POPULATION MOBILITY AND PUBLIC HEALTH RISK MAPPING

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

Biratnagar Metropolitan City

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1. INTRODUCTION

The Coronavirus disease 2019, hereinafter referred to as COVID-19, is caused by SARS CoV-2 Virus 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 9 December 2020, the number of cases stands at 67,210,778, including 1,540,777 deaths worldwide.[1]

In Nepal, the first case of COVID-19 was reported on 23 January 2020. As of 9 December 2020, the total number of confirmed cases in Nepal stands at 241,995 and 1,614 deaths.[2] 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 nation-wide lockdown, closure of international border, testing of suspected cases, isolation, treatment, contract tracing, and management of quarantine centres.

1.1 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:

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

[1] *https://covid19.who.int/?gclid=EAIaIQobChMIpu2y9aym6wIVjx0rCh2zNgN6EAAYASAAEgI1zvD_BwE*

[2] *Ibid*

II. Lumbini Province

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

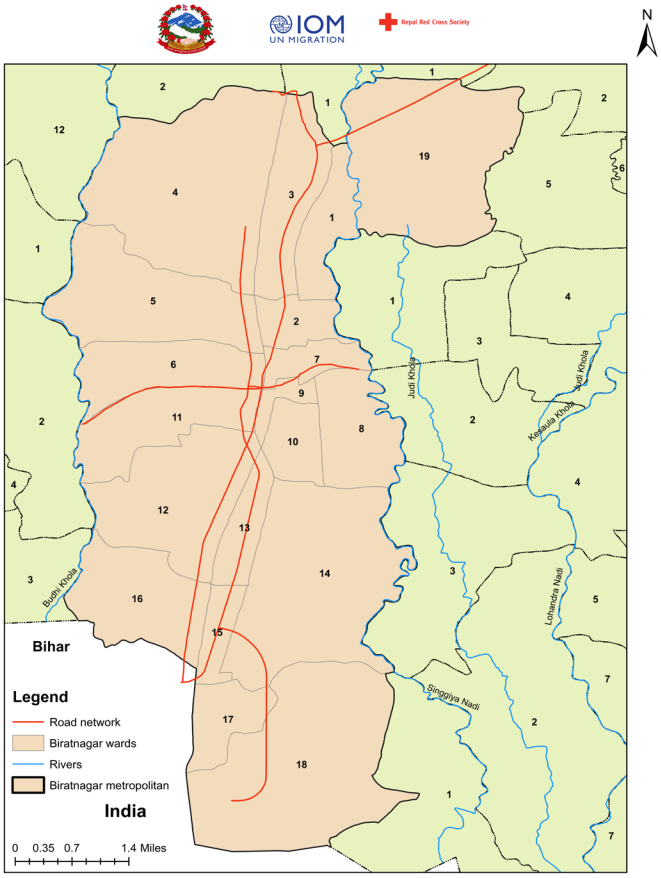
III. Province 1

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 Biratnagar Metropolitan City, Province 1, between 3 and 7 October 2020.

1.2 MUNICIPALITY PROFILE

Biratnagar Metropolitan City is located in Morang District, in the south-eastern part of Nepal. Situated in a plain (80 m above sea level), the municipality is over 370 km away from Kathmandu, the capital city. It covers a total of 125 sq. Km (see Map 1), and borders with Budhiganga Rural Municipality, Gramthan Rural Municipality, and Duhabi Rural Municipality in the north, Katahari Rural Municipality and Jahada Rural Municipality in the east, India in the south, and Barju Rural Municipality in the west.



Map 1: Boundaries of Biratnagar Metropolitan City, rivers and roads/paths. The map was used for the focus group discussions conducted as part of the PMM

According to the census in 2011, the population living in the area is 250,812 (127,914 men and 122,898 women). The main sources of income in the municipality are agriculture and business. In Biratnagar Metropolitan City there are a total of 21 urban health centres, including one (1) zonal hospital, one (1) Primary Health Care Center, and 19 health posts, for a total capacity of 356 beds. Registered health workers are 272, with 67 doctors, 77 nurses, 81 auxiliary nursing midwives, and 47 auxiliary health workers.

1.3 OBJECTIVES

The PMM has four main objectives:

1. Identify travellers' profiles and mobility patters 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 obtainment 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 City on 14 and 15 August 2020, in Nepalgunj Sub-Metropolitan City on 9 and 10 September 2020, and in Biratnagar Metropolitan City on 1 and 2 October 2020 (Picture 3 and 4), for a total of 45 NRCS staffs who have supported the IOM PMM staff in the implementation of field activities. 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: The PMM trainer presenting in Nepali (left) and GPS coordinate training (right)

2.2 DATA COLLECTION

The method implemented in Biratnagar Metropolitan City 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 Biratnagar Metropolitan City was conducted on 3 and 4 October 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).

PMM Exercise: Participatory mapping exercises during FGDs in Biratnagar Metropolitan City

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 1). 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 social 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: Examples of road infrastructure

3. RESULTS

3.1 PHASE I

Following the data entry and consequent matrix analysis (see Annex 2), a total of 80 sites with high population mobility were selected for further assessments for Phase II. In particular, these are; 13 POEs, 6 Health Centres, 8 Traditional Healers, 7 Schools and Colleges, 13 Entertainment Centres, 5 Market Centres, 12 Migrant Worksites, 5 Transport Stations, 9 Places of Worship, and 2 Other Places (see Table 1.1).

Table 1.1: Full names and localities of vulnerable sites identified within the municipality

POEs		
n	**Name Site**	**Locality**
1	Hatkhola POE	Singiya
2	Milan Chowk POE	Rani
3	ICP Int. POE	Khadani
4	Rani Int. POE	Jogbani
5	Kesaliya Pul POE	Keshaliya
6	Ikrai POE	Ikrai
7	China Dakshin Gate Int. POE	Rani
8	Taregama Int. POE	Budhnagar
9	Materwa Int. POE	Rani
10	Daraiya Int. POE	Dakshin Gate
11	Biratnagar Dhat POE	Nagarpalika Dhat
12	Khoksa (Islampur) Int. POE	Khoksa
13	Durbar Int. POE	Bedhayari

Health Centres		
n	**Name Site**	**Locality**
14	Koshi Hospital	Hospital Chowk
15	Nobel Medical College Teaching Hospital	Kanchanbari
16	Biratnagar Eye Hospital	Rani
17	Biratnagar Hospital	Bhrikuti Chowk
18	Neuro Hospital	Jahada Road
19	Golden Hospital	Hospital Chowk

Traditional Healers	
n	**Locality**
20	Kushal Tole Pathibharadevi Mata
21	Gauri Mandal Bhole Baba
22	Jharna Chowk Baba (MD Babar)
23	Hatkhola Dhami
24	Hamro Chowk Mata (MDG)
25	Hatkhola Mata
26	Bhrikuti Chowk Baba
27	Rampur Mata

