mahakali Sub Provincial Hospital	Mahendranagar Bajar
13	Mahendranagar Eye Hospital	Salghari
14	S.K. Polyclinic Hospital	Mahendranagar Bajar
15	Urban Health Clinic	Basantapur

Traditional Healers	
<i>n</i>	Locality
16	Airi
17	Basantapur
18	Bhasi M.D.
19	Bhasi M.J.
20	Gajjar
21	Katan

Schools and Colleges		
<i>n</i>	Name Site	Locality
22	Bajjnath Engineering College	Mahendranagar Bajar
23	Farwest School of Medicine	Bhasi
24	Little Buddha College	Mahendranagar Bajar



Entertainment Centres		
<i>n</i>	<b>Name Site</b>	<b>Locality</b>
25	Bhimdatta Park	Mahendranagar Bajar
26	Covered Hall	Mahendranagar Bajar
27	Jhilmila Lake	Tilachaur
28	Khulla Mancha	Mahendranagar Bajar
29	OMG Club	Mahendranagar Bajar
30	Suklaphanta Wildlife Reserve Centre	Pipariya

Market Centres		
<i>n</i>	<b>Name Site</b>	<b>Locality</b>
31	Airi Market	Airi
32	Bramhadev Market	Bramhadev
33	Freeline Market	Mahendranagar Bajar
34	Gaddachauki Market	Gaddachauki
35	Jhulunge Market	Pipariya
36	Sabjimandi Market	Sabjimandi
37	Tilachaur Market	Tilachaur

Migrant Worksites		
<i>n</i>	<b>Name Site</b>	<b>Locality</b>
38	Barber Shop	Mahendranagar Bajar
39	Janaki Laundry Shop	Mahendranagar Bajar
40	Jugeda Construction Site	Mahendranagar Bajar
41	Motorbike Workshop	Mahendranagar Bajar
42	Motorbike Workshop	Buspark Road
43	Shambhu Jewelry	Mahendranagar Bajar
44	Steel Furniture Udhog	Mahendranagar Bajar
45	Tilakpur Brick Factory	Tilakpur
46	Tripura Sundari Jagadamba Brick Factory	Tilachaud

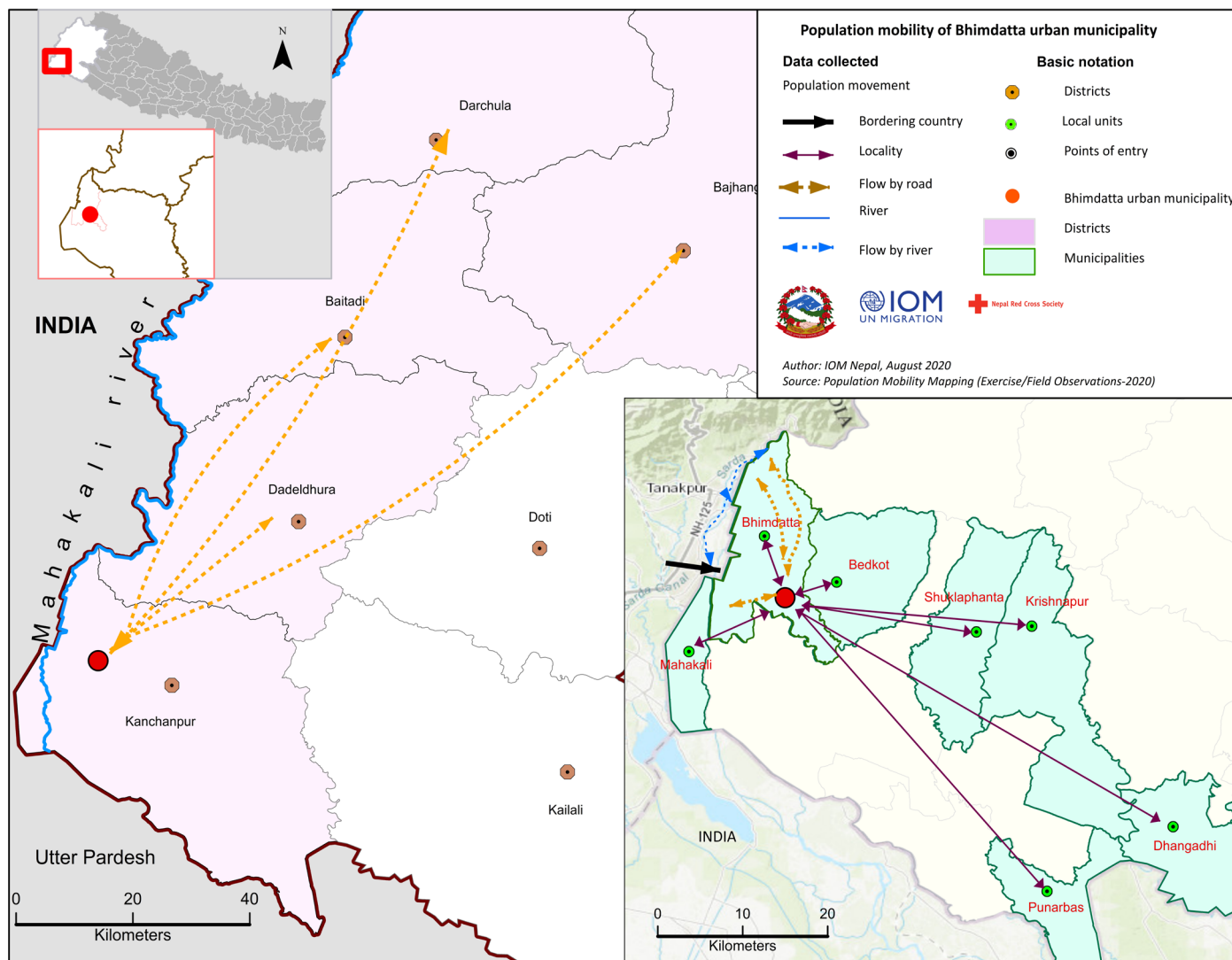
Transport Stations		
<i>n</i>	<b>Name Site</b>	<b>Locality</b>
47	Auto Park Station	Gaddachauki
48	Bhasi Transportation Station	Bhasi
49	Bramhadev Chowk Auto Station	Bramhadev
50	Gaddachauki Auto Station	Gaddachauki
51	Jhulunge Auto Station	Jhulunge Pool
52	Mahendranagar Bus Park	Buspark

Places of Worship		
<i>n</i>	<b>Name Site</b>	<b>Locality</b>
53	Bhamkeni Dham	Tilachaur
54	Bishnu Temple	Tilakpur
54	Kalika Temple	Salghari
55	Shiva Dham Temple	Mahendranagar Bajar
56	Siddhanath Temple	Bramhadev
57	Siddhanath Temple	Mahendranagar

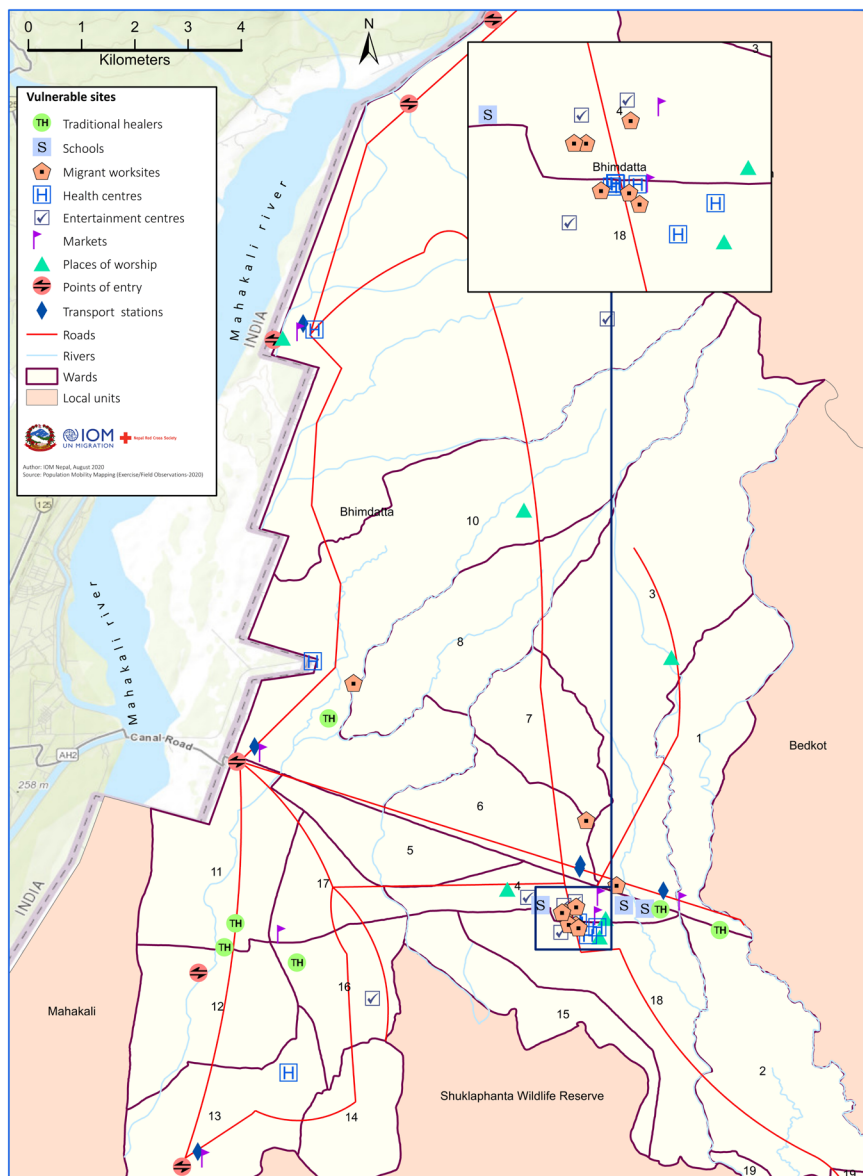
## 3.2 PHASE II

Based on the data gathered with KoBo Collect on POEs, population movement and vulnerable sites present in Bheemdatta Municipality, the below maps were created using GIS software.

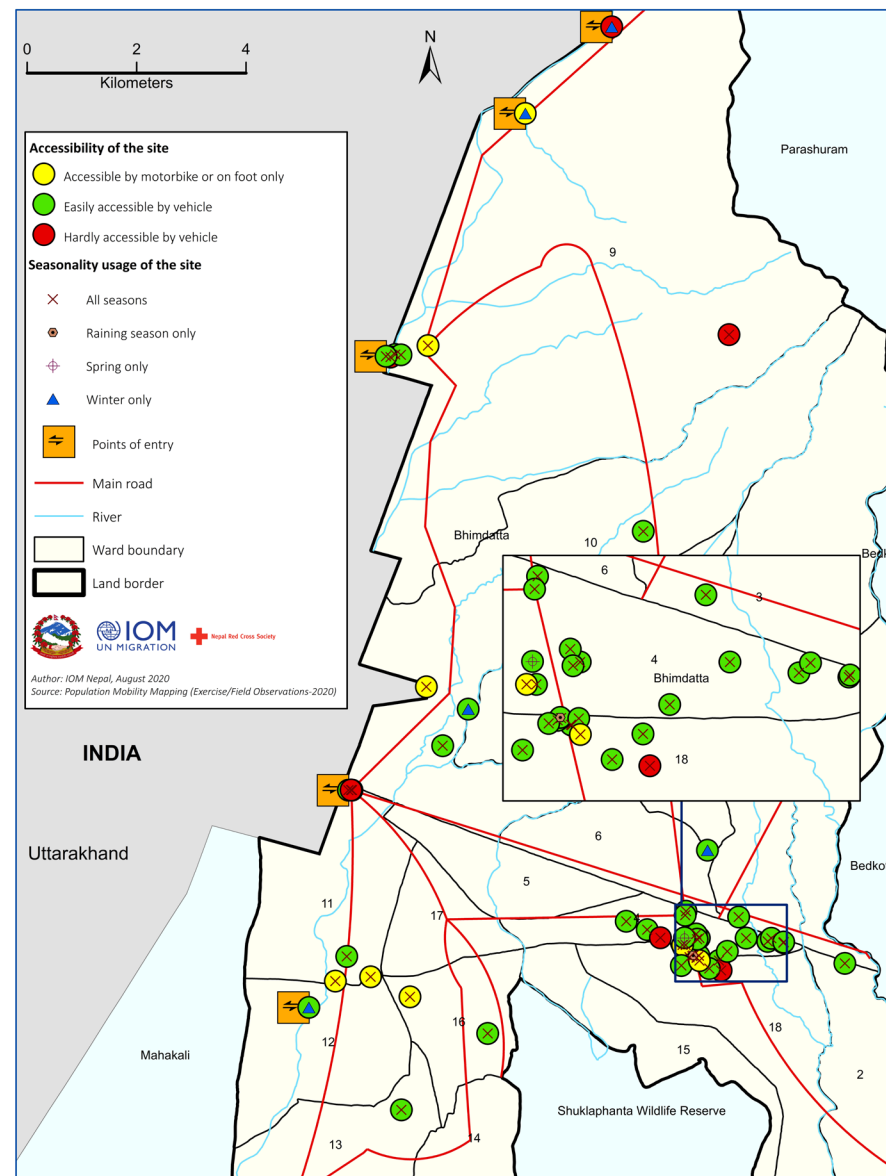
### 3.2.a MAPS



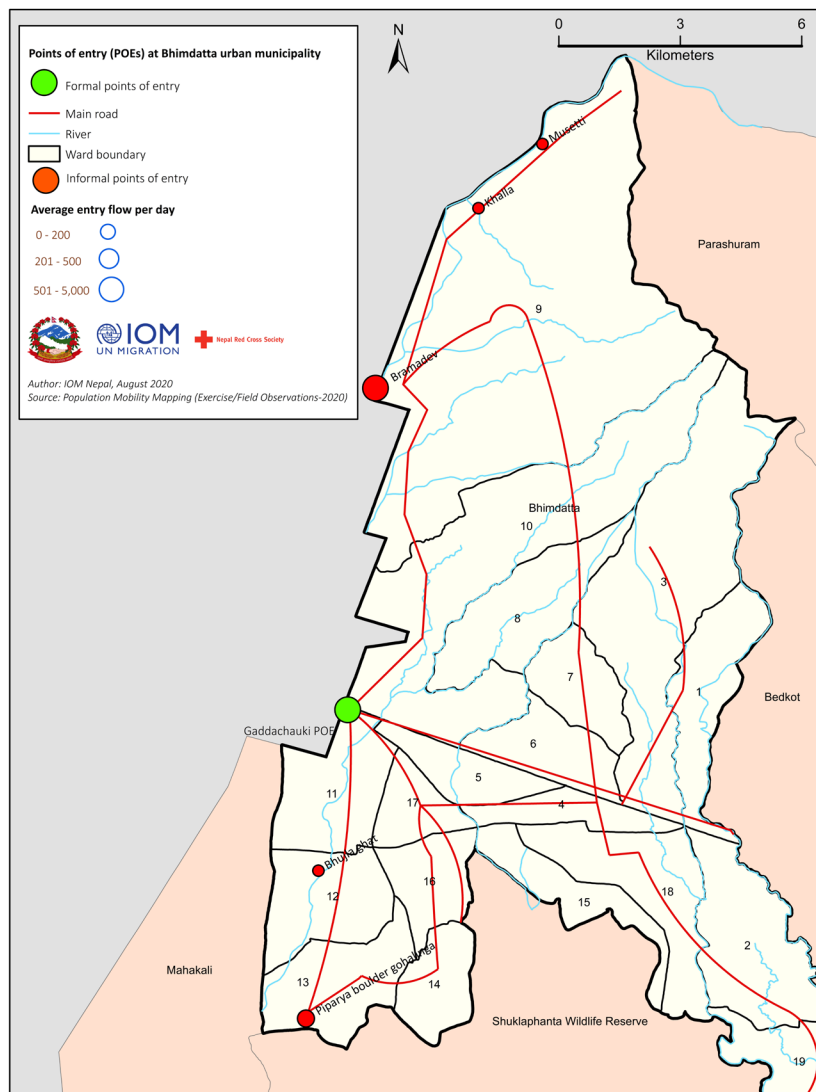
**Map 2:** Population movement from/to Bheemdatta Municipality at the municipality, district and international level



**Map 3:** Identified vulnerable sites within the municipality boundary



**Map 4:** Accessibility and seasonality usage of identified vulnerable sites



**Map 5:** Formal and informal POEs at the India-Nepal border (Bheemdatta Municipality)



**Field observations:** IOM and NRCS field observations at one of the identified places of worship (right)



### 3.2.b POINTS OF ENTRY (POEs)

#### Population Mobility Pattern (who, where they come from, where they go)

The findings revealed that, in Bheemdatta Municipality, the population using POEs is mostly from India, and preferred destination districts are *Kanchanpur, Kailali, Dadeldhura, and Kalikot*, whereas destination municipalities are *Bheemdatta, Mahakali, Suklaphanta, Bedkot, Krishnapur, and Dhangadi Sub-Metropolitan*. People use these POEs throughout the year, however, the busiest months of the year are January, February, March, November, and December.

#### Connectivity (link with the main community, route, accessibility, mode of transport, seasonality, communication)

The largest portion of population coming from India use *Gaddachauki POE* (formal) connected to the *East-West Highway* which lies near the junction of *Mahendranagar* – the biggest city of this municipality. Also, people who use informal POEs, such as *Pipariya, Musetti, Bramhadev*, eventually come to *Mahendranagar Junction* to make their journey to other districts or municipalities. People use horse carts, tricycles, and minivans as modes of transport to travel from *Gaddachauki POE* to *Mahendranagar*. However, people commute on foot from most of the informal POEs to the main junctions of the municipality or destination districts, due to the inaccessibility of roads and unavailability of mode of transport.

#### Vulnerability/Capacity Analysis (in front of a risk of spread of communicable diseases)

In Bheemdatta Municipality, six (6) POEs were investigated, and out of these, only one is a formal POE. Two out of six (2/6) are land border (*Bramhadev* and *Gaddachauki* POEs). The circle (dot) in blue shows the average number of people crossing the border per day, the dot in orange the average flow in the busiest day(s), in green is the average dual flow, and in red is the percentage coming from India. The highest entry flow was found in *Bramhadev, Gaddachauki, and Pipariya* POEs, with an average dual entry flow of 6,333, 1,833 and 617 people, respectively (see Fig. I.1). Among the POEs that attract people from other countries, notably India, *Bramhadev, Gaddachauki, and Bhujela Ghat* POEs have 30, 20, and 5 per cent, respectively; whereas, in the remaining three (3) POEs 100 per cent is Nepalese citizens.

**Average entry flow per day, busiest day, distance to the nearest health centre and percentage coming from India (August 2020)**

Name of POE	Type of POE	Site Status	Average entry flow per day	Average entry flow in the busiest day	Average dual flow	Percentage coming from India
Bhujela Ghat POE	Water landing (swimming/boat/by foot if shallow water)	Informal	200	500	283	5
Bramhadev POE	Land border	Informal	5,000	8,000	6,333	30
Gaddachauki POE	Land border	Formal	1,500	2,000	1,833	20
Khalla POE	Water landing (swimming/boat/by foot if shallow water)	Informal	30	50	38	0
Musetti POE	Water landing (swimming/boat/by foot if shallow water)	Informal	50	100	67	0
Pipariya POE	Water landing (swimming/boat/by foot if shallow water)	Informal	500	700	617	0

**Fig. I.1: Mobility patterns across the POEs**

*Mahakali Sub Provincial Hospital* is the nearest and most used health centre from the POEs (3/6 and 2/6). The remaining health centres that were mentioned are *J.K. Polyclinic Hospital*, *Samudayik Health Post* and *Bramhadev Urban Health Centre*, and the types of the most used health centres include Health Post and Government Hospital (3/6 and 2/6, respectively). Majority of the POEs are busy throughout the week, except for *Bhujela Ghat*, *Bramhadev*, and *Gaddachauki* POEs, whose busiest days are Saturday and Sunday, respectively. The busiest month of the year varies across the POEs in Bheemdatta Municipality. Almost 70 per cent lack a toilet facility nearby (4/6) and half of the POEs do not have a water facility (for drinking, handwashing and/or other purposes) on site (see Table 1.2).

**Table 1.2:** Basic health infrastructure at the POEs

Name of POE	Name of the nearest health centre	Name of the most used health centre	Type of the most used health centre	Busiest day of the week	Busiest month of the year	Availability of toilet nearby	Availability of water at POEs
Bhujela Ghat POE	Mahakali Sub Provincial Hospital	J.K. Polyclinic Hospital	Clinic	Saturday	March, April	Not available	Not available
Bramhadev POE	Samudayik Health Post	Samudayik Health Post	Health Post	Sunday	January, February, March, December	Available	Available
Gaddachauki POE	Mahakali Sub Provincial Hospital	Mahakali Sub Provincial Hospital	Government Hospital	Sunday	January, February, November, December	Available	Available
Khalla POE	Bramhadev Urban Health Center	Bramhadev Urban Health Center	Health Post	Every day	November	Not available	Not available
Musetti POE	Bramhadev Urban Health Center	Bramhadev Urban Health Center	Health Post	Every day	August, September, October, November, December	Not available	Not available
Pipariya POE	Mahakali Sub Provincial Hospital	Mahakali Sub Provincial Hospital	Government Hospital	Every day	Every month	Not available	Available

According to the results obtained, (see Fig. 1.2) all POEs are knowledgeable of procedures to follow if someone is a suspected COVID-19 case. However, there is an inadequate presence of International Health Regulations (IHR) and Public Health Emergency of International Concern (PHEIC) focal points in both Nepal and the corresponding country, notably India. Only half of the POEs have community health workers available. Two out of six (2/6), specifically *Bramhadev* and *Gaddachauki* POEs, have an agent in charge of health issues present on site. The distance to the nearest health centre varies across the POEs, with *Bhujela*, *Gaddachauki*, and *Musetti* POEs, being the most distant, with an average of 7.5 Km.

**Availability of health infrastructure and distance to the nearest health centre**

Name of POE	Knowledge for procedures to follow if suspected for COVID-19	Availability of special equipment to address health issues of PHEIC	Presence of IHR Focal Point at POE	Presence of community health worker	Presence of health agent at POE										
Bhujela Ghat POE	Yes	Do not know	Do not know	Not available	Not available										8
Bramhadev POE	Yes	Available	Not available	Available	Available	1									
Gaddachauki POE	Yes	Available	Available	Available	Available									7	
Khalla POE	Yes	Not available	Not available	Not available	Not available								6		
Musetti POE	Yes	Not available	Not available	Available	Not available									7	
Pipariya POE	Yes	Not available	Not available	Not available	Not available										
						2									
						0 1 2 3 4 5 6 7 8 9									
						Distance to the nearest health centre [in Km]									

**Fig. 1.2:** The presence of IHR and PHEIC focal points at the POEs

The availability of IPC at various POEs is missing in almost all the POEs investigated (5/6). Half of the POEs are used throughout the year, whereas the remaining are used in winter only. In regard to voice communication, 50 per cent of the POEs has uninterrupted network and only one has interrupted network (Pipariya), whereas *Khalla* and *Musetti* POEs have no network. Health or hand washing stations are absent across all POEs, except for *Bramhadev* POE.

Similarly, four (4) out of six (6) POEs do not keep record of travellers, with the remaining two being uncertain (*Bramhadev* and *Gaddachauki* POEs). The respondents from half of the POEs agreed that greater than 50 per cent wear masks, one-third (1/3) placed the percentage between 31-50 per cent, and only one respondent (*Bhujela Ghat POE*) reported that less than 10 per cent of people wears masks (see Table 1.3).

**Table 1.3: Status of IPC at the POEs**

Name of POE	Estimated percentage wearing mask	Record of traveller's on book/device status	Presence of hand washing station at POEs	Presence of IPC Personnel	Seasonality at POEs	Status of voice communication system
Bhujela Ghat POE	<10%	Not available	Not available	Do not know	Winter only	Good (uninterrupted network)
Bramhadev POE	>50%	Don't know	Available	Not available	All seasons	Good (uninterrupted network)
Gaddachauki POE	>50%	Don't know	Not available	Not available	All seasons	Good (uninterrupted network)
Khalla POE	>50%	Not available	Not available	Not available	Winter only	No network
Musetti POE	31%-50%	Not available	Not available	Not available	Winter only	No network
Pipariya POE	31%-50%	Not available	Not available	Not available	All seasons	Bad (interrupted network)

### 3.2.c HEALTH CENTRES

#### **Population Mobility Pattern (who, where they come from, where they go)**

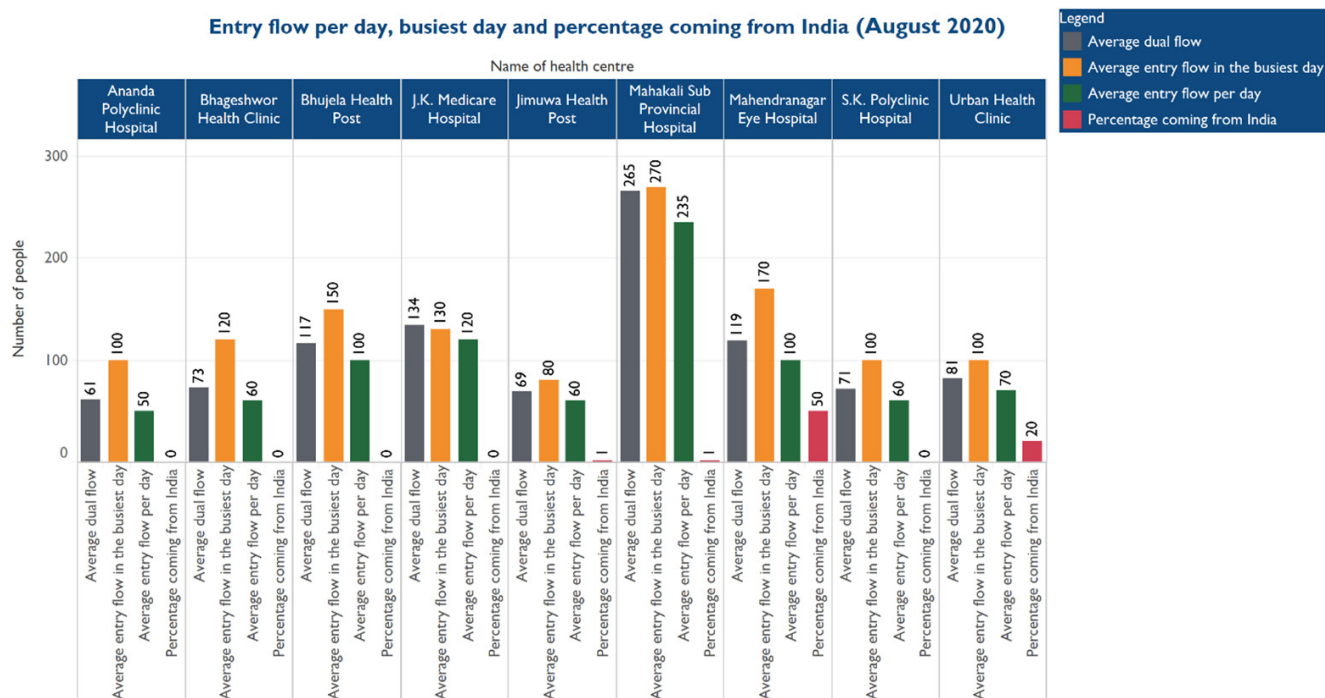
The study showed that, in Bheemdatta Municipality, the health centres are busy every day, throughout the year. Visitors and patients mostly come from the following districts; *Kanchanpur*, *Dadeldhura*, *Darchula*, *Baitadi* and *Doti*, to seek help from the health centres situated at *Mahendranagar* locality. At the municipality level, people mostly come from four (4) municipalities; *Shuklaphanta*, *Bedkot*, *Mahakali*, and *Krishnapur*.

#### **Connectivity (link with the main community, route, accessibility, mode of transport, seasonality, communication)**

The health centres situated in *Mahendranagar* locality are mainly accessed by bus, minivan, car, motorbike, and horse cart, for both Indians and Nepali travelling from other districts and municipalities. The health centres situated outside the *Mahendranagar* locality are interlinked with the *East-West Highway*, which connects *Jimuwa*, *Pipariya*, and *Bhujela* localities. People mostly reach health centres by motorbike or minivan and on foot.

#### **Vulnerability/Capacity Analysis (in front of a risk of spread of communicable diseases)**

Following the participatory mapping exercises, nine (9) health centres were selected based on the matrix analysis. Among them, *Mahakali Sub Provincial Hospital*, *J.K. Medicare Hospital*, and *Mahendranagar Eye Hospital* have the highest number of patients per day with 235, 120, and 100, respectively. On the busiest days, the number increases to 270, 130, and 170 patients visiting these hospitals. However, *Urban Health Clinic* has the highest percentage of people coming from India (20%), while the remaining health centres have none or only 1 percent visiting the health centres for medical cure. The average dual flow slightly differs across the health centres, except for *Mahakali Sub Provincial Hospital* and *J.K. Medicare Hospital*, where both entry and dual flow are completely dispersed (see Fig. 2.1).



**Fig. 2.1:** Mobility patterns across the health centres

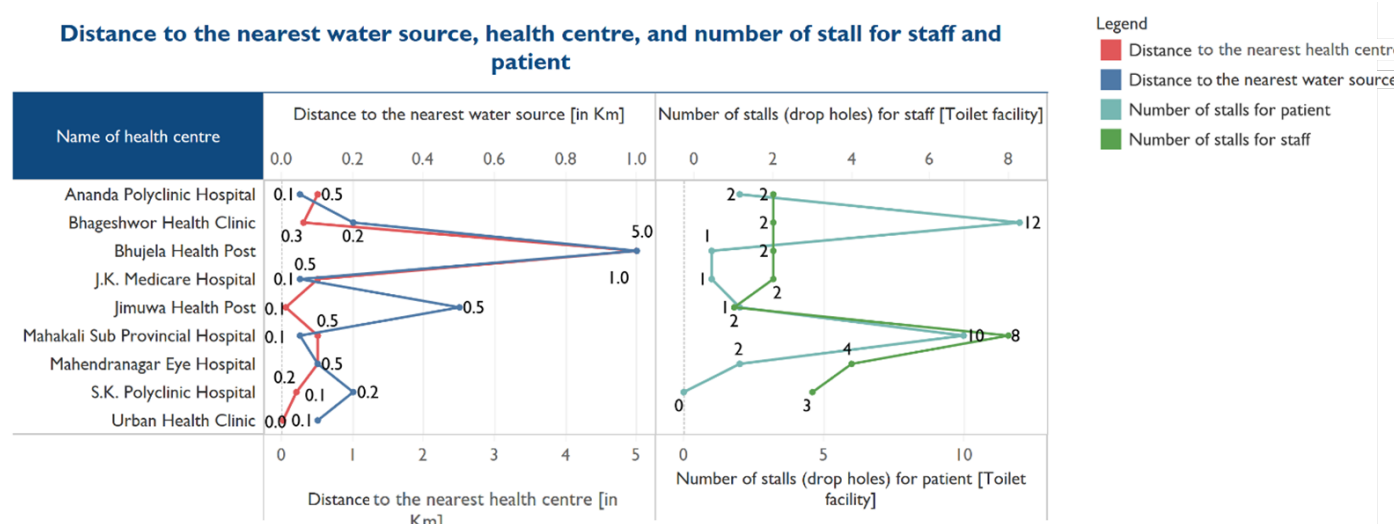
Fig. 2.2 shows the number of inpatients and outpatients and the type of health centres in Bheemdatta Municipality and reflects the figures from the last three months (June-August 2020). The bar in dark green shows the average number of inpatients and outpatients admitted and dispersed in wards, respectively. The bar in blue shows the number of stalls/drop holes present at the various health centres. *S.K Polyclinic Hospital*, *Urban Health Clinic*, and *Mahendranagar Eye Hospital* have the highest influx of patients in the outpatient ward and no individuals admitted in the inpatient ward. *Mahakali Sub Provincial Hospital*, *Jimuwa Health Post*, and *Bhujera Health Post* have both flows of inpatients and outpatients with 270, 300, and 15 people in the outpatient ward, and 450, 22, and 15 patients admitted in the inpatient ward, respectively. *Ananda Polyclinic Hospital* has the highest number in the inpatient ward (1,500) but no patient in the outpatient ward. The number of stalls (drop holes) at the toilet facilities varies across the health centres. *Mahakali Sub Provincial Hospital* (government) and *Bhageshwor Health Clinic* (private) have the largest number of stalls (18 and 14, respectively). Except for *Urban Health Clinic*, there are separate toilet facilities for staffs and patients across the health centres.

Name of health centre	Type of health centre	Availability of separate toilet for staffs & patients	Average number of Inpatient admitted ward	Average number of Outpatient ward	Number of stalls (drop holes) [Toilet facility]
Ananda Polyclinic Hospital	Private Hospital	Available	1,500	0	4
Bhageshwor Health Clinic	Private Hospital	Available	0	0	14
Bhujela Health Post	Government Hospital	Available	15	15	1
J.K. Medicare Hospital	Private Hospital	Available	0	25	3
Jimuwa Health Post	Government Hospital	Available	22	300	3
Mahakali Sub Provincial Hospital	Government Hospital	Available	450	270	18
Mahendranagar Eye Hospital	Private Hospital	Available	0	800	6
S.K. Polyclinic Hospital	Private Hospital	Available	0	1,200	2
Urban Health Clinic	Government Hospital	Not available	0	1,000	

**Fig. 2.2:** Number of inpatients, outpatients and stalls (toilet facility) at the health centres



The line in red shows the distance to the nearest health centre, in dark blue is the distance to the nearest water source, numbers of stalls/drop holes for patients are in light blue, whereas the line in green refers to the number of stalls for staffs. In the cases of *Bhageshwor Health Clinic* and *J.K. Medicare Hospital*, people take 5 Km and 1 Km, respectively, to reach the health centre from their home. The remaining health centres are within the surrounding communities, with an average distance of approximately 200 meters. *Bhageshwor Health Clinic* and *Mahakali Sub Provincial Hospital* have the largest number of stalls for patients (12 and 10, respectively), followed by *Mahendranagar Eye Hospital* with a total of 6 stalls for both patients and staffs (4 and 2, respectively). The remaining have an average of 2 stalls each, except for *S.K. Polyclinic Hospital* with no toilets for patients, and *Urban Health Clinic* which has no separate stalls for patients and staffs (see Fig. 2.3).



**Fig. 2.3:** Distance to the nearest water source and health centre, and number of stalls for staffs and patients

In Bheemdatta Municipality, out of the nine (9) health centres investigated, respondents from four (4) sites asserted that patients only seek health care at the hospital. Table 2.1 shows the list of the health centres according to which, people in Bheemdatta Municipality do seek health care in other places before going to the hospital for treatment (5/9 health centres = 56%). The places for treatment before going to the health centres include; home, private clinic/hospitals, religious leaders, traditional healers, other public hospitals, and pharmacy. The percentage of people who seek alternative health care is sinusoidal, between 10-30 percent, and less than 10 percent across the municipality.

**Table 2.1:** Most common places people seek care from before going to the hospital

Name of health centre	Care at home	Care at other public hospital	Care at private hospital	Care at the religious leader	Care at the traditional healer	Care at the pharmacy
J.K. Medicare Hospital	10%-30%	10%-30%	31%-50%	10%-30%	<10%	31%-50%
Jimuwa Health Post	<10%	<10%	<10%	<10%	<10%	<10%
Mahakali Sub Provincial Hospital	<10%	<10%	10%-30%	<10%	<10%	<10%
Mahendranagar Eye Hospital	10%-30%	<10%	<10%	<10%	10%-30%	>50%
Urban Health Clinic	10%-30%	<10%	<10%	<10%	10%-30%	10%-30%

Table 2.2 indicates the population of medical personnel in Bheemdatta Municipality across the health centres. Among the assessed facilities, *Mahakali Sub Provincial Hospital*, *S.K. Polyclinic Hospital*, *Jimuwa Health Post*, and *Mahendranagar Eye Hospital* have the largest medical personnel with a total of 366, 38, 34, and 20, respectively. This relates to the high

population mobility on both the busiest days and per day.

**Table 2.2:** Population of medical personnel at the health centres

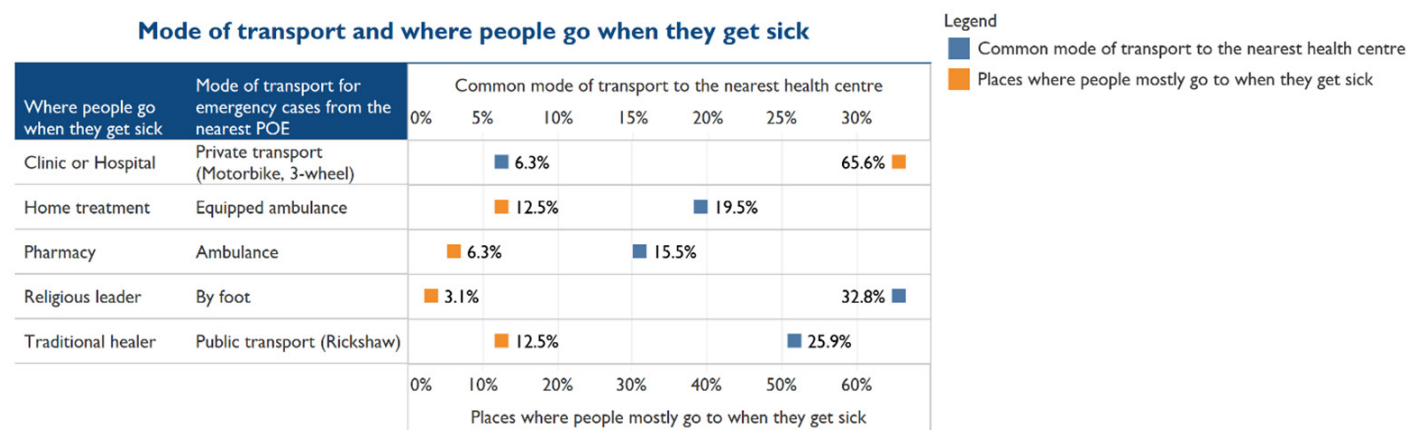
	Name of health centre									
	Ananda Polyclinic Hospital	Bhageshwor Health Clinic	Bhujela Health Post	J.K. Medicare Hospital	Jimuwa Health Post	Mahakali Sub Provincial Hospital	Mahendranagar Eye Hospital	S.K. Polyclinic Hospital	Urban Health Clinic	
Auxiliary Health Worker	0	0	0	0	1	7	0	0	1	
Auxiliary Nursing Midwifery	0	0	0	0	3	18	2	0	2	
Community Health Volunteer	0	0	0	0	24	0	0	0	11	
Health Assistant	3	0	0	1	1	2	2	11	0	
Lab Technician	1	1	0	0	0	2	0	21	0	
Medical Officer	4	3	0	5	0	240	1	1	0	
Number of House Keeper	0	1	0	0	0	8	2	0	0	
Number of Lab Assistant	0	0	0	0	1	5	0	1	0	
Number of Medical Recorder	0	0	0	0	0	2	1	0	0	
Number of Radiographer	1	0	0	0	0	5	0	0	0	
Nursing Officer	1	0	3	1	0	17	5	1	0	
Office Helper	0	1	0	0	3	31	2	1	1	
Pharmacist	3	0	0	0	0	1	0	0	0	
Pharmacy Assistant	0	0	0	0	0	1	0	0	0	
Public Health Nurse	0	0	0	0	0	4	0	0	0	
Staff Nurse	2	1	0	3	1	23	5	2	0	
Total Health Officers	15	7	3	10	34	366	20	38	15	

The importance of IPC status during an outbreak or pandemic is eminent to mitigate the transmission of a virus. Various categories to determine the status of the health infrastructure were investigated (see Table 2.3). Out of the nine (9) assessed health centres, five (5) have IPC equipment supplies available and all have conducted IPC training, except for *Mahendranagar Eye Hospital*. There is availability of a waste management system in most of the health centres, except for *Mahendranagar Eye Hospital*. However, 24/7 health screening stations are unavailable across the health centres, except for *Mahendranagar Eye Hospital*. On the other hand, there is presence of health screening stations (nomadic/temporal) in *Ananda Polyclinic Hospital*, *Mahakali Sub Provincial Hospital*, and *Mahendranagar Eye Hospital*, whereas in the remaining six (6) health centres are unavailable. The emergency preparedness plan has been tested in five out of nine (5/9) health centres, either in the last three months or between 6 and 9 months prior to the date of observation (August 2020). In the remaining six (6) health centres, the emergency preparedness plan has not been tested. At the majority of the health centres (6/9), greater than 50 per cent of the people wear masks, whereas the percentage is between 31-50 at *Mahendranagar Eye Hospital* and *Bhujela Health Post*, and less than 10 per cent at *Jimuwa Health Post* (see Table 2.3).