Schools and Colleges		
n	**Name Site**	**Locality**
28	Bal Kalyan Vidya School	Pitchra
29	Merryland College	Jaljalamond
30	Pokhariya Secondary School	Pokhariya
31	St. Joseph Secondary School	Tinpaini Chowk
32	Nobel Medical College Teaching Hospital	Kanchanbari
33	Jamia Islamia Secondary School	Sarochiya
34	Gautam Budha School	Mills Area

Entertainment Centres		
n	**Name Site**	**Locality**
35	Central Mall	DSP Chowk
36	RK City Center	Hatkhola Chowk
37	Sahid Rangsala	Hospital Chowk
38	City Cinema Hall	Tinpaini Chowk
39	Bhatbhateni Supermarket	Sat Ghumti
40	Eco Fountain Park	Hospital Chowk
41	Himalayan Talkies Pvt. Ltd.	Mahendra Chowk
42	Food Festival Site	Main Road
43	Arun Cinema Hall	Rani
44	Geet Ghazal	Mahendra Chowk
45	Metro City Hotel	Mahendra Chowk
46	Hungry Café and Bar	Buspark
47	Deurali Hotel and Bar	Rani

Market Centres		
n	**Name Site**	**Locality**
48	Jaljalamond Market	Jaljalamond
49	Central Mall	DSP Chowk
50	Mainroad Market	Main Road
51	Bhatbhateni Supermarket	Sat Ghumti
52	Gudri Market	Gudri

Migrant Worksites		
n	**Name Site**	**Locality**
53	Bhatbhateni Supermarket	Sat Ghumti
54	Bhumi Parasan Worker Gathering Area	Roadcess Chowk
55	Raghupati Jute Mill	Mills Area
56	Hatkhola Chowk Worker Gathering Area	Hatkhola Chowk
57	Sneak Appareals Pvt. Ltd.	Mills Area
58	Gudri Worker Gathering Area	Gudri
59	Rathi Group Anapurna Cable Factory	Hatkhola Chowk
60	Manakamana Laghu Udhyog	Hatkhola
61	Kanchanjanga Electronic Shop	Jaljalamond
62	Hulas Metal Factory	Mills Area
63	Chandra Shiva Rice Mill	Sat Ghumti
64	Shyam Copy Factory	Tinpaini Chowk

Transport Stations		
n	**Name Site**	**Locality**
65	Rani Buspark	Rani
66	Rangeli Buspark	Hatkhola Chowk
67	Nobel Park Bus Station	Kanchanbari
68	Biratnagar Buspark	Buspark
69	Taxi Park Station	Mahendra Chowk

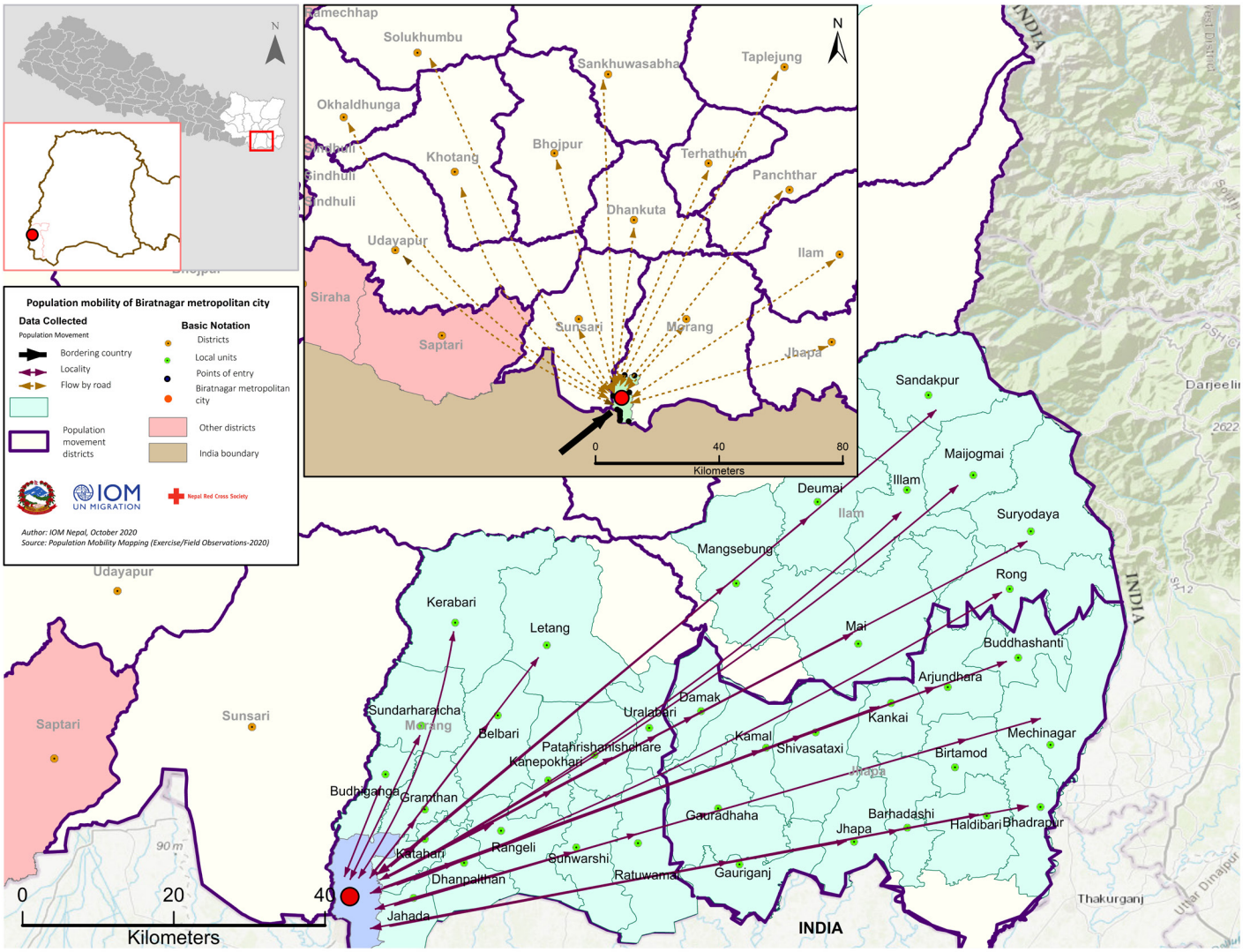
Places of Worship		
n	**Name Site**	**Locality**
70	Shree Satya Narayan Mandir	Main Road
71	Kali Mandir	Jaljalamond
72	Lakshmi Narayan Temple	Panchali
73	Sarochiya Jamun Mosque	Sarochiya
74	Radha Krishna Mandir	Pokhariya
75	Durga Mandir	Rani
76	Shree Ganesh Mandir	Hospital Chowk
77	Gausiya Rajaiya Mustafa Jame Masjid	Gudri
78	Balaji Babosa Mandir	Main Road