**Table 2.3:** Status of emergency preparedness plan, IPC, and health screening

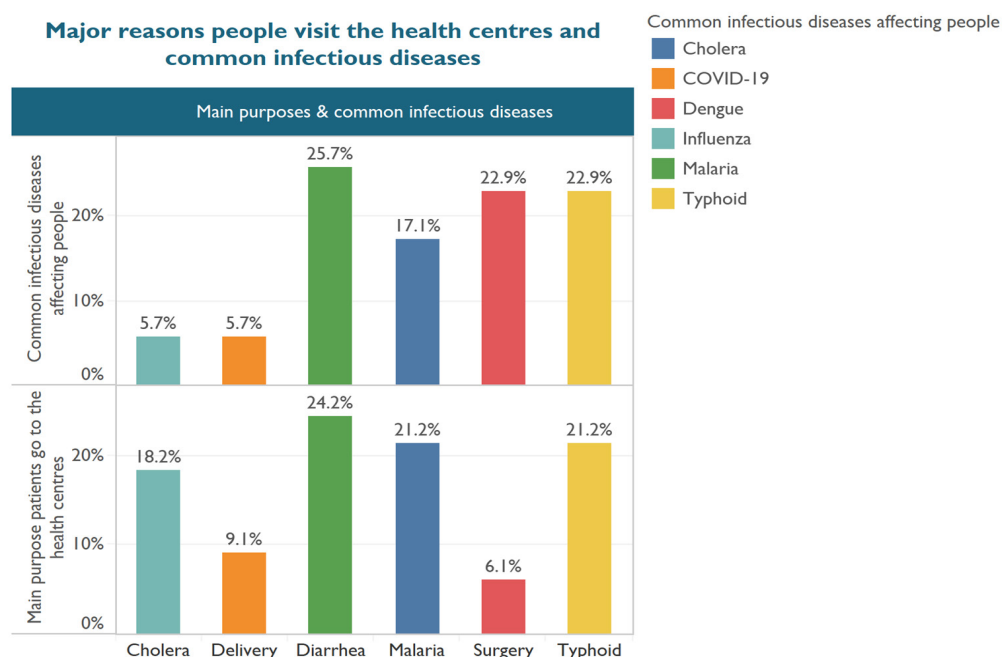
Name of health centre	Status of IPC supply	Availability of waste management system	Presence of health screening station 24/7	Estimated percentage wearing mask	Emergency preparedness plan last tested	Emergency preparedness plan status	Presence of health screening station	Status of IPC training
Ananda Polyclinic Hospital	Available	Available	Not available	>50%	Less than 3 months	Yes, tested	Available	Yes, conducted
Bhageshwor Health Clinic	Available	Available	Not available	>50%	Not tested	Not tested	Not available	Yes, conducted
Bhujela Health Post	Not available	Available	Not available	10%-30%	Not tested	Yes, tested	Not available	Yes, conducted
J.K. Medicare Hospital	Available	Available	Not available	>50%	Not tested	Not tested	Not available	Yes, conducted
Jimuwa Health Post	Not available	Available	Not available	<10%	Not tested	Yes, tested	Not available	Yes, conducted
Mahakali Sub Provincial Hospital	Not available	Available	Not available	>50%	Less than 3 months	Yes, tested	Available	Yes, conducted
Mahendranagar Eye Hospital	Available	Not available	Available	31%-50%	Between 6 to 9 months	Yes, tested	Available	No training
S.K. Polyclinic Hospital	Available	Available	Not available	>50%	Not tested	Not tested	Not available	Yes, conducted
Urban Health Clinic	Not available	Available	Not available	>50%	Not tested	Do not know	Not available	Yes, conducted

Health is a major determinant when it comes to mobility pattern analysis. Movement of sick people from POEs to the nearest health centre is key, especially for emergency cases. The square in blue indicates the most common modes of transport to reach the nearest health centre, whereas the square in orange shows where people go to when they get sick. Most people go to a clinic or a hospital when they fall ill (65.6%), followed by home treatment and traditional healers (12.5% each). The most common means of transport to access the health centre for emergency cases is by foot, public transport (rickshaw), and equipped ambulance, with a percentage distribution of 32.8, 25.9 and 19.5, respectively (see Fig. 2.4). It is important to note that people walk long distance to access the health centres, especially from POEs (32.8%).



**Fig. 2.4:** Mode of transport for emergency cases to access the health facilities from POEs and places where people mostly go to when they get sick

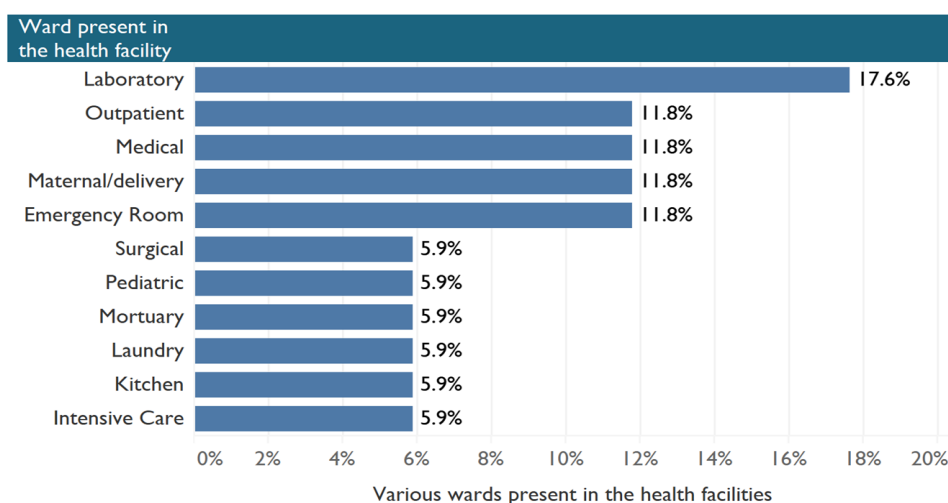
Fig. 2.5 shows the common infectious diseases affecting people in Bheemdatta Municipality (top). The analysis shows that, in ascending order; malaria, typhoid, dengue, and cholera, are the major diseases that affect people in the municipality, whereas COVID-19 and influenza are emerging diseases. On the other hand, the figure (bottom) shows the main purposes patients visit the health centres for treatment, in ascending order, these are; diarrhea, typhoid, malaria, and cholera. Delivery and surgery have a limited weight in the scale (9.1% and 6.1%, respectively).



**Fig. 2.5:** Major reasons patients visit the health centres and common infectious diseases

Various categories of wards in the health facilities were studied to determine their presence and these include; laboratory, outpatient, medical, maternal/delivery, emergency room, which are among the topmost layer. On the other hand, the bottom layer includes; surgical, pediatric, mortuary, laundry, kitchen, and intensive care. This shows that there are more laboratories in the health centres, compared to any other ward listed in Fig. 2.6.

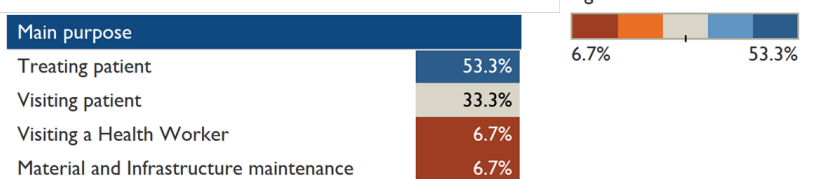
#### Category of wards in the health centres



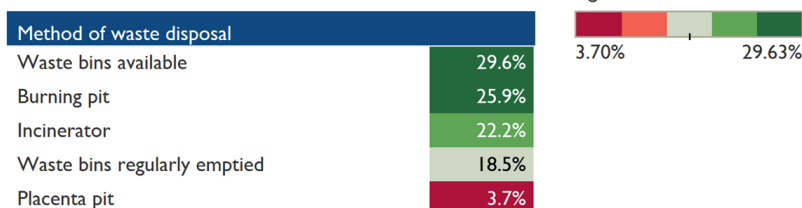
**Fig. 2.6:** Number of wards present at the health centres by category

As shown in Fig 2.7, the analysis indicates that the main purposes of visitors coming from India (top) are for treating patients and visiting patients, which account for the percentage of 53.3 and 33.3, respectively. The findings reveal that medical practitioners or professionals are mostly coming from India to check their patients' health conditions. Visits of health workers, and material and infrastructure maintenance are not significant. On the other hand (bottom), waste management within the health centres was also investigated, and the following methods were identified, in order of relevance; waste bins, burning pit, incinerator, waste bins regularly emptied, and placenta pit. However, burning pit and incinerator with regards to the availability of waste bins are mostly adopted for managing waste within the health centres in Bheemdatta Municipality.

#### Main purpose visitors come from India



#### Method of waste disposal at the health centres



**Fig. 2.7:** Main purpose visitors come from India and method of waste disposal at the health centres



### 3.2.d TRADITIONAL HEALERS

#### Population Mobility Pattern (who, where they come from, where they go)

Among the investigated traditional healers in Bheemdatta Municipality, the busiest days are Wednesday and Saturday, and the busiest months are September and October. People mainly come from India and within Nepal, specifically, *Kanchanpur, Kailali, Dadeldhura, and Darchula* districts, to visit the traditional healers' compounds. Furthermore, at the municipality level, apart from Bheemdatta, mobility pattern shows *Mahakali, Shuklaphanta, and Krishnapur* as places of origin.

#### Connectivity (link with the main community, route, accessibility, mode of transport, seasonality, communication)

The traditional healers in Bheemdatta Municipality are found in different localities, ranging from *Airi, Gajjar, to Bhasi* and *Basantapur*. People use the *East-West Highway* which connects a route to *Bhasi* and *Basantapur*. Alternatively, they can use another route which allows to reach the sites in *Gajjar*. People usually access these localities via motorbike, minivan or foot. Similarly, individuals coming from India use the formal POE (*Gaddachauki*) and travel using the *East-West Highway*.

#### Vulnerability/Capacity Analysis (in front of a risk of spread of communicable diseases)

The bar in orange shows the average number of people's entry on the busiest days, in blue is the average entry flow per day, in red is the dual entry flow and the green bar indicates the percentage of people coming from India. *Bhasi M.D, Basantapur, and Airi* localities have the highest entry flow both per day and on the busiest days, with 25, 13 and 13, respectively (see Fig. 3.1). *Basantapur* and *Airi* have the highest percentage of people coming from India (5% each), whereas the remaining localities have either 1 per cent (*Gajjar* and *Katan*) or no people coming from the neighbouring country (*Basantapur*).

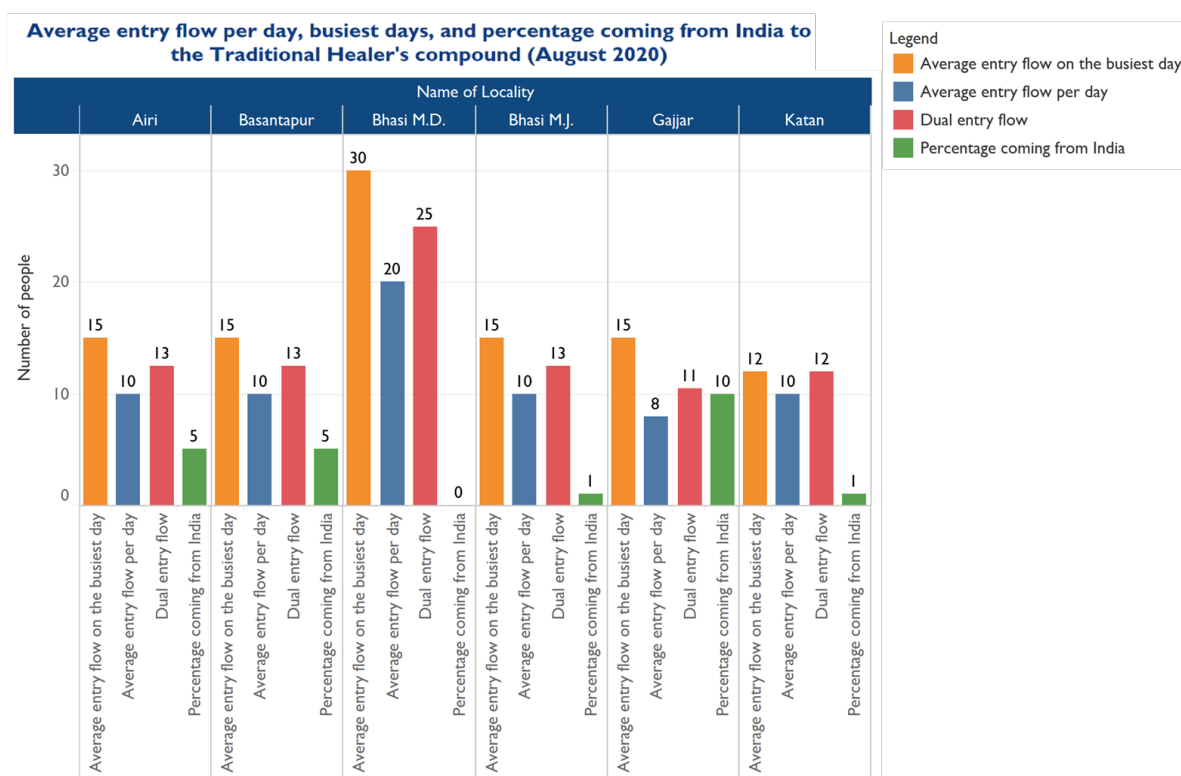
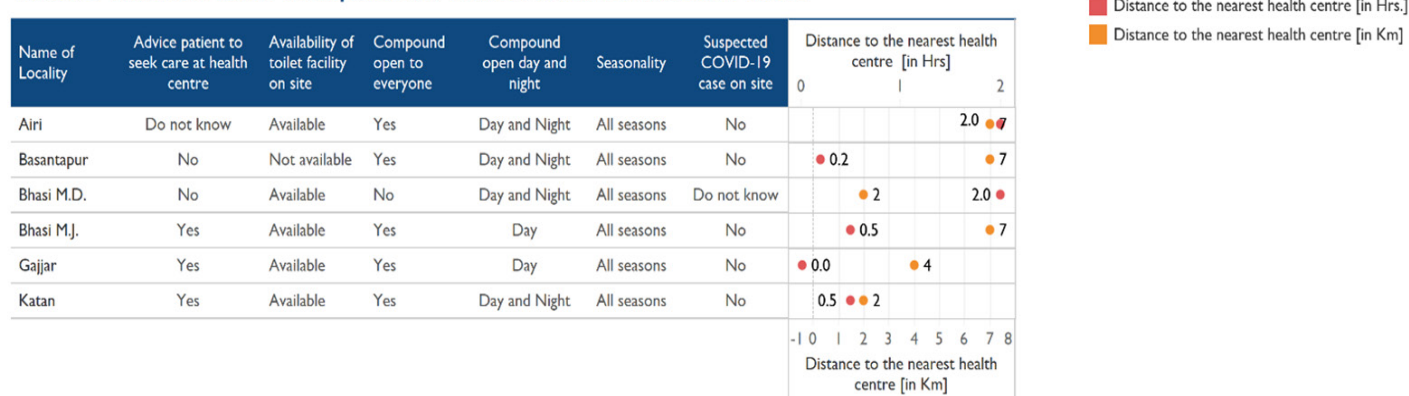


Fig. 3.1: Mobility patterns across the traditional healers' compounds

At the traditional healers' compounds, an assessment was done to determine the status of the health infrastructure which might pose serious health threats. Half of the traditional healers asserted that they advise their patients to seek alternative cure. Two (2) in *Bhasi M.D.* and *Basantapur* do not recommend patients to seek alternative health care and one of them is uncertain with the response. Toilet facilities are available at all localities, except for *Basantapur*. The traditional healers' compounds are open to everyone, except for *Bhasi M.J.*, and are mostly accessible day and night, excluding *Bhasi M.J.* and *Gajjar*, which are only open during the day. All the traditional healers investigated are accessed throughout the year and according to respondents, there were no identified nor suspected COVID-19 cases that might have passed through the various traditional healers' localities. The farthest distance to the nearest health centre from the traditional healers' compound is 7 Km and travel time is 2 hours (*Airi*, *Basantapur*, and *Bhasi M.J.*). The average distance to the nearest health facility from the remaining traditional healers' localities is around 2.5 Km (see Fig. 3.2).

**Status of traditional healer's compound and distance to the nearest health centre**



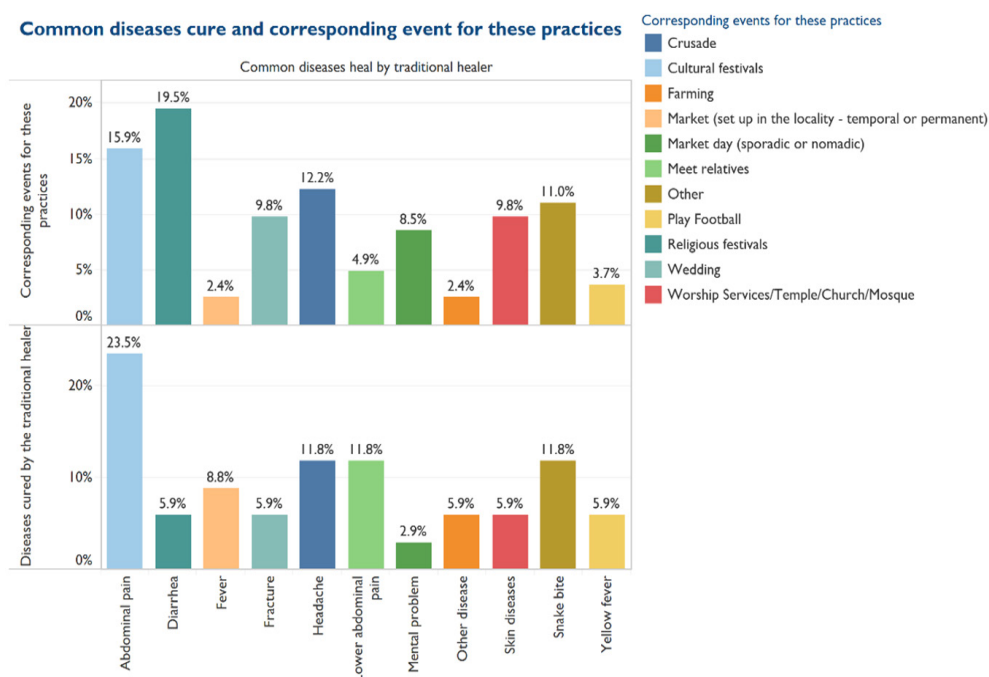
**Fig. 3.2:** Health capacity, related practices and distance to the nearest health centre from the traditional healers

Traditional healers in *Airi* and *Basantapur* are equally busy throughout the week, whereas the remaining localities are less busy on Tuesday and Friday. The busiest month of the year varies across traditional healers' localities. Less than 50 per cent of the people wear masks, except at *Bhasi M. J.* and *Gajjar* localities. Only half of the traditional healers have a waste management system in place. Trash is not visible on the floor and in the open, except at *Bhasi M. J.* However, there is a wide visibility of unwanted animals/insects. According to the traditional healers, three (3) out of six (6) of them use protective materials during their practices, whereas the remaining either do not or are uncertain about protective gears.