Other Places		
n	**Name Site**	**Locality**
79	Puspalal Junction	Puspalal Chowk
80	Hotel Big	Buspark

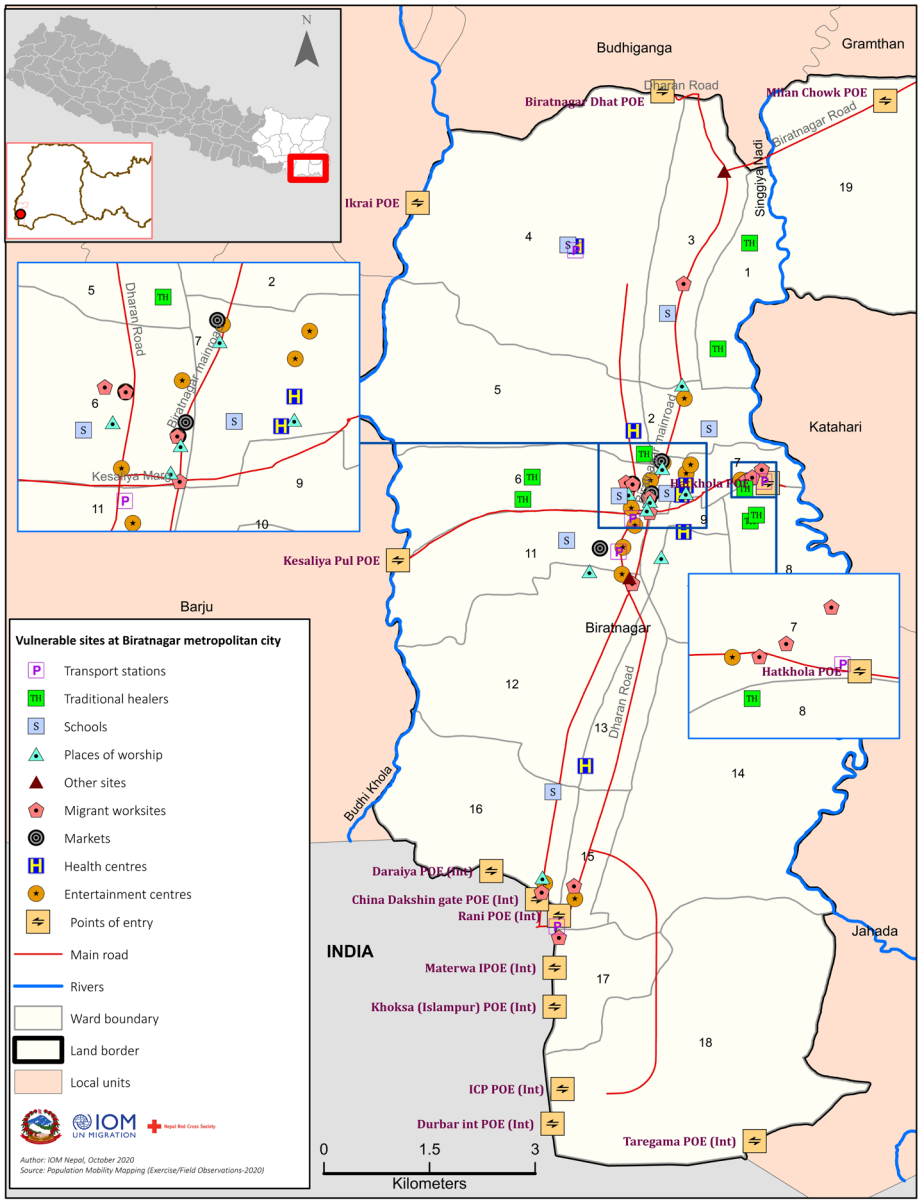
3.2 PHASE II

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

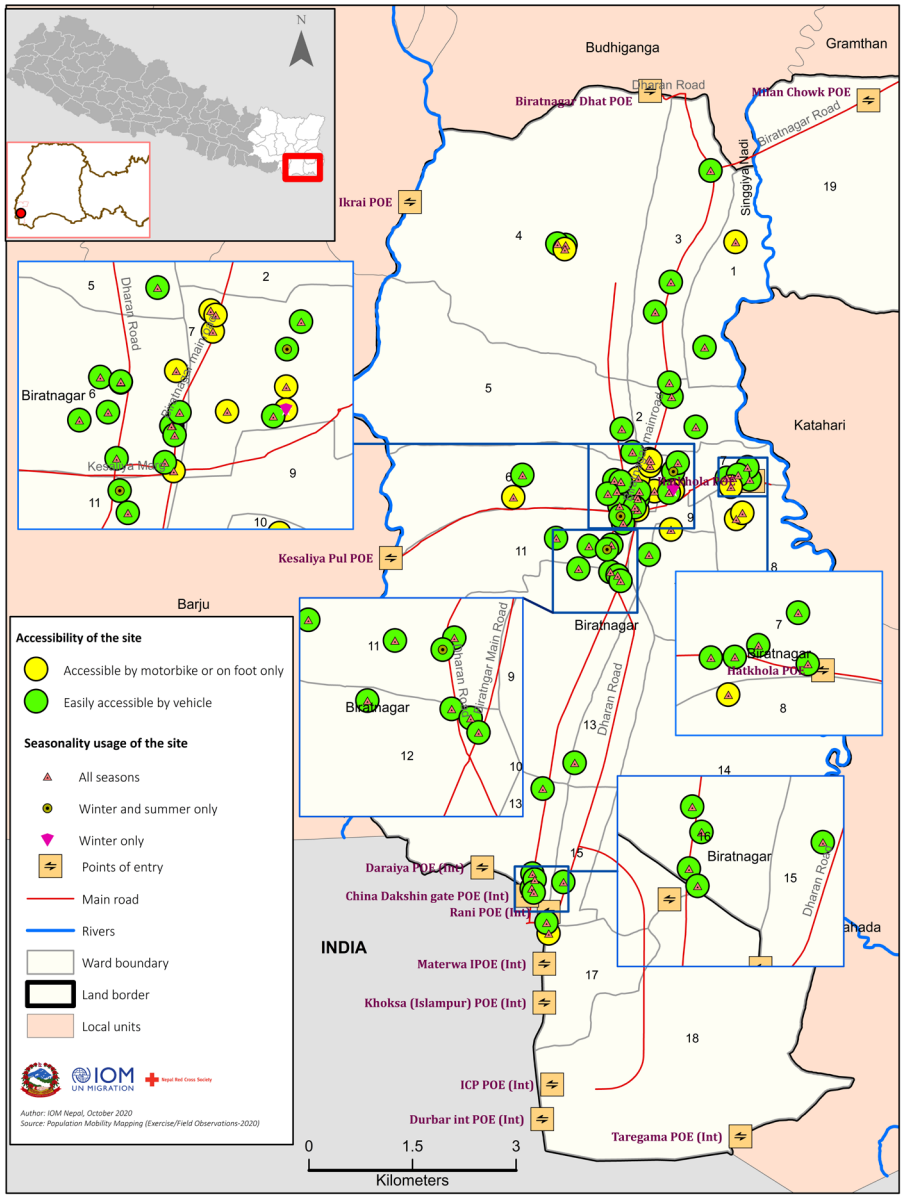
3.2.a MAPS



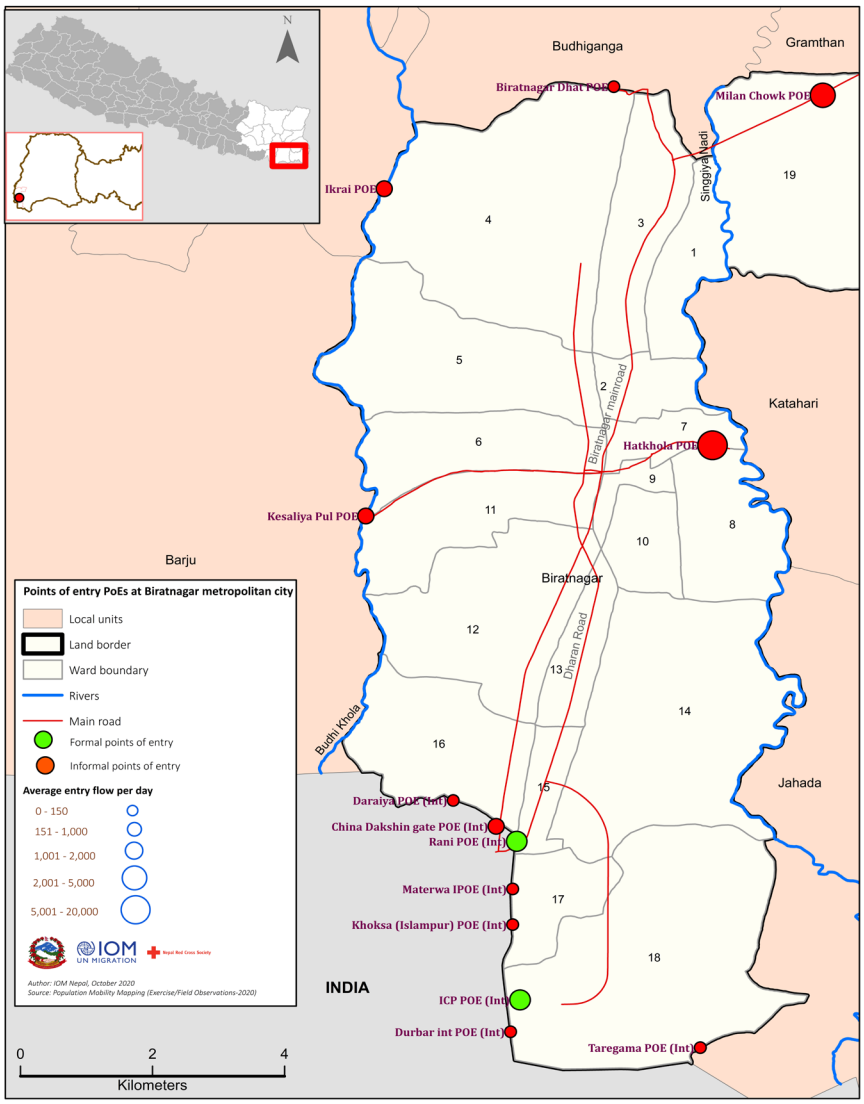
Map 2: Population movement from/to Biratnagar Metropolitan City at the municipality, district and international level



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 (Biratnagar Metropolitan City)

Field Observations: Site assessments and interviews with KIs

3.2.b POINTS OF ENTRY (POEs)

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

In terms of population mobility pattern in Biratnagar Metropolitan City, people are mainly from Nepal and India. The biggest international crossing points in terms of people's movement are identified as *ICP POE* (formal) and *Rani POE* (formal). According to the results obtained from the field observations, population mobility at the investigated POEs in Biratnagar Metropolitan City mostly originates from *Morang, Jhapa, Sunsari, Ilam* and *Panchthar* districts. At the municipality level, people's movement at the respective POEs is recorded mainly in Biratnagar Metropolitan City and from *Rangeli Municipality, Budhiganga Rural Municipality, Ratuwamai Municipality, Sunbarshi Municipality* and *Katahari Rural Municipality*. The study reveals that the POEs are open to the public every day throughout the year, except state's prohibition in certain circumstances, like cross country disease transmission or any other governance issues. However, Wednesday, Friday, Saturday, and Sunday are observed as the busiest days in terms of population mobility. Similarly, in normal times at these POEs, January to April are identified as the busiest months.

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

The study shows that *Rani POE* (formal) is connected to *Dharan Road*, which is linked to other alternative vehicle routes, such as *Rani Path, Raja Birat Marg*, and *Raghupati Marg*. This POE is accessible by all kinds of vehicles. However, people from India mostly use tricycles and motorbikes to access this POE. Likewise, *ICP POE* (formal) is situated near *Rani POE* (formal), which is connected to *Raghupati Marg,* followed by *Dharan Road*. As per the results obtained from the field survey, this POE is accessible by vehicle and the nearest localities are identified as *Rani, Hansmukhi Tole* and *Daraiya*. Similalry, *Daraiya POE* is situated at *Daraiya* locality, associated with *Daraiya Road*, and connected to the *Dharan Road* via *Rani Path*. However, people mainly use tricycles to access this POE. Likewise, *Khoksa (Islampur) POE* and *Materwa POE* are situated close to *ICP POE* (formal) and are accessible by motorbike, car and minivan. The alternative route to access these POEs is *Raja Birat Marg,* also accessible by car, minivan and motorbike. The nearest localities to these POEs are identified as *Rani, Hansmukhi Tole* and *Daraiya*. Correspondingly, *China Dakshin Gate POE* lies near *Rani POE* (formal), which is located at *Rani* locality and connected to *Dharan Road* with the alternative vehicle routes, such as *Rani Path, Raja Birat Marg* and *Raghupati Marg*. This POE is accessible by all kinds of vehicles, however, people mainly use tricycles to reach this site, due to the informal use of this crossing point. *Durbar POE* and *Taregama POE* are situated at *Buddhanagar* locality, in close proximity to each other. Specifically, *Durbar POE* is located near *Rani POE* (formal) and *Buddhanagar Railway Station,* whereas *Taregama POE* is situated at the southern terrain of *Buddhanagar* locality. Furthermore, *Biratnagar Dhat POE, Ikrai POE,* and *Kesaliya Pul POE* are situated at *Biratnagar Dhat, Ikrai* and *Kesaliya* localities, respectively, and are used to enter into Biratnagar Metropolitan City from other surrounding municipalities. As per the observations, these POEs are accessible by all kinds of vehicles, however, people from other districts and municipalities mostly use buses, minivans and cars to access these. Similarly, *Hatkhola POE* and *Milan Chowk POE* are situated at *Hatkhola* and *Milan Chowk* localities, respectively, and are accessible by all kinds of vehicles from different municipalities and localities. The nearest localities to these POEs are recorded as *Tinpaini, Bhrikuti Chowk, Satghumti* and *Pushpalal Chowk*.