**Table 3.1:** Waste management, environmental condition, and estimated percentage of people wearing masks

Name of Locality	Name of the most used health centre	Busiest day of the week	Busiest month of the year	Percentage of people wearing mask	Availability of waste management system	Visibility of unwanted animals/insects	Visibility of stagnant water on the floor	Use of protective materials during practices	Visibility of trash in the open
Airi	Mahakali Sub Provincial Hospital	Every day	September, October, November, December	<10%	Not available	Yes, visible	Yes, visible	Yes	Not visible
Basantapur	Mahakali Sub Provincial Hospital	Every day	August, September, October	31%-50%	Available	Yes, visible	Yes, visible	Do not know	Not visible
Bhasi M.D.	Mahakali Sub Provincial Hospital	Saturday	March, April	10%-30%	Available	Yes, visible	Not visible	Do not know	Not visible
Bhasi M.J.	Mahakali Sub Provincial Hospital	Wednesday, Thursday, Sunday	October	>50%	Available	Yes, visible	Not visible	No	Yes, visible
Gajjar	Mahakali Sub Provincial Hospital	Saturday	May, June	>50%	Not available	Yes, visible	Not visible	Yes	Not visible
Katan	Urban Health Center	Monday, Wednesday	Every month	<10%	Not available	Yes, visible	Not visible	Yes	Not visible

The topmost layer of Fig. 3.3 shows the corresponding events for the busiest days or months at the various traditional healers' compounds. On the other hand, the bottommost layer shows the major practices or diseases treated by the traditional healers. In this regard, abdominal pain, headache, lower abdominal pain, snake bite, and fever account for the highest percentage. The remaining diseases carry an average percentage distribution of 5.9. These practices correspond to various activities in the municipality (top). Activities that trigger-up the mobility population at the various traditional healers' compounds are presented in ascending order of magnitude as thus; religious and cultural festivals, crusades, weddings, and worship services, especially at temples.



**Fig. 3.3:** Common health practices and corresponding events at the traditional healers' compounds

### 3.2.e SCHOOLS AND COLLEGES

#### **Population Mobility Pattern (who, where they come from, where they go)**

Schools/colleges situated in Bheemdatta Municipality largely attract students from the nearest localities, and lie in Mahendranagar. The study shows that the mobility of students is limited within the neighbouring districts, such as Bheemdatta, Kailali, Dadeldhura and Baitadi municipalities.

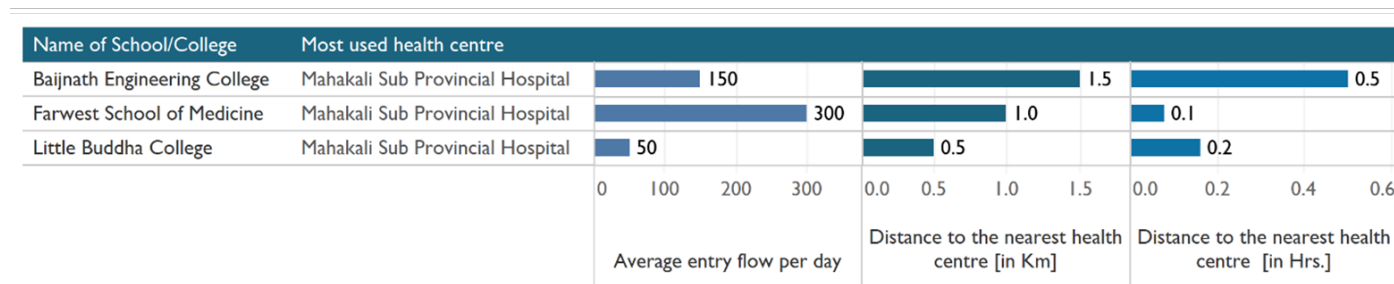
#### **Connectivity (link with the main community, route, accessibility, mode of transport, seasonality, communication)**

Since the investigated schools/colleges are located in Mahendranagar city, students use the *East-West Highway* connecting *Bedkot Municipality* to access these sites. The main communities near these schools/colleges reside at *Pipariya, Bramhadev* and *Tilachaur*. A road connects the *East-West Highway* to *Bramhadev* and *Tilachaur*, easily accessible by tricycle.

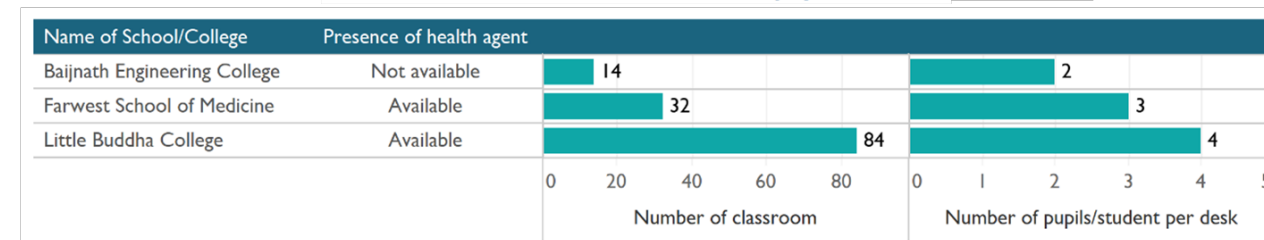
## Vulnerability/Capacity Analysis (in front of a risk of spread of communicable diseases)

Three (3) schools were selected following the matrix analysis for Bheemdatta Municipality. Fig. 4.1 shows the average attendance of students/pupils per day and the distance to the nearest health centre (top), number of classrooms and desk per student ratio (bottom). The most used health centre is *Mahakali Sub Provincial Hospital*. *Farwest School of Medicine* and *Bajjnath Engineering College* are the most populated schools with an average attendance of 300 and 150 students per day, respectively. The distance to the nearest health centre from *Bajjnath Engineering College* and *Farwest School of Medicine* is 1.5 Km and 1 Km, respectively. It takes 30 minutes by foot to reach the health centre from *Bajjnath Engineering College*, whereas the other two schools/colleges are closer to the health centre by foot. Among the schools/colleges, only one does not have an agent dedicated specifically for students who get sick (bottom). *Little Buddha College* has the highest number of classrooms with 4 students per desk, while the remaining two (*Farwest School of Medicine* and *Bajjnath Engineering College*) have 32 and 14 classrooms, with 3 and 2 students per desk, respectively.

**Average attendance per day, and distance to the nearest health centre (August 2020)**



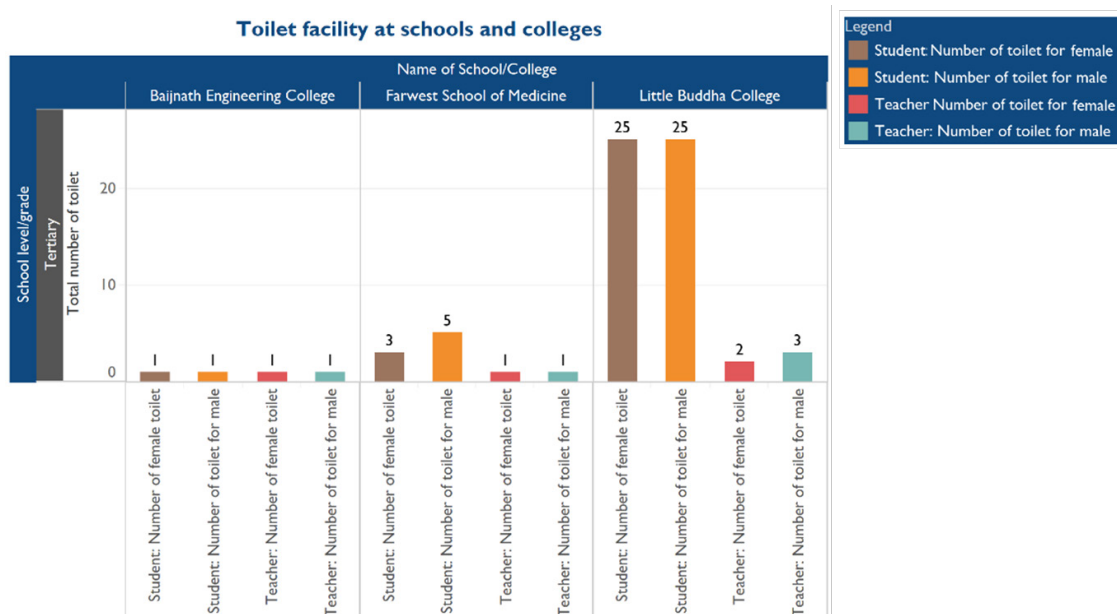
**Number of classrooms, desks, and pupils/students ratio (2019)**



**Fig. 4.1: Average attendance per day, distance to the nearest health centre and classroom capacity**

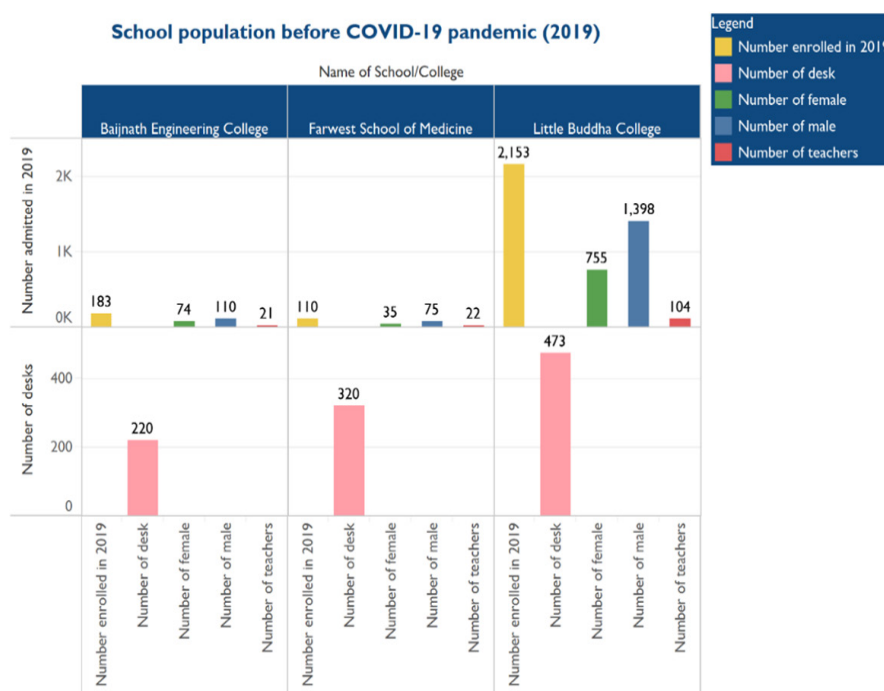
Fig. 4.2 shows the distributions of toilet facilities within the three schools selected for the PMM mapping exercise. The bar in brown colour indicates the number of toilets for female students, in orange is the number of toilets for male students, the red bar shows the number of toilets for female teachers, and the one in sky blue indicates the number of toilets for male teachers. *Little Buddha College* has the best equipped toilet facilities with 25 for each category (male and female) and five (5) dedicated for teachers, only two (2) for females and three (3) for males. It is followed by *Farwest School of Medicine*, with a total of ten (10) toilets facilities, three (3) for females and five (5) for male students. In terms of number of students per toilet, *Bajjnath Engineering College* has the highest number of students using the same toilet, 1 toilet for over 70 female pupils and 1 toilet for over 110 male pupils. This is closely followed by *Little Buddha College* (1 toilet for almost 30 female students and 1 toilet for 55 males). *Farwest School of Medicine* is the best equipped with toilet facilities with only 11 female students using the same toilet and 1 toilet for 15 males (see Fig. 4.2 and 4.3). All the schools investigated in Bheemdatta Municipality are tertiary educational institutions.





**Fig. 4.2:** Toilet facilities and students/pupils' seating accommodation

The bar in yellow colour shows the total number of students enrolled in 2019, in pink is the number of desks, green indicates the number of female students, the blue bar shows the number of male students, and in red is the number of teachers. Among the schools investigated, *Little Buddha College* is the most populated with 2,153 students enrolled in 2019 (before COVID-19 pandemic). The gender disparity is greater for male students than for female students, with almost double the size of males (643 difference). *Bajinath Engineering College* is the second most populated with 183 students in total. Similarly, the number of male students exceeds that of female students with a population of 110 and 74, respectively (36 difference). *Farwest School of Medicine* and *Bajinath Engineering College*, though less densely populated, have more desks than the actual school population. The gender disparity among the schools in Bheemdatta Municipality is wide in terms of male to female ratio (see Fig. 4.3).



**Fig. 4.3:** Population distribution at the schools/colleges

The schools/colleges' basic facilities were assessed, and include; an estimated percentage of people wearing mask, isolated places dedicated for students (before the COVID-19), availability of water and toilet facilities, and the availability of a cafeteria or food service. Water and toilet facilities are available, together with food services for students and teachers, and isolated places dedicated for sick students at all the schools, except at *Bajjnath Engineering College*. Greater than 50 per cent and between 31-50 per cent wear masks. There are 54 stalls or drop holes in *Little Buddha College*, which accounts for the highest population mobility. The remaining two schools, namely *Bajjnath Engineering College* and *Farwest School of Medicine*, have 2 and 6 stalls, respectively (see Fig. 4.4).

**Basic facilities in the schools/colleges**



**Fig. 4.4: Health infrastructure at the schools/colleges**

Waste management is key in terms of vulnerability and capacity assessment, especially for communicable diseases. There is a waste management system, though inadequate, and visibility of trash and unwanted animals on the floor. There were no suspected COVID-19 cases that might have passed through those schools before the lockdown was imposed. The schools are busy throughout the week and are open during all seasons in Nepal (before COVID-19). The busiest months of the year vary across the respective schools, more so in April and May.

**Table 4.1: Waste management, suspected COVID-19 cases, and schools/colleges seasonality**

Name of School/College	Name of the nearest health centre	Availability of waste management system	Suspected COVID-19 during the pandemic	Visibility of unwanted animals/insects	Visibility of trash on the floor	Busiest day of the week	Busiest month of the year	Seasonality
Bajjnath Engineering College	Mahakali Sub Provincial Hospital	Available	No	Yes, limited	Yes, limited	Every day	April, May	All seasons
Farwest School of Medicine	Mahakali Sub Provincial Hospital	Available	No	No	Yes, in large quantity	Every day	March, April, May	All seasons
Little Buddha College	Mahakali Sub Provincial Hospital	Available	No	Yes, limited	No	Every day	January, February, August, September, December	All seasons

### 3.2.f ENTERTAINMENT CENTRES

#### Population Mobility Pattern (who, where they come from, where they go)

The movement of people towards entertainment centres in Bheemdatta Municipality is present every day, however the busiest day is Saturday. People who visit these places are mostly from *Kanchanpur*, *Kailali*, *Dadeldhura*, and *Baitadi* districts. People from India also come to visit some of the entertainment places, such as *Suklaphanta Wildlife Reserve Centre* and *Jhilmila Lake*.

#### Connectivity (link with the main community, route, accessibility, mode of transport, seasonality, communication)

*Suklaphanta Wildlife Reserve Centre* borders with a large community at *Pipariya* and is also close to India, which is connected to the *East-West Highway* through *Mahendranagar Market*. Conversely, *Jhilmila Lake* is situated in the northern part of the municipality and close to *Musetti POE* where no large community is situated nearby. The accessibility of vehicles to reach these sites is difficult due to the geographic terrain and poor road infrastructure. Other entertainment centres are located at *Mahendranagar* locality, which is connected to the *East-West Highway* and is in proximity of *Gaddachauki POE* (formal).

#### Vulnerability/Capacity Analysis (in front of a risk of spread of communicable diseases)

The bar in blue colour denotes the average entry flow per day, the green percentage refers to people coming from India, in orange is the average entry flow on the busiest day, and in red is the average dual flow. In Bheemdatta Municipality, there is a high mobility of people at entertainment centres. At *Khulla Mancha*, there are many people visiting the site on the busiest day (5,000 people) and per day (200 people). At *Covered Hall*, the influx of people is 200 per day and on the busiest day 1,500, followed by *Bhimdatta Park*, with a population mobility of 300 people per day and 400 people on the busiest day (see Fig. 5.1). People coming from other countries, notably India, are in higher number in *OMG Club* (60%), compared to *Jhilmila Lake* (20%), *Bhimdatta Park* and *Covered Hall* (10% each).

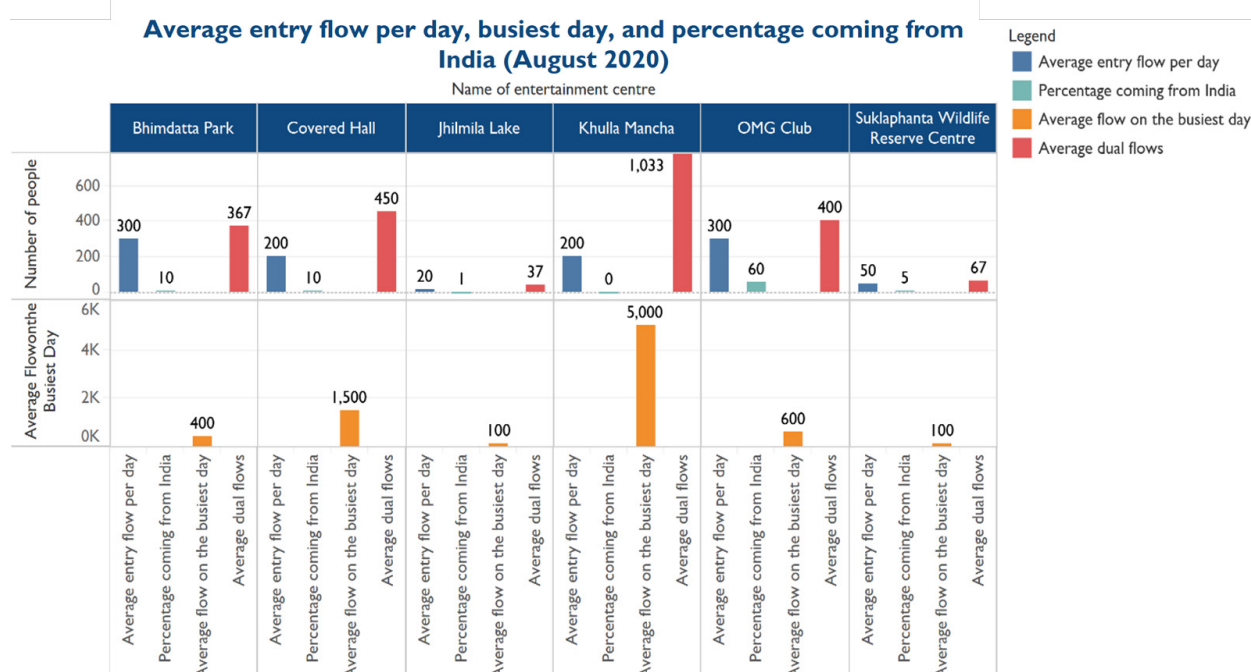


Fig. 5.1: Population mobility at the entertainment centres

The availability of basic health facilities at the various entertainment centres was assessed. Out of six (6) entertainment centres, only one (*OMG Club*) implements body temperatures checking on site and has a functional thermometer. All sites are used throughout the seasons, except for *Khulla Mancha*, which is only operational in spring. There is availability of toilet facilities at all the entertainment centres investigated. Similarly, water facilities are available, except for *Khulla Mancha*. The maximum distance to the water source is 1 Km (*OMG Club*) and less than 500 meters by foot (see Fig 5.2). The number of toilet stalls/drop holes is higher at *Covered Hall* (10) and *Khulla Mancha* (4).