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

A total of thirteen (13) POEs were investigated in Biratnagar Metropolitan City. Among them, only two (2) are formal and eleven (11) are informal crossing points. All the POEs assessed are land border crossing points. In Fig. 1.1,

the POEs are sorted in descending order of magnitude. The topmost layer of the figure shows that *Hatkhola POE* (informal) accounts for the highest influx of people with an average entry flow of 20,000 migrants per day and 25,000 migrants on the busiest day, which double the size of the remaining POEs combined. This is followed by *Milan Chowk POE, ICP Int. POE, Rani Int. POE,* and *Kesaliya Pul Int. POE,* with a population distribution of 5,000, 2,000, 1,500, and 1,000 people per day, respectively, which on the busiest day the number increases to 7,000, 2,500, 2,000, and 5,000 people, respectively. Surprisingly, despite *Kesaliya Pul POE*'s average entry flow per day is 1,000 people, which is lesser than *ICP Int. POE* and *Rani Int. POE*, on the busiest day the influx of people is higher than the size of these two (2) combined. The remaining eight (8) POEs are crossed daily at most by 500 people and at least 100 people, while on the busiest day the flow is at most 1,000 people and at least 150 people. The majority of the POEs in Biratnagar Metropolitan City attract people from India, except for *Milan Chowk POE* and *Ikrai POE. ICP Int. POE* (formal) attracts the largest number of people from India (90%), followed by five (5) other POEs (*Rani Int. POE, China Dakshin Gate Int. POE, Taregama Int. POE, Daraiya Int. POE,* and *Khoksa (Islampur) Int. POE*) with half of the population (50%) from India and half (50%) from Nepal. The remaining five (5) POEs receive at most 25 per cent and at least 10 per cent of people from India (see Fig. 1.1).

Average entry flow per day, busiest day, and percentage coming from India (October 2020)

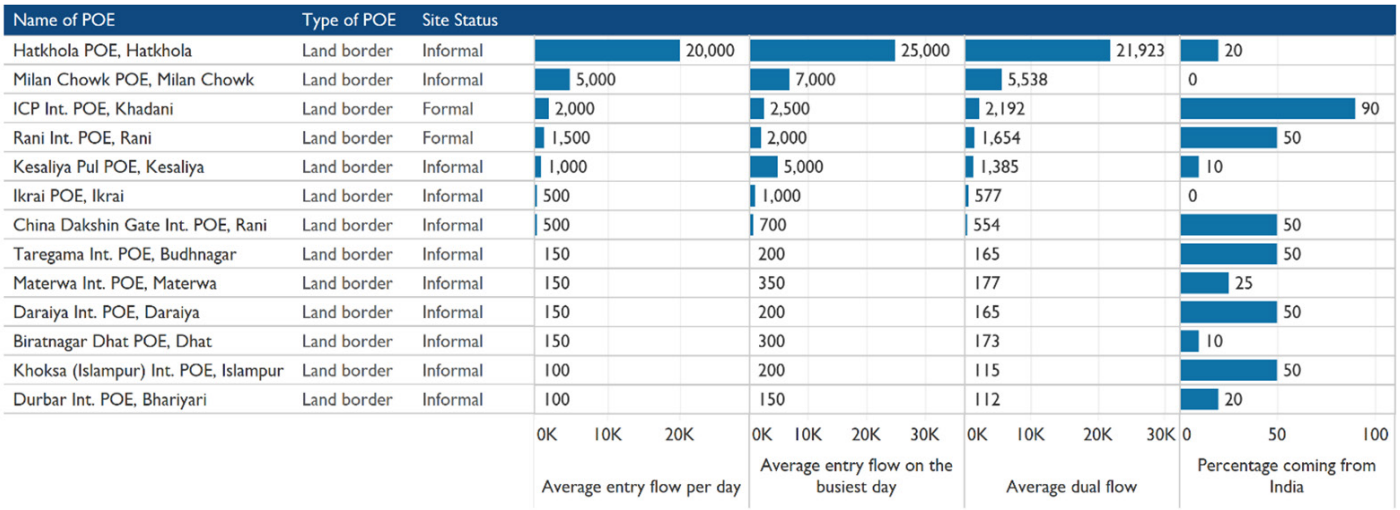


Fig. 1.1: Mobility patterns across the POEs

The nearest health centre to the respective POEs varies across each locality, except for *China Dakshin Gate Int. POE, Daraiya Int. POE, Khokasa (Islampur) Int. POE,* and *Materwa Int. POE,* whose nearest health centre is *Rani Health Post.* The most used health centre in Biratnagar Metropolitan City is *Koshi Hospital* (10/13) and *Nobel Medical College Teaching Hospital* (3/13), which is closer to *Biratnagar Dhat, Ikrai Int. POE,* and *Milan Chowk POEs.* The majority of the POEs lack electricity (7/13), while only six (6) POEs have electricity on site. Most of the POEs are busy throughout the week (6/13), while the remaining POEs are busy between Wednesday, Friday, Saturday, and Sunday (see Table 1.2). The busiest month of the year differs across each POE. However, *China Dakshin Gate Int. POE, Daraiya Int. POE, Durbar Int. POE, ICP Int. POE, Kesaliya Pul Int. POE,* and *Rani Int POE* (6/13) are busy throughout the year. Most of the POEs do not have toilet facilities nearby (12/13) except for *ICP Int. POE* (formal) and most of the POEs do not have water facilities for drinking, handwashing and/or other purposes (8/13), except for a few POEs (*Biratnagar Dhat, ICP Int., Ikrai Int., Kesaliya Pul Int.,* and *Rani Int.* POEs) which have water facility on site (5/13).