**Basic health screening and toilet facility**



**Fig. 5.2: Toilet facility, distance to the water source and health screening station**

Fig. 5.3 presents some basic parameters of health screening stations across the entertainment centres. As results revealed, there is no presence of health agents dedicated for ill people. *Bhimdatta Park* is the only entertainment centre to have isolated places dedicated for people who get sick. Half of the entertainment centres are busy throughout the week (if no lockdown in place), and the remaining sites are busy mostly on weekends (notably Friday, Saturday and Sunday). Made exception for *Khulla Mancha*, which is equally busy throughout the months, the remaining sites are most frequently accessed between October to December. The distance to the nearest health centre from *Jhilmila Lake* and *Bhimdatta Park* is approximately 1 hour and 48 minutes, respectively, whereas the remaining sites are closer by. However, *Jhilmila Lake* is 9 Km far from the nearest health centre, compared to *Bhimdatta Park*, which is only 200 meters away. The time taken to reach these health centres varies across the respective sites due to different road infrastructure.

**Availability of health worker/agent and distance to the nearest health centre**



**Fig. 5.3: Presence of health agent and isolated places for sick people, the busiest days/months, and distance to the nearest health centre**



Table 5.1 shows the hygiene and travellers' status at the various entertainment centres investigated. There is availability of waste management system, except at *Khulla Mancha*. In none of the sites that were assessed, health screening stations are present. The most used health centre is *Mahakali Sub Provincial Hospital* and half of the respondents agreed that greater than 50 per cent of the people wear masks, whereas the remaining have placed the percentage between 31-50 per cent or below 10 per cent. Trash is visible on the floor at *Covered Hall* and *OMG Club*; however, the latter is the only one out of all the entertainment centres assessed not to have unwanted animals/insects. Only half of the entertainment centres (3/6) keep a record book or devices for visitors.

**Table 5.1:** Hygiene and travellers' status at the entertainment centres

Name of entertainment centre	Availability of waste management system	Availability of screening station	Name of the most used health centre	Estimated percentage wearing mask	Visibility of stagnant water on the floor	Visibility of unwanted animals/insects	Visibility of trashes on the floor	Availability of record book/device for visitors
Bhimdatta Park	Available	Not available	Mahakali Sub Provincial Hospital	>50%	Not visible	Yes, visible	Not visible	Available
Covered Hall	Available	Not available	Mahakali Sub Provincial Hospital	31%-50%	Yes, visible	Yes, visible	Yes, visible	Not available
Jhimila Lake	Available	Not available	Bramhadev Urban Health Center	<10%	Not visible	Yes, visible	Not visible	Not available
Khulla Mancha	Not available	Not available	Mahakali Sub Provincial Hospital	>50%	Not visible	Yes, visible	Yes, visible	Not available
OMG Club	Available	Not available	Mahakali Sub Provincial Hospital	31%-50%	Not visible	Not visible	Not visible	Available
Suklaphanta Wildlife Reserve Centre	Available	Not available	Mahakali Sub Provincial Hospital	>50%	Yes, visible	Yes, visible	Not visible	Available

### 3.2.g MARKET CENTRES

#### **Population Mobility Pattern (who, where they come from, where they go)**

In Bheemdatta Municipality, most of the markets are open every day, however, the busiest day is Saturday. People coming to these markets are mainly from *Kanchanpur*, *Kailali*, and *Dadeldhura* districts. In terms of municipalities, people mainly come from *Punarbans*, *Bedkot*, *Mahakali*, and *Shuklaphanta*.

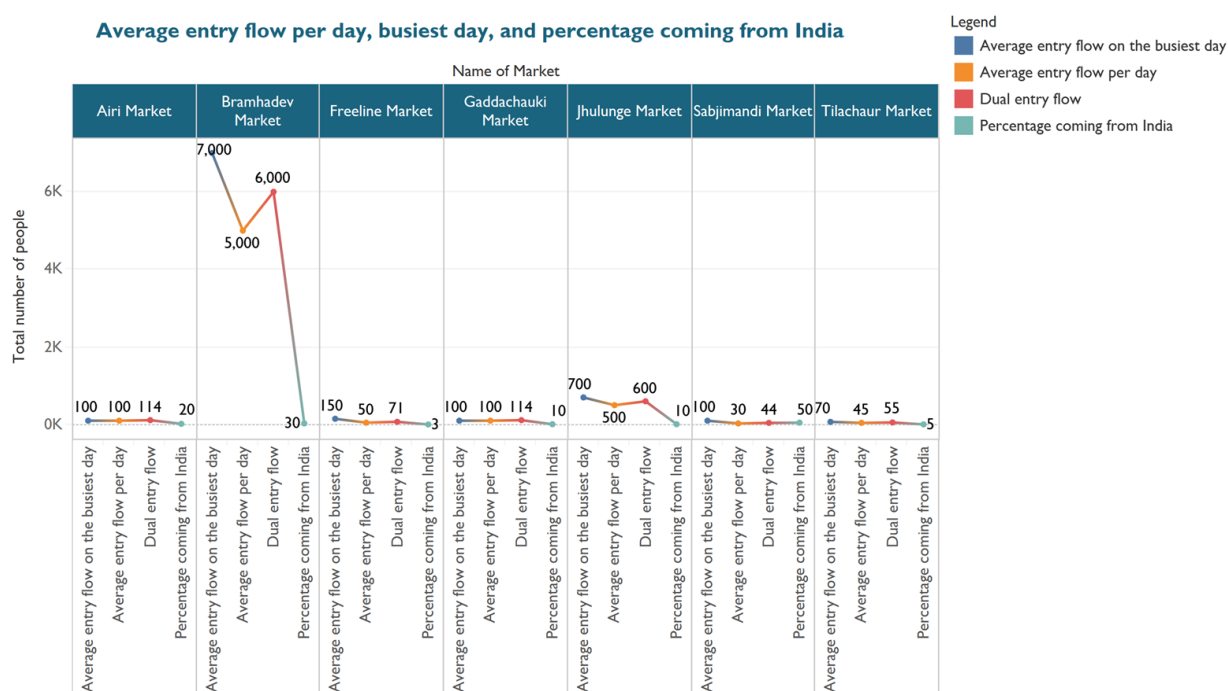
#### **Connectivity (link with the main community, route, accessibility, mode of transport, seasonality, communication)**

People use various routes to reach the biggest market, *Mahendranagar Bazar*, and originate from different localities within the municipality. For instance, from *Musetti village*, people use a route near the *Mahakali River* and *Bramhadev village*, which eventually connects to the *East-West Highway*. From *Bramhadev village*, people also use an alternative route to reach *Mahendranagar Bazar*, followed by *Tilakpur* and *Tirkhadani* localities. Similarly, people come from *Pipariya* locality using a route which connects to the *East-West Highway* near *Gaddachauki POE*.

#### **Vulnerability/Capacity Analysis (in front of a risk of spread of communicable diseases)**

Fig. 6.1 depicts a line chart with different colours as follows; the line in blue colour shows the average entry flow on the busiest day, the average entry flow per day is indicated in orange, the red line refers to the dual entry flow, and in green is the percentage of people coming from India. *Bramhadev Market* has the highest population mobility with 6,000 influx of people per day and 7,000 on the busiest day. It is followed by *Jhulunge Market*, with 600 and 700 people entering the market per day and on the busiest days, respectively. *Gaddachauki* and *Airi* markets have an

equal entry flow both per day and on the busiest day, each with 100 visitors. The remaining have an average entry flow of 20 people's entry per day and 35 on the busiest day. In *Subjimandi*, *Bramhadev*, and *Airi* markets, 50, 30 and 20 per cent of the people come from India, respectively (see Fig. 6.1). *Gaddachauki* and *Jhulunge* markets have an equal percentage of people coming from India (10%), followed by *Tilachaur* and *Freeline* markets (5% and 3%, respectively).



**Fig. 6.1:** Population mobility at the markets centres

Seven (7) market centres were investigated during the study in Bheemdatta Municipality. Among others, the availability of waste management system was evaluated and according to the results, most markets have a waste management on site (5/7). The most used and nearest health centre from the various markets is *Mahakali Sub Provincial Hospital* (5/7). The availability of isolated places dedicated for sick people is not adequate or not available (4/7); two respondents were uncertain about the presence of an isolation room. More than half of the market centres (4/7) have a health authority for emergency cases; in the remaining cases, either it is not present, or respondents were unsure. In 70 per cent of the cases, there is visibility of trash and stagnant water on the floor, though in limited quantity. This poses a health challenge at the market centres since it causes mosquitoes to breed. The percentage of people wearing masks is estimated at around 31-50 per cent. This means that a limited number of people wear masks across the various market centres.

**Table 6.1:** Hygiene status at the market centres

Name of Market	Availability of waste management system	Name of the most used health centre	Availability of isolated places dedicated for sick people	Presence of health authority for emergency case	Visibility of trashes in the open	Visibility of stagnant water on the floor	Estimated percentage wearing mask
Airi Market	Not available	Mahakali Sub Provincial Hospital	Not available	Available	Yes, limited	Yes, limited	31%-50%
Bramhadev Market	Available	Bramhadev Urban Health Center	Not available	Available	No	No	31%-50%
Freeline Market	Available	Mahakali Sub Provincial Hospital	Do not know	Do not know	Yes, limited	Yes, limited	31%-50%
Gaddachauki Market	Available	Mahakali Sub Provincial Hospital	Not available	Available	Yes, limited	No	>50%
Jhulunge Market	Not available	Mahakali Sub Provincial Hospital	Not available	Not available	Yes, limited	Yes, limited	>50%
Sabjimandi Market	Available	J.K. Polyclinic Hospital	Available	Do not know	No	Yes, limited	10%-30%
Tilachaur Market	Available	Mahakali Sub Provincial Hospital	Do not know	Available	Yes, limited	Yes, limited	31%-50%

Fig. 6.2 shows the availability of water and toilet facilities, as well as the distance to the nearest health centre. All the market centres have water and toilet facilities nearby, except for *Jhulunge Market*. The busiest days of the week across the market centres are the weekends, except for *Airi Market*, which is equally busy throughout the week. The busiest month of the year varies across the markets centres, with only *Sabjimiandi Market* being busy mainly in January. Despite being operational throughout the seasons, none of the markets assessed have a health screening station. People at the market centres usually elect the following alternative treatment when they are sick; clinic or hospital, home treatment, pharmacy, and traditional healers. People walk 7 Km from *Airi* and *Gaddachauki* markets to reach the nearest health centre. *Jhulunge Market* is about 2 Km away from the nearest health centre (*Mahakali Sub Provincial Hospital*), whereas the remaining markets centres are 1 Km distant. *Tilachaur* and *Gaddachauki* markets have the highest number of toilet stalls/drop holes (5 and 4, respectively), followed by *Freeline* and *Sabjimiandi* markets with 3 and 2 stalls/drop holes, respectively, and the remaining sites only having one (1) stall each.

**Availability of water and toilet facilities, and distance to the nearest health centre**

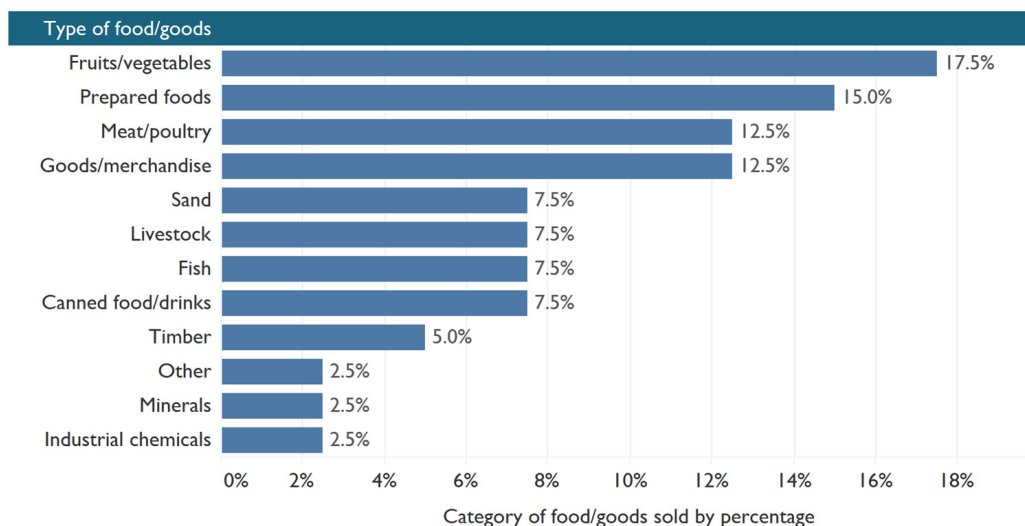
Name of Market	Availability of water	Availability of toilet nearby	Busiest day of the week	Busiest day of the year	Availability of health screening station	Market seasonality	Where people go when they get sick	Distance to the nearest health centre [in Km]	Number of stalls/drop holes [Toilet facility]
Airi Market	Available	Available	Every day	January, February, October, November	Don't know	All seasons	Clinic or Hospital	7.0	1
Bramhadev Market	Available	Available	Sunday	January, February, March	Not available	All seasons	Clinic or Hospital	1.0	1
Freeline Market	Available	Available	Saturday	March, April	Not available	All seasons	Pharmacy, Home Treatment	1.0	3
Gaddachauki Market	Available	Available	Sunday	January, February, November, December	Not available	All seasons	Clinic or Hospital	7.0	4
Jhulunge Market	Not available	Not available	Saturday	June, July	Not available	All seasons	Clinic or Hospital	2.0	
Sabjimiandi Market	Available	Available	Friday	January	Not available	All seasons	Clinic or Hospital	1.0	2
Tilachaur Market	Available	Available	Saturday	March, April	Not available	All seasons	Clinic or Hospital, Traditional Healer	0.5	5

**Fig. 6.2:** Basic hygiene, alternative treatment places and distance to the nearest health centre

At the various market centres in Bheemdatta Municipality, the assessment included the kind of goods or food items being sold. In ascending order of magnitude, the following items are sold by percentage distribution; fruits/vegetables, prepared foods, meat/poultry, and goods/merchandise, at the topmost layer. The middle layer is occupied by; sand, livestock, fish, and canned food/drinks. Lastly, timber, minerals, industrial chemicals, and other items are at the bottommost layer (see Fig. 6.3). It is important to note that the kind of food being sold and environmental factors at the market centres play a key role in disease transmission, especially during the COVID-19 pandemic and other diseases.<sup>3</sup>

<sup>3</sup> [https://www.who.int/environmental\\_health\\_emergencies/disease\\_outbreaks/communicable\\_diseases/en/](https://www.who.int/environmental_health_emergencies/disease_outbreaks/communicable_diseases/en/)

#### Food/goods sold at the market centres



**Fig. 6.3:** Different kind of goods/food sold at the market centres

### 3.2.h MIGRANT WORKSITES

#### **Population Mobility Pattern (who, where they come from, where they go)**

Among the migrant worksites investigated in Bheemdatta Municipality, almost all sites are open every day, and the busiest months of the year are January, March and October. One portion of the migrant workers comes either from India or other districts in Nepal, such as *Kailali, Doti* and *Achham*.

#### **Connectivity (link with the main community, route, accessibility, mode of transport, seasonality, communication)**

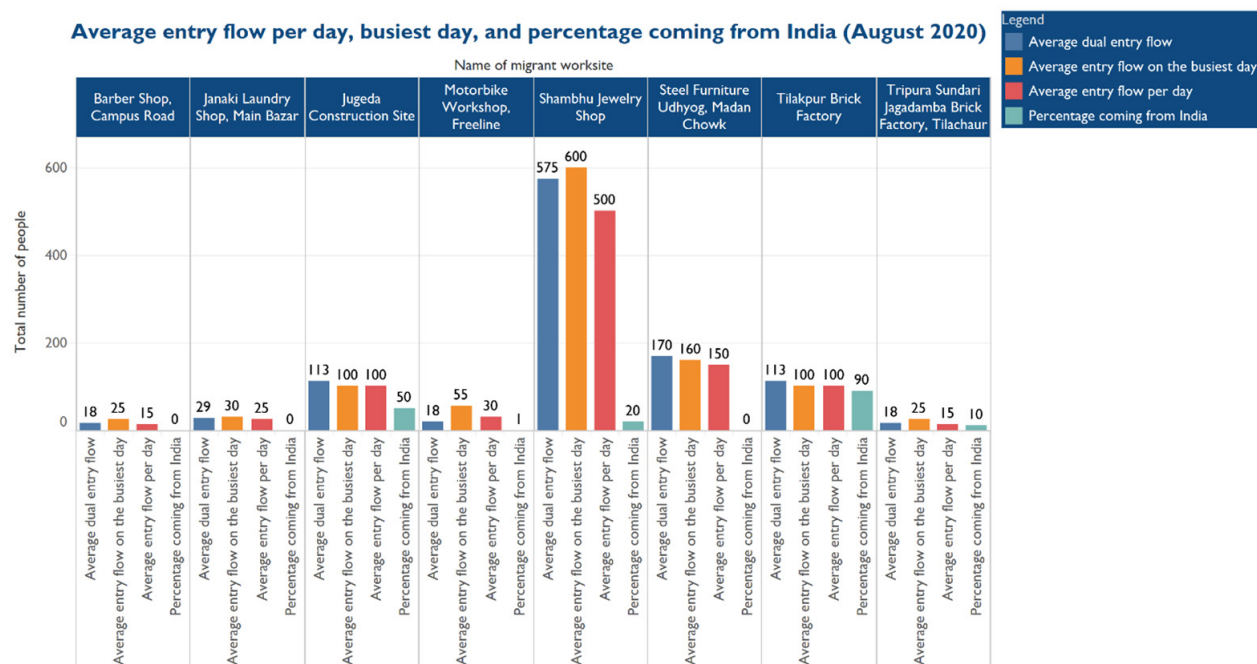
Most of the migrant worksites are located at *Mahendranagar* since it is the biggest market of this municipality. In order to reach the worksites, people of Indian nationality mainly use the formal POE (*Gaddachauki*), which connects *Mahendranagar* via the *East-West Highway*. Also, individuals coming from other districts mostly use the *East-West Highway*, followed by *Bedkot Municipality*. Workers travelling from India use horse carts, tricycles and minivans to access the worksites. On the contrary, workers coming from other districts in Nepal commute by bus, minivan, and truck.

#### **Vulnerability/Capacity Analysis (in front of a risk of spread of communicable diseases)**

The bar in blue colour shows the average dual flow, orange refers to the average entry flow on the busiest day, red indicates the average entry flow per day, and the green bar shows the percentage of people coming from India. *Shambhu Jewelry Shop* is the most populated migrant worksite with 500 and 600 people working per day and on the busiest day, respectively. On average, *Jugeda Construction Site*, *Steel Furniture Udhyog (Madan Chowk)*, and *Tilakpur Brick Factory* have a similar distribution of population mobility of 100 people per day and 120 people on the busiest day. *Shambhu Jewelry Shop* and *Tripura Sundari Jagadamba Brick Factory (Tilachaur)* have 20 and 10 per cent of people coming from India, respectively (see Fig. 7.1).



Only 1 per cent of people come from India at *Motorbike Workshop* (at two localities, *Buskpard Road* and *Mahendranagar Bajar*), whereas at the remaining sites, workers are only Nepalese citizens.



**Fig. 7.1** Population mobility at the migrant worksites

The hygiene status was investigated at nine (9) sites to determine, among others, the availability of health screening stations, body temperature checking, and accommodation for staffs (see Table 7.1). Most of the migrant worksites do not have health screening stations (7/9), including body temperature checking, made exception for *Tripura Sundari Jagadamba Brick Factory* and *Shambhu Jewelry Shop*. Accommodation for staffs is available at most of the migrant worksites investigated, except at *Janaki Laundry Shop (Main Bazar)*. The most used and nearest health centre from the various migrant worksites is *Mahakali Sub Provincial Hospital*. Water and toilet facilities are available at all locations. Most of the sites are busy throughout the week (4/9), and the remaining have a higher flow in the weekend (Saturday and Sunday). The busiest month of the year varies across the migrant worksites, except for *Jugeda Construction Site*, which is equally busy throughout the year.