Table 1.2: Basic health infrastructure at the POEs

Name of POE	Name of the nearest health centre	Type of nearest health centre	Name of the most used health centre	Availability of electricity	Availability of toilet nearby	Availability of water on site	Busiest day of the week	Busiest month of the year
Biratnagar Dhat POE, Dhat	Birat Medical College Teaching Hospital	Private hospital	Nobel Medical College Teaching Hospital	Available	Not available	Available	Wednesday, Friday	July, August, January
China Dakshin Gate Int. POE, Rani	Rani Health Post	Health post	Koshi Hospital	Not available	Not available	Not available	Every day	Every month
Daraiya Int. POE, Daraiya	Rani Health Post	Health post	Koshi Hospital	Available	Not available	Not available	Every day	Every month
Durbar Int. POE, Bhariyari	Buddhanagar Health Post	Health post	Koshi Hospital	Not available	Not available	Not available	Every day	April, March, February, July
Hatkhola POE, Hatkhola	RK Children Hospital	Private hospital	Koshi Hospital	Available	Not available	Not available	Wednesday, Sunday	April, March, January, February, October
ICP Int. POE, Khadani	Biratnagar Eye Hospital	Private hospital	Koshi Hospital	Do not know	Available	Available	Every day	Every month
Ikrai POE, Ikrai	Nobel Medical College Teaching Hospital	Private hospital	Nobel Medical College Teaching Hospital	Not available	Not available	Available	Sunday	October, September, November
Kesaliya Pul POE, Kesaliya	Bhimpur Health Post	Health post	Koshi Hospital	Available	Not available	Available	Every day	Every month
Khoksa (Islampur) Int. POE, Islampur	Rani Health Post	Health post	Koshi Hospital	Not available	Not available	Not available	Saturday	June, July, February, March, April, August
Materwa Int. POE, Materwa	Rani Health Post	Health post	Koshi Hospital	Not available	Not available	Not available	Friday, Saturday, Sunday	Every month
Milan Chowk POE, Milan Chowk	B&B Pharmacy	Clinic	Nobel Medical College Teaching Hospital	Available	Not available	Not available	Tuesday, Thursday	March, April
Rani Int. POE, Rani	Koshi Hospital	Government hospital	Koshi Hospital	Available	Not available	Available	Every day	Every month
Taregama Int. POE, Budhnagar	Budhnagar Health Post	Health post	Koshi Hospital	Not available	Not available	Not available	Saturday, Sunday	January, March, December, October

Seven (7) out of the thirteen (13) POEs investigated in Biratnagar Metropolitan City lack special equipment to address health related issue of Public Health Emergency of International Concern (PHEIC), expect for *Rani Int. POE, Daraiya Int., Ikrai POE, ICP Int. POE, Taregama Int. POE,* and *Biratnagar Dhat POE*. Furthermore, an assessment was also done to determine International Health Regulations (IHR) status across the POEs, especially the formal POEs. Among these, none has an IHR focal point within the border and only two (2) POEs (*Ikrai* and *Milan Chowk*) in the corresponding country, notably India. Similarly, there is inadequate presence of community health workers or agents or volunteers responsible for health issues related to minor and emergency cases (11/13), except at *Rani Int. POE* and *ICP Int. POE*. The distance to the nearest or most used health centres differs across each POE. In Fig. 1.2, the topmost bars (left) show that *Rani Int. POE,* is the farthest away from the health centres, approximately 9 Km away. This is followed by *Durbar Int. POE* and *Daraiya Int. POE* (4 Km away each), and *Khoka (Islampur) Int. POE, Ikrai Int. POE,* and *ICP Int. POE* (3 Km away each). On the contrary, the remaining POEs are between 100-200 meters and 1-2 Km from the nearest health centre. Most of the POEs distances from the nearest health centres to the referral centres are significant. The farthest distance from the health centres to the referral centre can be found at T*aregama Int. POE* and *Daraiya Int. POE,* with an equal distance of 10 Km each (see Fig. 1.2). The distance to the nearest water source varies across the five (5) POEs with water facilities, which are located within a radius of 200 meters, except for *Kesaliya Pul POE,* with the farthest distance (2 Km).

Status of health infrastructure and distance to the nearest health centre and water source

Name of POE	Availability of special equipment to address health issues of PHEIC	Presence of IHR focal point at POE	Presence of IHR focal point from corresponding country	Presence of community health worker/agent for emergency cases	Availability of water on site	Distance to the nearest health centre [in Km]	Distance from the nearest health centre to the referral centre [in Km]	Distance to the nearest water source [in Km]
Rani Int. POE, Rani	Available	Do not know	Not available	Available	Available	9.0	9.0	0.0
Durbar Int. POE, Bhariyari	Not available	Not available	Not available	Not available	Not available	4.0	7.0	
Daraiya Int. POE, Daraiya	Available	Not available	Not available	Not available	Not available	4.0	10.0	
Khoksa (Islampur) Int. POE, Islampur	Not available	Not available	Not available	Not available	Not available	3.0	7.0	
Ikrai POE, Ikrai	Available	Do not know	Available	Not available	Available	3.0	3.0	0.2
ICP Int. POE, Khadani	Available	Not available	Not available	Available	Available	3.0	9.0	0.0
Taregama Int. POE, Budhnagar	Available	Not available	Not available	Not available	Not available	2.0	10.0	
China Dakshin Gate Int. POE, Rani	Not available	Not available	Not available	Not available	Not available	1.5	8.0	
Materwa Int. POE, Materwa	Not available	Not available	Not available	Not available	Not available	1.0	6.0	
Kesaliya Pul POE, Kesaliya	Not available	Not available	Not available	Not available	Available	1.0	6.0	2.0
Biratnagar Dhat POE, Dhat	Available	Not available	Not available	Not available	Available	1.0	2.5	0.1
Hatkhola POE, Hatkhola	Not available	Not available	Do not know	Not available	Not available	0.2	0.5	
Milan Chowk POE, Milan Chowk	Not available	Not available	Available	Not available	Not available	0.1	2.5	

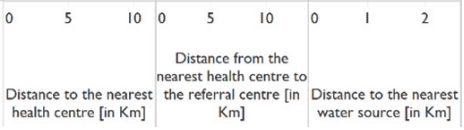


Fig. 1.2: The presence of IHR and PHEIC focal points, and distance to the nearest health/referral centre

The majority of the travellers passing through these BCPs do not wear masks with reference to the following analysis; either less than 10 per cent or between 31-50 per cent wear masks, and only at *ICP Int. POE* the percentage is greater than 50 (see Table 1.3). Most of the POEs have an uninterrupted voice communication network, except at *Daraiya Int. POE* and *Ikrai POE* where there is no network and interrupted (bad) network, respectively. There is no record of tracking people or contact tracing mechanism across all the POEs as people cross the border. Similarly, health screening stations (handwashing with soap and hand sanitizer) and body temperature checking are completely absent, except at *ICP Int. POE* where body temperature is checked and *Rani Int. POE* which has health screening mechanism in place. Most of the POEs do not have IPC personnel nor necessary equipment to implement IPC measures. This is concerning also considering that 100 per cent of the POEs in Biratnagar Metropolitan City are operational throughout the seasons, similarly to other municipalities where the study was conducted. There were four (4) suspected COVID-19 cases reported by the respondents at *Hatkhola POE, ICP Int. POE (formal), Kesaliya Pul POE,* and *Milan Chowk POE.*