**Table 7.1:** Hygiene status at the migrant worksites

Name of migrant worksite	Availability of health screening station	Status of body temperature checking	Availability of accommodation for staffs	Name of the most used health centre	Availability of water	Availability of toilet nearby	Busiest day of the week	Busiest month of the year
Barber Shop, Campus Road	Not available	Not available	Available	Mahakali Sub Provincial Hospital	Available	Available	Saturday	March, April
Janaki Laundry Shop, Main Bazar	Not available	Not available	Not available	Mahakali Sub Provincial Hospital	Available	Available	Saturday	August
Jugeda Construction Site	Not available	Not available	Available	Mahakali Sub Provincial Hospital	Available	Available	Every day	Every month
Motorbike Workshop, Freeline	Not available	Not available	Available	J.K. Polyclinic Hospital	Available	Available	Saturday	March
				Mahakali Sub Provincial Hospital	Available	Available	Sunday, Monday	January, December
Shambhu Jewelry Shop	Available	Available	Available	Mahakali Sub Provincial Hospital	Available	Available	Friday	June, August, October, November
Steel Furniture Udhog, Madan Chowk	Not available	Not available	Available	Mahakali Sub Provincial Hospital	Available	Available	Every day	January, February, March, June, July, August, October
Tilakpur Brick Factory	Not available	Not available	Available	Mahakali Sub Provincial Hospital	Available	Available	Every day	January, February, March, October, November, December
Tripura Sundari Jagadamba Brick Factory, Tilachaur	Available	Available	Available	Jimuwa Health Post	Available	Available	Every day	January, September, October, November, December

Hygiene is a serious determinant for any outbreak or pandemic, especially for COVID-19. Fig. 7.2 depicts the health screening status and distance to the nearest water source and health centre (*Mahakali Sub Provincial Hospital*). There is availability of a waste management system for most of the sites (8/9), except for *Jugeda Construction Site*, and a limited presence of trash on the floor (2/9). Conversely, there is an inadequate management of waste across the migrant worksites due to the following reasons:

1. Visibility of unwanted animals/insects and excrement on the floor (7/9).
2. Visibility of stagnant water on the floor making room for mosquitoes and some other insects to breed (4/9).
3. According to direct observations, animals like cows, buffaloes, horses, etc. have constant contact with people across the municipalities

As per respondents' statements, the percentage of people wearing masks stands at either greater than 50 per cent (5/9) or between 31-50 per cent (4/9). The distance to the nearest health centre from the *Barber Shop (Campus Road)* and *Jugeda Construction Site* is 1.5 Km, closely followed by *Tilakpur Brick Factory*, *Shambhu Jewelry Shop*, and *Tripura Sundari Jagadamba Brick Factory (Tilachaur)*, which are 1 Km away. The remaining sites are approximately 500 meters from the nearest health centre. The distance from the various sites to the nearest water source is less than 1 Km, except for the *Barber Shop (Campus Road)*, which is 1 Km away.

**Waste management, mask wearing and distance to the nearest water source and health centre**

Name of migrant worksite	Availability of waste management system	Visibility of trash in the open	Visibility of stagnant water on the floor	Estimated percentage wearing mask	Visibility of unwanted animals/insects	Distance to the nearest health centre [in Km]		Distance to the nearest water source [in Km]	
Barber Shop, Campus Road	Available	Not visible	Not visible	>50%	Yes, visible	1.5	1.0		
Janaki Laundry Shop, Main Bazar	Available	Not visible	Not visible	>50%	Yes, visible	0.7	0.2		
Jugeda Construction Site	Not available	Yes, visible	Yes, visible	31%-50%	Yes, visible	1.5	0.1		
Motorbike Workshop, Freeline	Available	Not visible	Not visible	10%-30%	Not visible	0.5	0.2		
				>50%	Yes, visible	0.5	0.3		
Shambhu Jewelry Shop	Available	Not visible	Yes, visible	31%-50%	Not visible	1.0	0.0		
Steel Furniture Udhyog, Madan Chowk	Available	Not visible	Yes, visible	>50%	Yes, visible	0.2	0.1		
Tilakpur Brick Factory	Available	Not visible	Not visible	>50%	Yes, visible	1.0	0.2		
Tripura Sundari Jagadamba Brick Factory, Tilachaur	Available	Yes, visible	Yes, visible	10%-30%	Yes, visible	1.0	0.3		
						0.0	0.5	1.0	1.5
						Distance to the nearest health centre [in Km]		Distance to the nearest water source [in Km]	

**Fig. 7.2** Waste management, estimated percentage wearing mask and distance to the water source and health centre

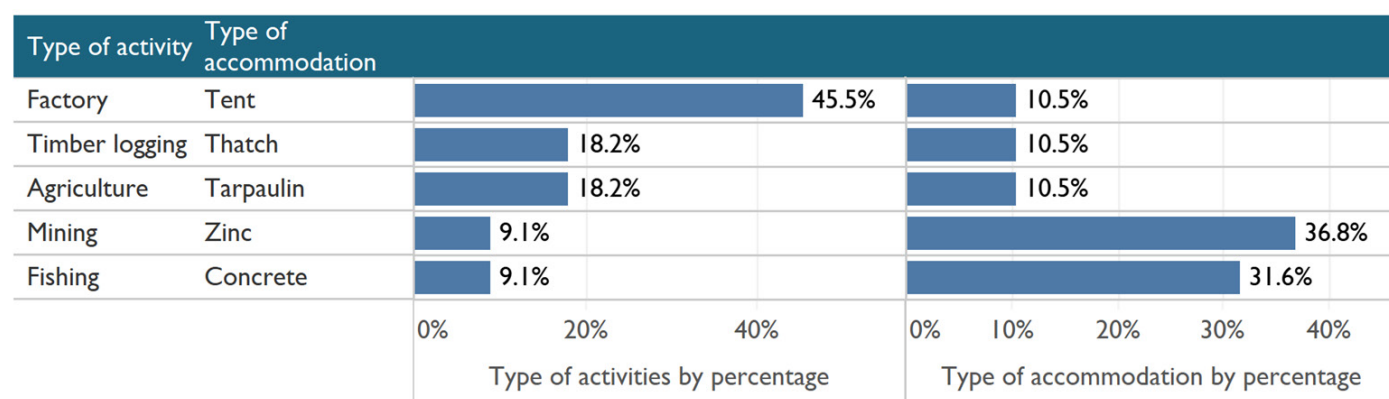
Tracking travellers or staffs within the migrant worksites is key, especially if foreign nomadic workers (in this specific case, from India). Table 7.2 shows that half of the sites do not have a record book nor a device to track workers' movement. During the COVID-19 pandemic, there was a suspected case at *Motorbike Workshop* in *Buspark Road* locality. Most of the migrant worksites are operational throughout the year (7/9), except for *Tilakpur Brick Factory* and *Tripura Sundari Jagadamba Brick Factory (Tilachaur)*, which are open only during winter. No health agents responsible for people who get sick are present at the worksites, except at *Jugeda Construction Site*. However, people at these sites seek alternative healthcare when in poor health and this includes; home treatment, clinics or hospitals, traditional healers, and pharmacy.

**Table 7.2:**Tracking visitors/travellers at the migrant worksites

Name of migrant worksite	Record book/device for visitor	Suspected COVID-19 case on site	Seasonality	Availability of health agent	Where people go when they are sick
Barber Shop, Campus Road	Not available	Do not know	All seasons	Not available	Home Treatment, Clinic or Hospital
Janaki Laundry Shop, Main Bazar	Not available	No	All seasons	Not available	Clinic or Hospital
Jugeda Construction Site	Don't know	No	All seasons	Available	Clinic or Hospital Pharmacy, Traditional Healer
Motorbike Workshop, Freeline	Available	Yes	All seasons	Not available	Clinic or Hospital
	Not available	No	All seasons	Not available	Clinic or Hospital
Shambhu Jewelry Shop	Available	No	All seasons	Not available	Clinic or Hospital
Steel Furniture Udhyog, Madan Chowk	Available	No	All seasons	Not available	Clinic or Hospital
Tilakpur Brick Factory	Not available	No	Winter only	Not available	Clinic or Hospital
Tripura Sundari Jagadamba Brick Factory, Tilachaur	Available	No	Winter only	Not available	Clinic or Hospital

At the migrant worksites, the type of activities and accommodation provided to migrant worker were also investigated. The respondents agreed that factory, timber logging, agriculture, mining and fishing are all activities in operation in Bheemdatta Municipality. The major activities conducted at these sites are related to factory, timber logging and agriculture, with a percentage weight of 45.5, 18.2, and 18.2, respectively. In terms of accommodation, majority uses zinc and concrete types, with almost the same weight (36.8% and 31.6%). The remaining (tent, thatch, and tapoline) carry an equal weight of 10.5 per cent each (see Fig. 7.3).

#### Type of activity and accommodation at the migrant worksite

**Fig. 7.3:** Type of activity and accommodation at the migrant worksites

## 3.2.i TRANSPORT STATIONS

### Population Mobility Pattern (who, where they come from, where they go)

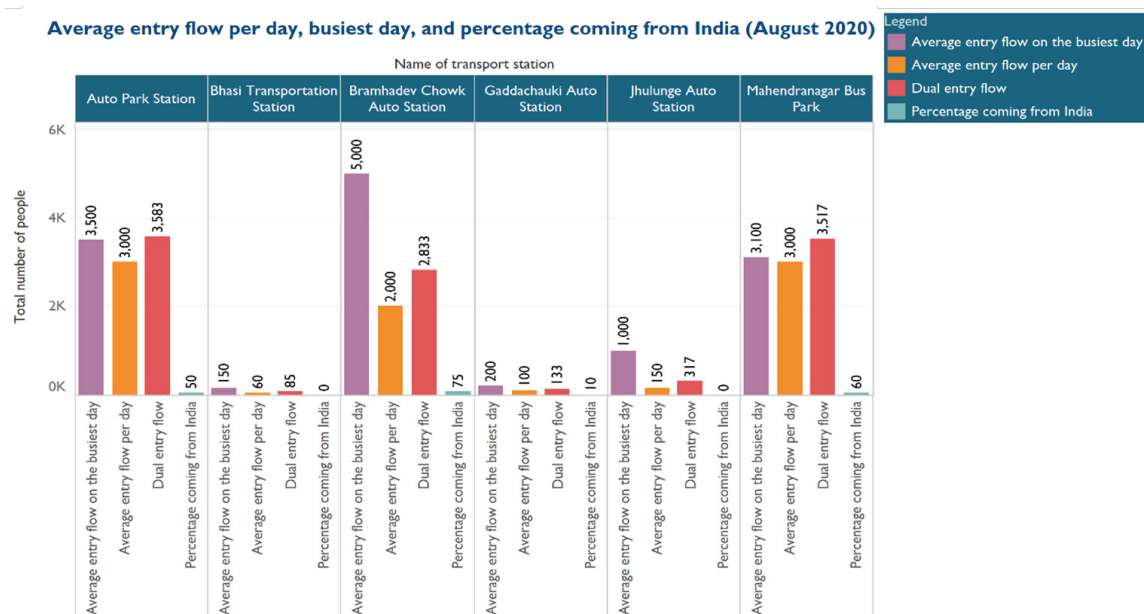
In Bheemdatta Municipality, almost all the transport stations are busy every day, except during lockdown. People come from India and all over Nepal, specifically from the following municipalities; *Bedkot, Bheemdatta, Mahakali*, and *Krishnapur* to use the main transport station (*Mahendranagar Bus Park*). However, people from *Kailali, Doti, Achham*, and *Bajura* districts use this transport station, especially to go to India.

### Connectivity (link with the main community, route, accessibility, mode of transport, seasonality, communication)

The study shows that *Mahendranagar Bus Park* is the biggest transport station in Bheemdatta Municipality, which is located at *Mahendranagar* city, connected to the *East-West Highway*. *Gaddachauki Bus Park* is located on the highway connecting Nepal and India. In addition, there are two other transport stations in *Bramhadev* and *Jhulunge* which link the communities from both sides of the countries and are easily accessible by vehicles.

### Vulnerability/Capacity Analysis (in front of a risk of spread of communicable diseases)

The bar in pink colour shows the average entry flow on the busiest day, in orange is the average entry flow per day, red indicates the dual entry flow, and the green bar reflects the percentage of people coming from India (see Fig. 8.1). Among the various sites investigated in Bheemdatta Municipality, the transport stations account for the highest mobility across various localities. *Bramhadev Chowk Auto Station* has the highest influx of people on the busiest days (5,000); however, the population mobility is far less on daily bases (2,000). On the contrary, *Auto Park Station* and *Mahendranagar Bus Park* have an equal proportion of daily entry flow with 3,000 people each, and on the busiest days, with 3,500 and 3,100 people, respectively. In *Jhulunge Auto Station*, the population mobility per day is 150 people, and on the busiest days the number increases to 1,000 people. The remaining transport stations have far less population mobility, specifically *Bramhadev Chowk Auto Station*, *Auto Park Station*, *Mahendranagar Bus Park*, and *Jhulunge Auto Station*. It is important to also note that the percentage of people coming from India is significantly high at *Bramhadev Chowk Auto Station*, *Mahendranagar Bus Park*, and *Auto Part Station*, with a percentage of 75, 60, and 50, respectively.



**Fig. 8.1:** Population mobility at the transport stations



The blue dot shows the distance to the nearest water source in Km, in red is the distance to the nearest health centre in Km, and the orange dot refers to the number of stalls/drop holes at toilet facilities available at the various transport stations (see Fig. 8.2). Most of the transport stations have water facilities on site (4/6), except at *Bramhadev Chowk Auto Station* and *Gaddachauki Auto Station*. Half of the transport stations have toilet facilities nearby, with 11 stalls/drop holes each, at *Auto Park Station* and *Mahendranagar Bus Park*. Fifty (50) per cent of the sites investigated are busy throughout the week (3/6), whereas the remaining are busy on Monday, Friday, Saturday and Sunday. The busiest month of the year varies across the transport stations, except for *Bhasi Transport Station* and *Jhulunge Auto Station*, which are busy throughout the year. *Auto Park Station* and *Mahendranagar Bus Park* are 1 Km away from the nearest water source, while both *Bhasi Transport Station* and *Jhulunge Auto Station* are 200 meters (both) away. The distance to the nearest health centre is 3 Km each in the case of *Jhulunge Auto Station* and *Gaddachauki Auto Station*, 2 Km from *Bhasi Transport Station*, whereas the remaining are 1 Km away.

**Availability of water, record book/device, and busiest days/months**

Name of transport station	Availability of water	Availability of toilet nearby	Busiest day of the week	Busiest month of the year	Availability of record book for travellers												
Auto Park Station	Available	Available	Monday	June, July	Not available		1.0	<div><div></div></div>	<div><div></div></div>	1					11	<div><div></div></div>	
Bhasi Transportation Station	Available	Available	Every day	Every month	Not available	<div><div></div></div>	0.2			<div><div></div></div>	2		<div><div></div></div>	2			
Bramhadev Chowk Auto Station	Not available	Not available	Every day	January, February, November, December	Don't know				<div><div></div></div>	1							
Gaddachauki Auto Station	Not available	Not available	Sunday, Saturday, Friday	June, May, July	Not available						<div><div></div></div>	3					
Jhulunge Auto Station	Available	Not available	Every day	Every month	Not available	<div><div></div></div>	0.2				<div><div></div></div>	3					
Mahendranagar Bus Park	Available	Available	Sunday, Monday	January, July, June, November	Available	<div><div></div></div>	0.1			<div><div></div></div>	1					11	<div><div></div></div>
						0.0	0.5	1.0	0	1	2	3	4	0	5	10	
						Distance to the nearest water source [in Km]		Distance to the nearest health centre [in Km]		Number of stalls/drop holes [Toilet facility]							

**Fig. 8.2: Water availability, travellers' tracking status and the busiest days/months**

The assessment of hygiene status and health challenges at the transport stations was also conducted, by looking at the waste management, the status of people wearing masks, body temperature checking, and the availability of health agent(s) for any traveller that might get sick. A suspected COVID-19 case was found in *Bramhadev Chowk Auto Station*, which is also the transport station with the highest movement of people (5,000 on the busiest day). Half of the respondents agreed that more than 50 per cent of visitors wear masks, whereas other interviewees have placed the percentage at 31-50. Neither health agents nor community health workers are present at the transport stations. Similarly, there is no body temperature checking nor isolated place dedicated for ill people. A waste management system is in place at most sites (5/6), except at *Bramhadev Chowk Auto Station*, despite its high mobility (see Table 8.1). Notwithstanding the available waste management system, there was visibility of trash in the open, stagnant water on the floor and unwanted animals/insects across the transport stations, except for *Mahendranagar Bus Park*.

**Table 8.1:** Hygiene status and health challenges at the transport stations

Name of transport station	Suspected COVID-19 Case during travelling	Estimated percentage of people wearing mask	Availability of health agent	Body temperature checking status	Isolated place dedicated for sick people	Availability of waste management	Visibility of trash in the open	Visibility of stagnant water on the floor	Visibility of unwanted animals/insects
Auto Park Station	No	31%-50%	Not available	Not available	Not available	Available	Yes, visible	Yes, visible	Not visible
Bhasi Transportation Station	No	>50%	Not available	Not available	Do not know	Available	Yes, visible	Yes, visible	Yes, visible
Bramhadev Chowk Auto Station	Yes	31%-50%	Do not know	Not available	Not available	Not available	Yes, visible	Not visible	Yes, visible
Gaddachauki Auto Station	No	>50%	Not available	Not available	Not available	Available	Yes, visible	Not visible	Yes, visible
Jhulunge Auto Station	No	>50%	Not available	Not available	Not available	Available	Yes, visible	Yes, visible	Yes, visible
Mahendranagar Bus Park	No	31%-50%	Not available	Not available	Not available	Available	Not visible	Yes, visible	Yes, visible

### 3.2.j PLACES OF WORSHIP

#### **Population Mobility Pattern (who, where they come from, where they go)**

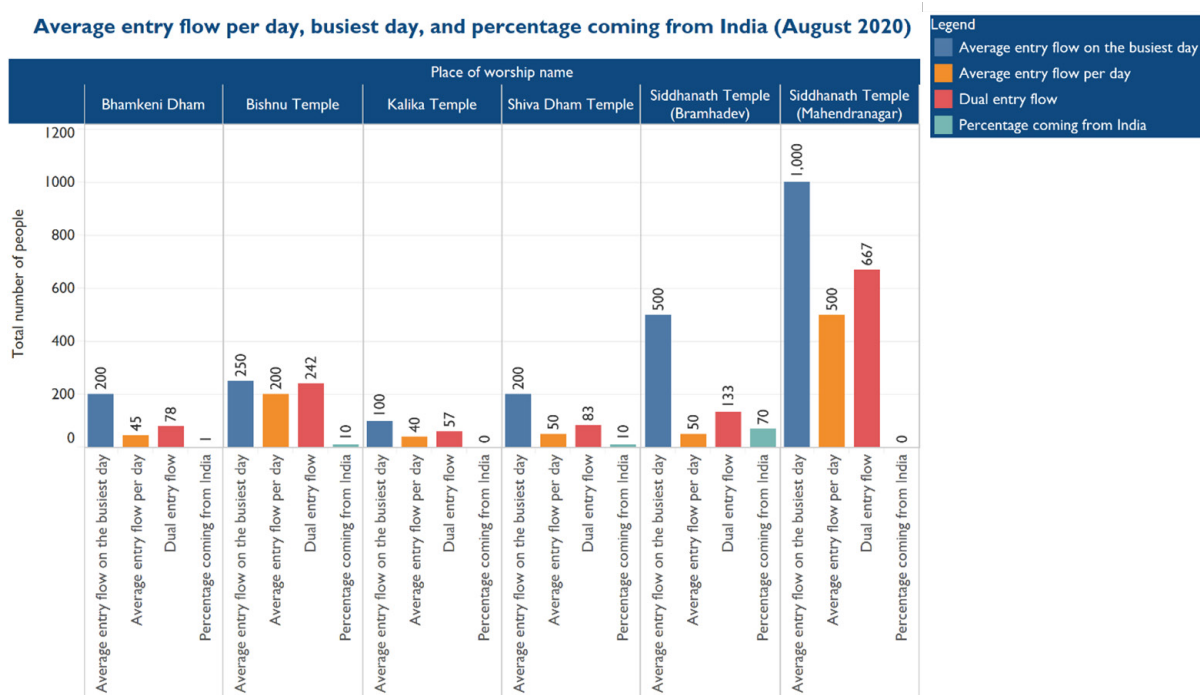
The analysis shows that the busiest day for places of worship is Monday, followed by Tuesday and Saturday. People come to these sites mostly from *Baitadi*, *Darchula*, *Kailali* and *Dadeldhura* districts. On the other hand, at the municipality level, mobility to Bheemdatta Municipality mainly originates from *Shuklaphanta*, *Bedkot*, and *Mahakali*. However, at some places of worship, there is a large movement of people from India.

#### **Connectivity (link with the main community, route, accessibility, mode of transport, seasonality, communication)**

*Siddhanath Temple (Mahendranagar)* is situated in *Mahendranagar* city, which attract a large number of pilgrims from India every year, and is connected to the *East-West Highway*. Another *Siddhanath Temple (Bramhadev)* – which mostly attracts people of Indian nationality – is situated in *Bramhadev POE* (informal), which lies near *Tilakpur* and *Tilachaur* localities. The study shows that, for almost all the places of worship, accessibility of transportation mainly ranges from minivan, car, and motorbike.

#### **Vulnerability/Capacity Analysis (in front of a risk of spread of communicable diseases)**

Majority of the places of worship investigated are temples (Hinduism religion). The bar in blue colour shows the average entry flow on the busiest day, orange indicates the average entry flow per day, in red is the dual entry flow, and the green bar refers to the percentage of individuals from India. The most visited temples are *Siddhanath (Manhendranagar)*, *Siddhanath (Bramhadev)*, and *Bishnu*, with an average entry flow per day of 500, 50, and 200 people, and on the busiest days with 1,000, 500, and 250 influx of people, respectively. The highest population coming from India is found in *Siddhanath Temple (Mahendranagar)* with 70 per cent (350 people on the busiest day). It is followed by *Shiva Dham* and *Bishnu Temple*, each with 10 per cent of people coming from India (20 and 25 people, respectively). The remaining places of worship are only visited by believers from Nepal, except for *Bhamkeni Dham*, with one (1) per cent coming from India (2 people on the busiest day).



**Fig. 9.1:** Population mobility at the places of worship

Vulnerability capacity analysis can be determined by the inadequacy or unavailability of basic health facilities, which might contribute to health threats. Table 9.1 shows how waste management and other health related issues are managed at the various places of worship. As stated in other sites analysis, the name of the nearest health centre is *Mahakali Sub Provincial Hospital* (4/6), followed by *Urban Health Centre* (2/6). Most of the respondents agreed that greater than 50 per cent of the people wear masks on site (4/6), while the remaining two reported less than 10 per cent and 31-50 per cent. There is availability of a waste management system on site (5/6), except at *Bhamkeni Dham*, which has 200 people's movement on the busiest day. At most of the localities where the study was conducted, there is limited visibility of stagnant water on the floor and trash in the open (2/6). However, unwanted animals/insects were visible at all the places of worship investigated (6/6). No health screening stations, such as hand washing and body temperature checking, were present at the places of worship, despite being visited throughout the seasons.

**Table 9.1:** Waste management and health screening capacity

Place of worship name	Name of the nearest health centre	Estimated percentage wearing mask	Availability of waste management system	Visibility of stagnant water on the floor	Visibility of trash in the open	Visibility of unwanted animals/insects	Availability of health screening station	Seasonality
Bhamkeni Dham	Urban Health Center	<10%	Available	Not visible	Yes, visible	Yes, visible	Not available	All seasons
Bishnu Temple	Mahakali Sub Provincial Hospital	10%-30%	Not available	Yes, visible	Yes, visible	Yes, visible	Not available	All seasons
Kalika Temple	Mahakali Sub Provincial Hospital	>50%	Available	Yes, visible	Not visible	Yes, visible	Not available	All seasons
Shiva Dham Temple	Mahakali Sub Provincial Hospital	>50%	Available	Not visible	Not visible	Yes, visible	Not available	All seasons
Siddhanath Temple (Bramhadev)	Urban Health Center	>50%	Available	Not visible	Not visible	Yes, visible	Not available	All seasons
Siddhanath Temple (Mahendranagar)	Mahakali Sub Provincial Hospital	>50%	Available	Not visible	Not visible	Yes, visible	Not available	All seasons

Fig. 9.2 shows basic hygiene status at the various places of worship in Bheemdatta Municipality. Most of the assessed sites do not have isolated places dedicated for people when they get sick (4/6), whereas they are available at *Bhamkeni Dham* and *Siddhanath Temple (Mahendranagar)*. In case of illness, people use alternative healthcare, such as, clinic or hospital, home treatment, traditional healers, and religious leaders; with clinic or hospital being the preferred choice. Water is available on site, except at *Kalika Temple*, where toilet facilities are absent. The busiest days of the week and months of the year vary across the places of worship (see Fig. 9.2). The distance to the nearest health centre is farther from *Siddhanath Temple (Bramhadev)* and *Bishu Temple* (14 Km and 6 Km, respectively). *Bhamkeni Dham* and *Shiva Dham Temple* are 3 Km and 2 Km distant from the nearest health centre, respectively. All evaluated sites have nearby water source, except for *Bishu Temple*, which is about 1.5 Km away.

Hygiene status at the places of worship

Place of worship name	Isolated place dedicated for sick people	Where people go when they are sick	Availability of water	Availability of toilet nearby	Busiest day of the week	Busiest month of the year	Distance to the nearest health centre [in Km]	Distance to the nearest water source [in Km]
Bhamkeni Dham	Available	Clinic or Hospital, Traditional Healer, Home Treatment, Religious Leader	Available	Available	Monday, Tuesday, Saturday	April, June, July	3.0	0.01
Bishnu Temple	Not available	Clinic or Hospital, Traditional Healer	Available	Available	Friday	April, October, December	6.0	1.50
Kalika Temple	Not available	Clinic or Hospital	Available	Not available	Monday, Tuesday	June, December	0.3	0.02
Shiva Dham Temple	Not available	Clinic or Hospital	Available	Available	Monday	April, June, August, October, December	2.0	0.02
Siddhanath Temple (Bramhadev)	Not available	Clinic or Hospital	Available	Available	Monday, Thursday, Saturday	January, February, March, June, December	14.0	0.10
Siddhanath Temple (Mahendranagar)	Available	Clinic or Hospital	Available	Available	Monday	January, February, March, December	0.3	0.05
							0 5 10 15	0.0 0.5 1.0 1.5 2.0
							Distance to the nearest health centre [in Km]	Distance to the nearest water source [in Km]

Fig. 9.2: Hygiene status and distance to the nearest water source and health centre

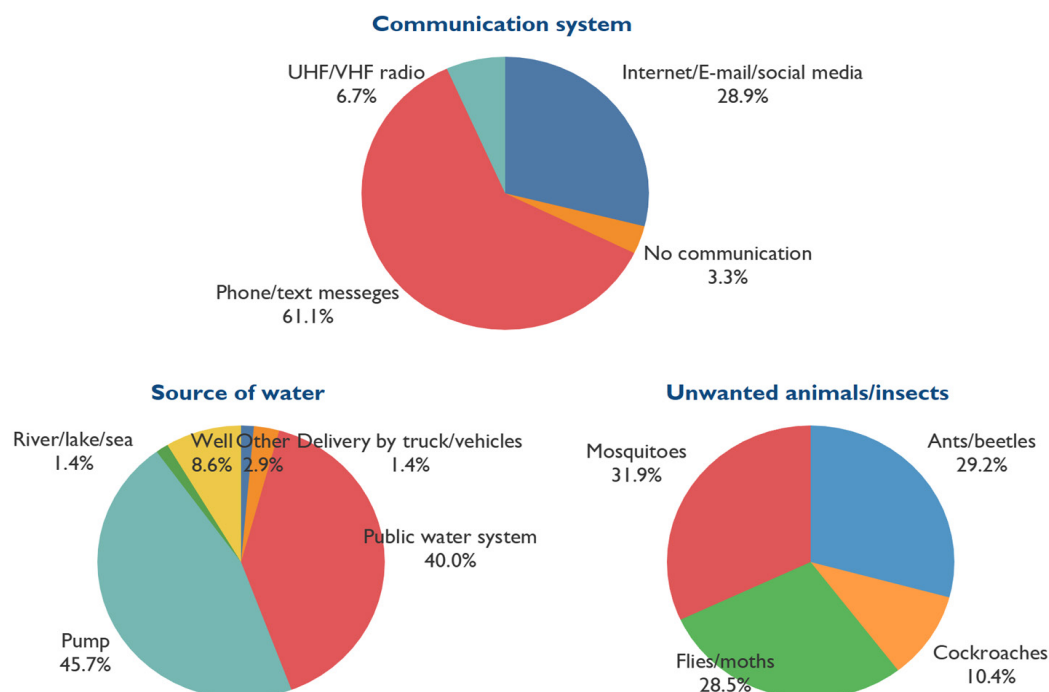
### 3.3 GENERAL ANALYSIS

This section of the report indicates the general analysis of all common variables or indicators where its core parameters are evaluated, holistically. Some indicators were analysed separately since different findings were obtained from various sites. The rationale of combining these variables lies in the fact that the results would be the same across all the sites where the study was conducted. Key highlights are listed as follows:

1. Communication system
2. Sources of water
3. Names of unwanted animals/insects and other domestic animals
4. Modes of transport
5. List of procedures to follow when someone is affected by COVID-19
6. Major reasons for the busiest days/months

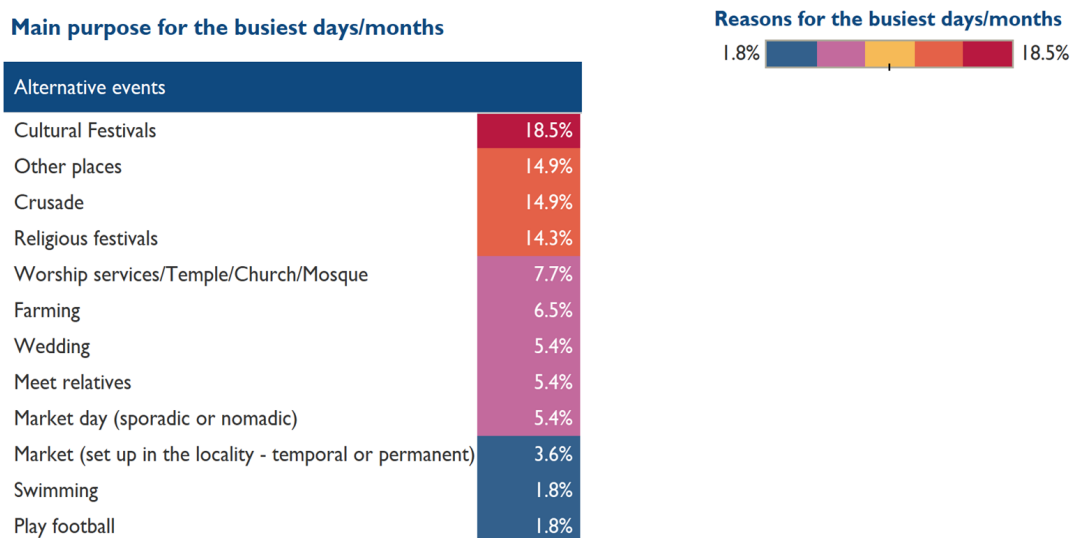
Fig. 10.1 depicts the communication system, source of water and presence of unwanted animals/insects. The findings reveal that communication mainly happens through phone or text messages (61.1%) and internet connectivity (28.9%). The remaining (UHF/VHF radio and no communication) are not significant.





**Fig. 10.1:** Communication system, source of water, and unwanted animals/insects

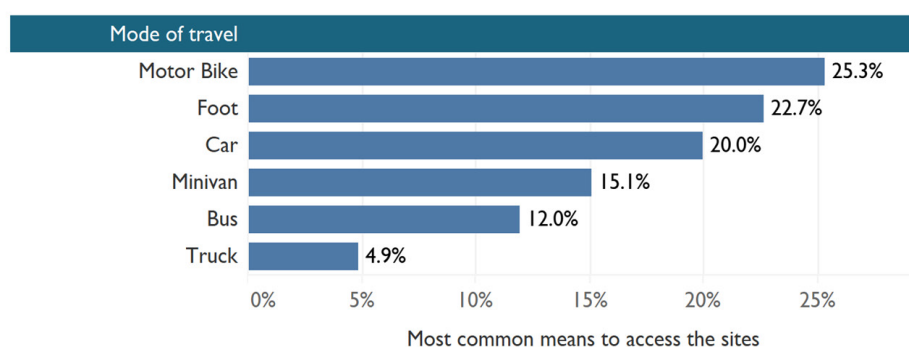
Generically, an investigation was conducted to determine the main reasons behind the population mobility across various sites. Fig. 10.2 shows the main purpose for the busiest days and months in Bheemdatta Municipality. According to the analysis, cultural festivals, other places, crusade, religious festivals and places of worship, in ascending order, account for the major factors of people's movement within the municipality and border crossing points (BCPs). Based on the data obtained from the various key informants, the other factors are less relevant.



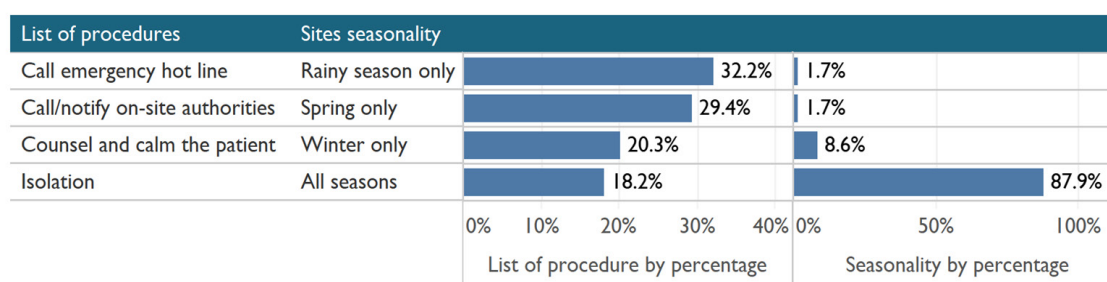
**Fig. 10.2:** Major reasons for the busiest days/months in Bheemdatta Municipality

Within the various sites investigated, the analysis shows that the most common means to access the various sites, such as POEs, market centres, entertainment centres, and transport stations, to name a few, is by motor bike, foot and car, with a percentage distribution of 25.3, 22.7, and 20.0, respectively (top figure). Fig. 10.2 (bottom) presents the list of procedures to follow if someone is affected by COVID-19 and sites seasonality, by percentage distributions. The identified procedures, in ascending order, are to; call emergency hot line, call/notify on-site authorities, counsel and calm the patient, and lastly, isolate the patient. Respondents from majority of the sites agreed that the main functions of these places are operational throughout the year (87.9%), or only in winter (8.6%), while in the remaining seasons they are either not functional or with a nomadic movement.

**Most common means to access all the sites**



**List of procedures and seasonality**



**Fig. 10.3: Mode of transport and list of procedure to follow if someone is affected by COVID-19**

## 4. CONCLUSIONS, RECOMMENDATIONS AND LESSONS LEARNT

### 4.1 CONCLUSIONS

It is important to note that, in some of the sites where the research was conducted, the questions asked to key informants refer to practices prior to the enforcement of lockdown and restricted movement regulations. In this sense, the aim was to identify and understand the population mobility patterns both across bordering municipalities, and between Nepal and India.

#### Points of entry (POEs)

Six (6) points of entry (POEs) were investigated, with only one formal crossing point located at the *Gaddachauki* POE. Population mobility is especially high in *Bramhadev* POE, *Gaddachauki* POE and *Pipariya* POE, with 8,000, 2,000, and 700 people crossing the border on the busiest days, and 5,000, 1,500 and 500 people accessing these BCPs every

day, respectively. About 20 and 30 per cent of people coming from India pass through *Bramhadev POE* and *Gaddachauki POE*, respectively. At *Bhujela Ghat POE*, 200 people cross the border per day, and 500 on the busiest day, with 5 per cent coming from India. Toilet and water facilities are inadequate across the POEs. The most used and nearest health centre is *Mahakali Sub Provincial Hospital*, which is about 7 Km away from the POEs, on average. There is inadequate tracking matrix of people's movement, health screening stations, absence of IPC personnel and only 31-50 per cent of people wear masks. Half of the POEs are busy throughout the week, whereas the remaining have higher movement on weekends. In terms of connectivity, most people use the informal POEs located at *Pipariya*, *Musetti*, *Bramhadev* to arrive at *Mahendranagar Junction*, and make their journey mainly to *Kanchanpur*, *Kailali*, *Dadeldhura*, and *Kalikot* districts, and *Bheemdatta*, *Mahakali*, *Suklaphanta* and *Bedkot* municipalities.

The study shows that, in *Bheemdatta Municipality*, the health centres are busy every day, throughout the year. Visitors and patients mostly come from *Kanchanpur*, *Dadeldhura*, *Darchula*, *Baitadi* and *Doti* to seek care from the health centres situated in *Mahendranagar*. Health centres from the POEs situated in *Mahendranagar* are accessed by bus, minivan, car, motorbike, horse cart, etc., by both Indians and Nepali, from other districts and municipalities. Health centres situated outside *Mahendranagar* are connected near the *East-West Highway*, which links with *Jimuwa*, *Pipariya*, *Bhujela*, and other localities. People mostly use motorbike or minivan to access health facilities.

### Health Centres

Nine (9) health centres were investigated in *Bheemdatta Municipality*. *Mahakali Sub Provincial Hospital*, *J.K. Medicare Hospital* and *Mahendranagar Eye Hospital* have the highest influx of patients per day of 265, 120, and 100, respectively. On the busiest day, the number increases to 270, 130, and 170 patients visiting the premises. Specifically, *Urban Health Clinic* has 20 per cent of people coming from India. Population mobility is higher at the outpatient than the inpatient ward. *Mahakali Sub Provincial Hospital* and *Bhageshwor Health Clinic* have adequate toilet facilities, but a smaller number of outpatients compared to *Mahendranagar Eye Hospital*, *S.K. Polyclinic Hospital* and *Urban Health Clinic*, in order of magnitude. The distance to the water source and toilet facilities is nearby, except for *Bhujela Health Post* and *J.K. Medicare Hospital*, which are approximately 5 Km and 1 Km away, respectively. According to the hospital analysis based on data obtained from the health care personnel, 63 per cent agreed that people seek alternative healthcare before going to the hospital. *Mahakali Sub Provincial Hospital*, *S.K. Polyclinic Hospital*, and *Jimuwa Health Post* account for the largest medical personnel with a total of 366, 38 and 34, respectively.

The emergency preparedness plan has been tested in five (5) health centres out of nine, whereas *S.K. Polyclinic Hospital*, *J.K. Medicare Hospital*, and *Bhageshwor Health Clinic* have not tested it. At the health centres, most people wear masks. Movement of sick people from POEs to the nearest health centre for emergency cases is a serious health determinant with respect to the distance. According to the analysis, the most common means to access health facilities are by foot, motorbike, and public transport (rickshaw). Furthermore, though there are health screenings at the health centres, they are not operational 24/7. The most common diseases affecting people in *Bheemdatta Municipality* are malaria, typhoid, dengue, and cholera, and to a lesser extent, influenza and COVID-19 (emergency diseases). The wards present at the health facility include; laboratory, outpatient, medical, maternal or delivery, and emergency room. The findings revealed that medical practitioners at these health centres mostly come from India to treat patients and check their medical conditions. Population mobility patterns denote people moving from India and the following districts in Nepal; *Kanchanpur*, *Dadeldhura*, and *Kailali*. At the municipality level, people mainly come

from *Bheemdatta, Suklaphanta, Bedkot, and Mahakali*.