Table 1.3: Status of IPC and suspected COVID-19 cases at the POEs

Name of POE	Suspected COVID-19 cases on site	Estimated percentage wearing mask	Presence of IPC personnel	Availability of health screening station	Body temperature checking status	Availability of record book/device for travellers	Seasonality at POE	Voice communication status
Biratnagar Dhat POE, Dhat	No	31%-50%	Available	Not available	Not available	Not available	All seasons	Good (uninterrupted network)
China Dakshin Gate Int. POE, Rani	No	<10%	Not available	Not available	Not available	Not available	All seasons	Good (uninterrupted network)
Daraiya Int. POE, Daraiya	No	<10%	Not available	Not available	Not available	Not available	All seasons	No network
Durbar Int. POE, Bhariyari	No	<10%	Not available	Not available	Not available	Not available	All seasons	Good (uninterrupted network)
Hatkhola POE, Hatkhola	Yes	31%-50%	Not available	Not available	Not available	Not available	All seasons	Good (uninterrupted network)
ICP Int. POE, Khadani	Yes	>50%	Available	Not available	Available	Do not know	All seasons	Good (uninterrupted network)
Ikrai POE, Ikrai	No	<10%	Not available	Not available	Not available	Not available	All seasons	Bad (interrupted network)
Kesaliya Pul POE, Kesaliya	Yes	10%-30%	Not available	Not available	Not available	Not available	All seasons	Good (uninterrupted network)
Khoksa (Islampur) Int. POE, Islampur	No	<10%	Not available	Not available	Not available	Not available	All seasons	Good (uninterrupted network)
Materwa Int. POE, Materwa	No	<10%	Not available	Not available	Not available	Not available	All seasons	Good (uninterrupted network)
Milan Chowk POE, Milan Chowk	Yes	31%-50%	Available	Do not know	Do not know	Do not know	All seasons	Good (uninterrupted network)
Rani Int. POE, Rani	No	31%-50%	Available	Available	Do not know	Do not know	All seasons	Good (uninterrupted network)
Taregama Int. POE, Budhnagar	No	<10%	Not available	Not available	Not available	Not available	All seasons	Good (uninterrupted network)

3.2.c HEALTH CENTRES

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

According to the results obtained from the participatory mapping exercises and field observations, the investigated health centres in Biratnagar Metropolitan City are operational every day and throughout the year. However, Sunday, Monday and Tuesday are recorded as the busiest days, and January is identified as the busiest month in terms of population mobility. At the districts level, the population mobility at these health centres mostly originates from *Morang, Sunsari, Jhapa, Ilam, Taplejung, Bhojpur* and *Tehrathum*. At the municipality level, patients and visitors who come to visit the investigated health centres are mainly from within *Biratnagar Metropolitan City* and from *Urlabari Municipality, Rangeli Municipality, Belbari Municipality, Jhapa Rural Municipality*, and *Jahada Rural Municipality.*

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

Koshi Hospital and *Golden Hospital* are situated at *Hospital Chowk* locality, which is connected to *Dharan Road* through *Rangeli Marg* and *Buddha Marg*. These health centres are accessible by all kinds of vehicles and through other alternative routes, such as *Main Road, Sahid Marg, Siddhartha Marg* and *Paurakh Marg,* with the nearest localities identified as *Hatlkhola, Madumara, Janpath Tole* and *Jaljala Chowk*. Similarly, *Biratnagar Hospital* is situated at *Bhrikuti Chowk,* which lies in *Dharan Road* and is accessible by vehicle. This health centre is also reachable through other alternative routes, namely, *Janaki Path, Shankarpur Marg, Gopinath Marg* and *Chakrapani Marg.* The closest localities to this health centre are identified as *Sanihat Chowk, Bargachhi Chowk, Satghumti* and *Pipal Chowk*. Congruently, *Nobel Medical College Teaching Hospital* is located at *Kanchanbari* locality, which is linked to *Airport Road* and *Dharan Road.* The nearest localities to this health centre are *Airport Area, Thulo Mill Chowk, Pipal Chowk, Buddha Chowk* and *Pokhariya.* Likewise, *Neuro Hospital* is situated at *Jahada Road,* which is connected to the *Main Road,* with the nearest localities observed as *Panchali Tole, Janpath Tole* and *Madumara*. This health centre is also accessible by *Siddhartha Marg* and *Buddha Marg*. Furthermore, *Biratnagar Eye Hospital* lies in *Rani* locality, which is connected to *Dharan Road* via *Abibhadan Marg*. The alternative vehicle routes to access this health centre are identified as *Rani Path* and *Chakra Path*, with the nearest localities being *Pichara, Panchali Tole, Ganga Tole* and *Daraiya*. According to the results, the assessed health centres in Biratnagar Metropolitan City are accessible by vehicle. However, people from nearby localities and India use tricycles, motorbikes and minivans as modes of transport to access these sites.

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

A total of six (6) health centres were investigated in Biratnagar Metropolitan City. Among them, only one (1) (*Koshi Hospital*) is government-owned, whereas the remaining five (5) are private health facilities. The average number of people visiting the health centres varies across the respective facilities. *Koshi Hospital* and *Nobel Medical College Teaching Hospital* account for the highest flow with 2,500 and 1,200 people per day, while on the busiest days the numbers increase to 3,000 and 2,000, respectively. The remaining four (4) health centres are visited by at most 800 people and at least 250 people (see Fig. 2.1). Furthermore, all the assessed health centres attract people from India and Bangladesh. Specifically, at *Biratnagar Eye Hospital, Neuro Hospital* and *Golden Hospital* 45 and 40 per cent (each) of the population mainly comes from India, respectively, while the remaining 55 and 60 per cent (each) are from within the same municipality and nearby municipalities. The third highest influx of people from other countries can be found at *Biratnagar Hospital* (30%), whereas at the remaining two (2) health centres (*Koshi Hospital* and *Nobel Medical College Teaching Hospital*) the percentage distribution is not significant (10% and 7%, respectively).