### Traditional Healers

The population mobility at the traditional healers' compounds is moderately low with 12 to 25 people visiting the traditional healers per day, and 5 per cent coming from India in the case of *Basantapur* and *Airi* localities. The practices performed by traditional healers contribute/impact the spread of diseases due to the inadequate adoption of SOPs, as in the case of Ebola in West Africa.<sup>4</sup> On average, the distance from the traditional healers' localities to the health centre is 7 Km and travel time is 2 hours. Only half of the traditional healers stated that they advise patients to seek alternative healthcare. Most people at the traditional healers' compounds do not wear masks nor they undergo health screening before receiving their treatment. The vulnerability and environmental condition highly relate to the practices conducted by traditional healers to treat health issues (e.g. abdominal pain, headache, and fever) and the use of unprotected gears, which influence the spread of diseases, especially during an outbreak. Population mobility patterns across the traditional healers' localities mainly come from India and within Nepal; specifically, *Kanchanpur, Dadeldhura, Kailali* and *Darchula* districts. According to the respondents, people come from several municipalities, such as *Mahakali, Suklaphanta, and Krishnapur*, including *Bheemdatta*.

### Schools and Colleges

Based on the matrix analysis, three (3) schools/colleges were studied, namely *Bajinath Engineering College, Farwest School of Medicine* and *Little Buddha College*. On average, the distance from these educational institutions to the nearest health centre is 1 Km. The daily students' attendance at *Bajinath Engineering College* and *Farwest School of Medicine* is 300 and 150, respectively. *Little Buddha College* is the most populated school with 2,153 students enrolled in 2019, followed by *Bajinath Engineering College* (183 students). The gender disparity at *Little Buddha College* is greater for male students than for the female counterpart, with almost double the size of males (643). However, in all three schools/colleges investigated, overall there are more male than female students. There is a wide availability of water and toilet facilities, with *Little Buddha College* accounting for the highest number of stalls/drop holes due to its high population mobility. In terms of vulnerability, despite the presence of a waste management system, there is visibility of unwanted animals, trash and stagnant water on the floor, hence providing breeding spaces for mosquitoes and other organisms.

### Entertainment Centres

Six (6) entertainment centres were investigated to determine the vulnerability and population mobility patterns in Bheemdatta Municipality. *Khulla Mancha* has the largest mobility per day (200 people) and on the busiest day (5,000 people). The second most popular is *Covered Hall* with 200 and 1,500 visitors per day and on the busiest day, respectively. However, 60 per cent of people visiting *OMG Club* are from India and 20 per cent in the case of *Jhilmila Lake*. The population mobility at the places of entertainment is higher than other sites, except for POEs and transport stations. On average, the distance to toilets and other facilities is not significant. There are no health screening stations, such as temperature checking, hand sanitizer, hand washing stations, etc., which in turn enhances the vulnerability of entertainment centres in terms of spread of communicable diseases. This is exacerbated by the absence of health workers and isolated places dedicated for sick people, the visibility of stagnant water, unwanted animals/insects and trash on the floor, together with the unavailability of tracking matrix (record book or device for

<sup>4</sup> <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4709130/>



travellers), and the inadequate proportion of people wearing masks. Connectivity at the entertainment centres is key in terms of vulnerability space. This is because the findings revealed that this type of site has among the highest mobility flows. Visitors generally come from India and other districts; *Dadeldhura, Kailali, Kanchanpur* and *Darchula*. At the municipality level, people mainly come from *Suklaphanta, Mahakali, Punarbas*, and *Bedkot*. Specifically, at *OMG Club* entertainment centre, the proportion of people visiting from India is significant (60%).

### Market Centres

There is constant mobility at the market centres, except during lockdown/prohibitory order. *Bramhadev Market* accounts for the highest population mobility with 6,000 people per day, and 7,000 on the busiest day, whereas *Jhulunge Market* has 600 and 700 people entering the market per day and on the busiest day, respectively. *Gaddachauki* and *Airi* markets have an equal entry flow of 100 people. Half of the population at *Sabjimandi Market* is from India, compared to 30 and 20 per cent at *Bramhadev* and *Airi*, respectively. The most used health centre is *Mahakali Sub Provincial Hospital*. Most of the market centres have no isolated place nor health agent in charge of sick people, no health screening stations, (e.g. hand washing stations and hand sanitizer), trash is visible in the open, together with stagnant water, and a considerable amount of people do not wear masks (10-30%). The distance to the nearest health facility is considerable (5 Km on average). Population mobility patterns denote people moving from the following districts in Nepal; *Kanchanpur, Kailali, Dadeldhura*, and *Doti*. The study revealed that people reach the respective markets through *Bedkot, Bheemdatta, Mahakali, Suklaphanta*, and *Krishnapur* municipalities.

### Migrant Worksites

The population mobility at the various migrant worksites in *Bheemdatta Municipality* is very high, especially at *Shambhu Jewelry Shop*, with 500 and 600 people per day and on the busiest day, respectively. *Jugeda Construction Site* and *Steel Furniture Udhyog (Madan Chowk)* have a similar distribution of population mobility of 100 per day and 200 on the busiest day, on average. The average percentage of people coming from India is 15. Despite the availability of water and toilet facilities on site, there are inadequate IPC measures and health screening stations, such as hand washing, hand sanitizer, and temperature checking. This is alarming considering almost all the sites are busy throughout the week and only about 31-50 per cent of the people wear masks. A suspected COVID-19 case was reported at one of the *Motorbike Workshops (Buspark Road)*. There is visibility of stagnant water on the floor, trash in the open, and unwanted animals/insects, which are health determinants of transmission of communicable diseases. People at these sites seek alternative healthcare, which includes; home treatment, clinic or hospital, traditional healers and pharmacy. The main activities conducted at the migrant worksites, in descending order of weight, are; factory, timber logging, agriculture, mining, and fishing. Accommodation for the staffs working at the migrant worksites is adequate (zinc and concrete). The workers partly come from India and from several districts in Nepal; *Kailali, Doti, Achham*, and *Dadeldhura*. The study showed that the population mobility is mostly from *Bheemdatta, Suklaphanta*, and *Bedkot* municipalities.

### Transport Stations

Among the various sites' studies conducted in *Bheemdatta Municipality*, the transport stations account for the highest population mobility. *Bramhadev Chowk Auto Station* has the highest influx of people on the busiest day (5,000) and per day (2,000 people). *Auto Park Station* and *Mahendranagar Bus Park* have an equal entry flow per day of 3,000 people, whereas on the busiest days they have 3,500 and 3,100 travellers, respectively. It is important to note that people coming from India are significantly higher at *Bramhadev Chowk Auto Station, Mahendranagar Bus*

*Park*, and *Auto Park Station* with the percentage of 75, 60, and 50, respectively. The level of hygiene and health infrastructure at the transport stations is inadequate due to the unavailability of water and limited presence of toilets nearby, although majority of the sites are busy throughout the week. Furthermore, there is no record tracking matrix (book record of travellers' details). The distance to the near-est health centre is approximately 2 Km. A suspected COVID-19 case of a traveller was reported at *Bramhadev Chowk Auto Station*, nevertheless more than half of the population at this site does not wear masks. In terms of vulnerability, the following parameters are worrying; unavailability of health agents on sites, absence of body temperature taking, isolated place dedicated for sick people, visibility of trash in the open, stagnant water on the floor and presence of unwanted animals/insects. People from all over the country and India come to these transport stations. However, people mainly come from *Kailali, Doti, Achham, Bajura* and *Bajhang* districts; and *Bedkot, Bheemdatta, Mahakali, Suklaphanta* and *Krishnapur* municipalities.

### Places of Worship

Majority of the places of worship investigated are Hindu temples. The most populated sites are *Siddhanath Temple (Mahendranagar)*, *Siddhanath Temple (Bramhadev)*, and *Bishnu Temple* with a daily population flow of 500, 50, and 200, respectively. On the busiest days, the number increases to 1,000, 500, and 250 people, respectively. People from India are in higher numbers in *Siddhanath Temple (Mahendranagar)* with 70 per cent (350 people on the busiest day). The remaining temples, such as *Shiva Dham* and *Bishnu Temple*, have a far less percentage of 10 per cent each. The nearest health centre is *Mahakali Sub Provincial Hospital*, followed by *Urban Health Centre*. Only half of the population wears masks. The waste management system is inadequate as proved by the visibility of stagnant water, trash, and unwanted animals/insects, together with the unavailability of health screening stations, and isolated places dedicated for sick people. The distance to the nearest health centre is the farthest from *Siddhnath Temple (Bramhadev)* (14 Km) and *Bishnu Temple* (6 Km), which makes it very difficult for people to access health care. Water is available nearby for most of the places of worship, except at *Bishnu Temple* (1.5 Km away). The analysis showed that the majority of the population coming to these sites is mostly from India and Nepal; specifically, *Baitadi, Darchula, Kailali* and *Dadeldhura* districts. In regard to municipalities, the population movement mainly flows from *Suklaphanta, Bedkot, Krishnapur*, and *Mahakali*.

## 4.1.a ADDITIONAL FINDINGS

The analysis shows that some of the observed sites have common characteristics and face similar health challenges in terms of population mobility and public health risks mapping. The following are recurrent:

- The most used and nearest hospitals are *Mahakali Sub Provincial Hospital* (government) and *Urban Health Clinic* (private). The distance from these sites to the health centres varies across the sites.
- Inadequate or no presence of health authority/agent dedicated for sick people.
- Visibility of unwanted animals/insects, trash and stagnant water on the floor. This contributes to the proliferation of mosquitoes, which in turn leads to malaria and/or typhoid fever.
- The most common means of transportation to access the sites are motorbikes and travel by foot. In the case of POEs, walking long distances is eminent, and at times, it is the only way to reach the site, especially during emergency.
- At almost all of the sites, communication mostly happens through voice/messages. However, interrupted network is not rare, with higher instances at informal crossing points.

- There are no isolated or adequate places dedicated for sick people, especially at the majority of POEs assessed.
- There is availability of water in most of the sites where the study was conducted.
- People understand procedures to follow if someone is affected by COVID-19. However, there are inadequate mask-wearing practices in the municipality, especially in the following sites; traditional healers, some transport stations, entertainment centres, market centres and migrant worksites.
- Except for hospitals, there is no presence of health screening stations and IPC at the sites investigated. This poses serious health threats in case of COVID-19 infection, with a higher grade of vulnerability at POEs, transport stations, migrant worksites, traditional healers, and places of worship (mostly temples).
- The high population mobility across the sites results from the following reasons; cultural festivals, crusade, religious festivals, places of worship (temples), and other places, which account for the major factor of people's movement within the municipality and BCPs.

## 4.2 RECOMMENDATIONS

PMM has allowed us to better grasp the dynamics and characteristics of human mobility in Bheemdatta Municipality. The strength of PMM is two-fold; on one hand, its systematic methodology enables for data validation throughout the process; and on the other, it is inherently inclusive of the local communities which are personally involved and actively contribute not only to the rolling out of the activities, but to the final results which will impact the society, as a whole. Based on the PMM analysis of the area, several recommendations are suggested:

1. Establish health screening stations at POEs and all other priority locations, specifically transport stations, entertainment centres and places of worship (temples, churches, and mosques). Body temperature checking should be advised at all sites with high population mobility, considering the easy accessibility and low cost of thermometers, and hand sanitizers should be provided to visitors and travellers accessing the respective sites.
2. Set up mechanisms to record and track people's movement, especially their origin and destination. This is especially the case for POEs and transport stations. The information collected is indispensable to trace any affected case, in the event of an outbreak.
3. Strengthen IPC and Water, Sanitation and Hygiene (WASH) at all priority sites identified in the study with limited capacities and high population mobility. In case of lack of IPC and Personal Protective Equipment (PPE), the national supply should be addressed to ensure that everyone has access to basic items, such as surgical masks and hand sanitizer.
4. Invest in capacity building of health infrastructure. This is especially the case for health posts, which are often located in remote areas and are hardly accessible, even by foot. In case of grave ill people, they may not be able to reach the sites and receive the necessary health care. Similarly, medical equipment should be widely available to health workers and volunteers.
5. Focus on risk communication and community engagement. Based on direct field observation and from the respondents, the community seems to lack knowledge of potential risks of infectious diseases, such as COVID-19, and preventive measures for transmission. Citizens should be involved in health-related activities and awareness should be raised on the importance of good sanitary conditions affected by waste management systems, as well as the availability of water and toilet facilities.
6. Develop a health working group for Nepal and corresponding countries at formal POEs for both IHR and PHEIC focal points. This will allow for a better management of travellers' movement, especially for tracking purposes.

7. Conduct an urgent training and capacity development of health staff/immigration/security officials at POEs, including development of SOPs for the POEs and key priority areas.
8. Conduct leadership training for all traditional healers in order to enhance their health practices, adhere to SOPs within their communities, especially in hostile communities where people rely on them for health and other issues.

The findings will be shared with MoHP for further actions.

### 4.3 LESSONS LEARNT

1. Stakeholders' engagement at all levels (national, district and municipality) is key to ensure effective implementation and ownership of the project. Through such multi-level engagement, the capacity of officers is also enhanced, which in turn contributes to the sustainability of the project. Consequently, this helps to integrate mobility pattern data in epidemiological surveillance for meaningful analysis of public health risks.
2. Community engagement and participation at all levels of implementation ease the process of municipality entry, data collection and municipality/community ownership of the project. This also helps communities understand the possible vulnerabilities, in terms of health risks, that exist in the area, especially during the COVID-19 pandemic.
3. The training and simulations are key for the staff/enumerators to expand their knowledge and improve their skills in interviewing informants and collecting data. This in turn allows to validate and adopt the data collection tools ensuring they are suitable for the local context.
4. Early planning/preparations, logistical arrangements (vehicles, training materials, data collection, maps, plans for field teams, hand sanitizers, masks, etc.) are important for timely and effective implementation of the activities.
5. Field debriefing sessions are necessary to discuss successes, lessons learnt, challenges and recommendations for future improvement of action plans since the project exercise is a learning process in itself.



## 5. ANNEXES

### 5.1 ANNEX I

#### Groups and indicator weights for the vulnerability analysis selection

Indicator Group	Group Weight	Group Weight Score Rationale	Indicator	Indicator Weight
1. Ground Crossing Points	10	1) All points of entry and transit points carry equal weight (10) 2) Local people mix with travelers from outside the community in vehicles 3) Communities along major corridors/routes of transportation are vulnerable to infection through business activities with potentially infected travelers	The top 5 largest number of people crossing throughout the year	3
			The top 5 most easily accessible by car, lorry, truck or minivan	2
			Border crossing points most likely used by travelers to travel long distance internationally (Yes=1/No=0)	2
			Towns or villages along the border that share a common language or currency with villages across the border (Yes=1/No=0)	1
			Towns or villages close to regular or periodic large gatherings of people (Yes=1/No=0)	2
2. Water Landing Sites	10	1) All points of entry and transit points carry equal weight (10) 2) Local people mix with travelers from outside the community and through business activities at the border areas 3) Surrounding communities at river-side are vulnerable to infection through business activities with potentially infected travelers	The top 5 wharfs with largest number of boats and passengers coming from and going to other countries	3
			The top 5 wharfs with largest number of boats and passengers and coming from and going to other ports in the country	1
			Wharfs with largest number of boats landing throughout a year	1
3. Main Roads, Junctions and Rivers	0	1) There are no indicators associated with main routes, junctions and rivers. 2) The main roads, junctions and rivers identified by the group will be marked on the map, purely as a reference to preferred, high-volume mobility pathways.	N/A	0
4. Markets	10	1) Carries equal weight as Transit points (10) 2) Local people mix with travelers from outside the community through business activities at the market 3) Surrounding communities at markets are vulnerable to infection through business activities with potentially infected travelers and marketers	Markets attracting the largest number of people from other countries	10
5. Migrant Worksites	10	1) Local people mix with travelers from outside the community through business activities at the market 2) Surrounding communities at markets are vulnerable to infection through business activities with potentially infected travelers and marketers 3) Migrant workers may not have access to or be able to afford local healthcare, facilities or treatment 4) Worksite environmental conditions and infrastructure amplify spread of infectious diseases 5) Foreign workers have no immunities to local diseases 6) Migrant workers introduce foreign communicable diseases to local populations	Worksites have the most number of workers	10

6. Traditional Healers	20	1) Traditional Healers attract people who are ill (infected) 2) Culturally, traditional medicine is the preferred provider over clinical/hospital/government care 3) Traditional healers are most vulnerable providers, because they have no protective equipment, supplies or practices, like a clinical/hospital setting. 4) Host communities are vulnerable to infection from hosting infected individuals from outside the community, who seek treatment from the healer or fortune tellers	Traditional healers attracting the largest number of people from other countries	20
7. Health Facilities	15	1) Health facilities attract people who are ill (infected) 2) There is a history of healthcare workers and their families/communities becoming infected through ineffective or nonexistent preventative measures and subsequent unsafe burial practices 3) Host communities are vulnerable to infection by hosting infected individuals from outside the community, seeking treatment at the facility	Health facilities attracting the largest number of people from other countries	15
8. Transport Stations	10	1) All points of entry and transit points carry equal weight (10) 2) Local people mix with travelers from outside the community in vehicles 3) Surrounding communities transportation hubs are vulnerable to infection through business activities with potentially infected travelers	Transport stations attracting the largest number of foreign workers	10
9. Schools	5	1) Local students mix with students from outside the community	Schools and colleges attracting the largest number of people from other countries	5
10. Places of Worship	10	1) Religious leaders and institutions attract people who are ill (infected) 2) Spiritual power/healing is preferred provider over clinical/hospital/government care 3) Religious leaders are vulnerable, because they have no protective equipment, supplies or practices, like a clinical/hospital setting.	Places of worship attracting the largest number of people from other countries	10
11. Places of Entertainment	2	1) Local people mix with travelers from outside the community at public venues and seasonal festivals, resulting in greater potential for exposure to infectious diseases	Places of entertainment attracting the largest number of people from other countries	2
12. Other Places	2		Other places attracting the largest number of people from other countries	2

## 5.2 ANNEX II

Vulnerability capacity and sites location generated by the matrix analysis

			M	N	O	P	Q
Group Weight			10	10	20	15	10
Individual Indicator Weight			10	10	20	15	10
Afficher les localités			Markets	Migrant Worksites	Traditional Healers	Health Facilities	Transport Stations
Locality	Priority Score	Priority	Markets that attract the largest number of people from other countries	Worksites that have the largest number of workers	Traditional and Religious Healers that attract the largest number of people from other countries	Health Facilities that attract the largest number of people from other countries	Transport stations that attract the largest number of people
Mahendranagar Bajar	1428		250	360	20	495	10
Bramadev	639		190	0	0	15	100
Gaddachauki	529		160	0	0	0	220
Bhasi	511		20	0	420	0	20
Gajjar	480		0	0	480	0	0
Salghari	440		0	0	40	390	0
Tilachaud	264		0	220	0	0	0
Pipariya	249		20	0	0	0	100
Buspark	210		0	0	0	0	210
Airi	200		20	0	180	0	0
Tilakpur	110		0	50	0	0	0
Rajpur	80		0	0	80	0	0
Bhagatpur	80		0	0	0	0	0
Katan	70		0	0	0	0	0
Jimuwa	65		20	0	0	15	0
Rautela Mandir	60		0	0	60	0	0
Gobariya (Near Ninglasaini Temple)	60		0	0	60	0	0
Jhilmila	50		0	0	0	0	0
Bankhet	42		0	0	0	0	0
Sukhasal	30		20	0	0	0	10
Mahakali River Bank	30		0	30	0	0	0
Baghphanta	30		0	10	20	0	0
Rautela	30		0	0	0	0	0
Jhulunge Pool	30		0	0	0	0	30
Khairani	30		0	30	0	0	0



**International Organization for Migration**

768/12 Thirbam Sadak, Baluwatar 5 - P.O. Box: 25503, Kathmandu, Nepal

**Tel.:** +977-1-4426250. **Email:** [iomnepal@iom.int](mailto:iomnepal@iom.int). **Web:** <http://www.nepal.iom.int>.