Average entry flow per day, busiest day, and percentage coming from other country (October 2020)

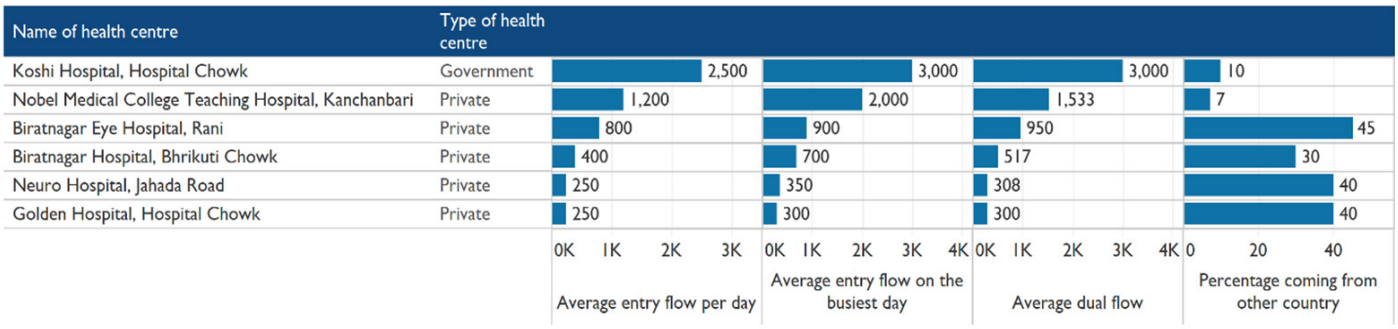


Fig. 2.1: Mobility patterns at the health centres

All six (6) health centres are operational and functioning 24/7. All the health centres have separate toilets for staffs and patients with minimum stalls (drop holes) of 25 at *Golden Hospital,* and maximum stalls of 150 at *Neuro Hospital*. Astoundingly, comparing *Neuro Hospital* to *Nobel Medical College Teaching Hospital, Biratnagar Hospital* and *Koshi Hospital,* these have less than one-third (1/3) of the stalls (50 each), despite a population mobility (inpatient ward) 11 and 7 times higher, respectively, with 2,500, 1,200 and 800 people per day (see Fig. 2.1). As of October 2020, all the health centres have people in both inpatient and outpatient wards. It was observed that, some of the health centres with less inpatients have a high population in the outpatient ward, especially *Biratnagar Eye Hospital, Koshi Hospital* and *Neuro Hospital*, with 25,000, 15,000, and 8,000 outpatients, respectively, based on data from the last three months (July-September 2020). *Nobel Medical College Teaching Hospital* and *Biratnagar Hospital* have the largest amount of people as inpatients (3,500 and 2,250, respectively) but lesser in the outpatient ward, when compared to *Golden Hospital, Koshi Hospital* and *Neuro Hospital*. Generally, the numbers of outpatients are significantly higher than inpatients across all the health centres, except for *Golden Hospital*. This is probably due to the inadequate capacity of the treatment facilities based on the last three months (July-September) from the date of observations (October 2020).

Numberof Inpatients and Outpaitents based on the last three months from the date of observation (October 2020)

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

Fig. 2.3 shows the distribution of basic hygiene mechanism at the health centres as well as the distances from the health centre to the nearest water source and to another health centre (referral centre). The farthest distance to the referral centres is 4 and 5 Km from *Koshi Hospital* and *Nobel Medical College Teaching Hospital,* respectively, and 3 Km each from *Biratnagar Hospital* and *Biratnagar Eye Hospital*. The remaining two (2) health centres are at most 2 Km away and at least less than 100 meters away. The distance from the health centres to the nearest water source is within a radius of 300 meters. This means that all the health centres have a water system nearby. Similarly, all the assessed sites have toilet facilities for both staffs and patients. The maximum number of patients per stall (drop hole) is 71 (*Koshi Hospital*) and the minimum number of patients per stall is 3 (*Neuro Hospital*) based on the average number of patients visiting the health centre per day. Similarly, the highest number of staffs per stall can be found at *Nobel Medical College Teaching Hospital* (303) and *Neuro Hospital* (42), whereas the minimum number of staffs per stall is 3 (*Biratnagar Eye Hospital*) based on the total population of health personnel at the respective health centres.

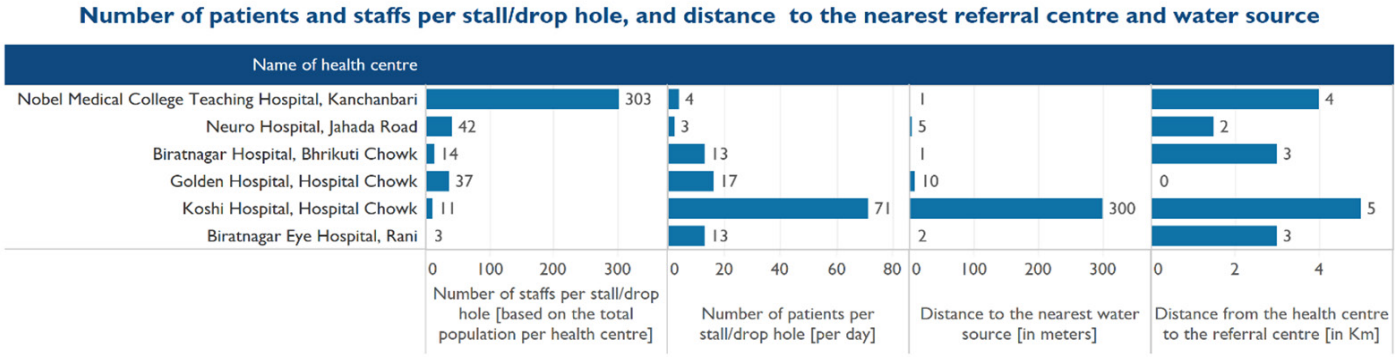


Fig. 2.3: Number of patients and staffs to stall/drop hole ratio, and distances to the nearest health centre and water source

In Biratnagar Metropolitan City, out of six (6) respondents at the health centres investigated, four (4) asserted that people who fall ill do seek alternative health treatment before going to the health centres (see Table 2.1). Analysis for these findings is stated as follows:

- Less than 10 per cent and between 20-40 per cent seek healthcare at home
- Between 15-35 per cent seek healthcare at other public hospitals
- Less than 10 per cent and between 10-30 per cent seek healthcare at other private hospitals
- Less than 10 per cent and between 10-30 per cent seek healthcare at the pharmacy
- Less than 10 per cent and between 20-40 per cent seek healthcare from religious leaders
- Less than 10 per cent seek healthcare from traditional healers
- Between 10-30 per cent and greater than 50 per cent seek healthcare somewhere else

Table 2.1: Most common places people seek care from before going to the health centre

Name of health centre	Care at home	Care at other private hospital	Care at other public hospital	Care at the pharmacy	Care at the religious leader	Care at the traditional healer	Care at somewhere else
Biratnagar Eye Hospital, Rani	<10%	10%-30%	<10%	<10%	<10%	<10%	10%-30%
Biratnagar Hospital, Bhrikuti Chowk	31%-50%	31%-50%	10%-30%	<10%	<10%	10%-30%	>50%
Golden Hospital, Hospital Chowk	10%-30%	10%-30%	10%-30%	10%-30%	<10%	<10%	10%-30%
Koshi Hospital, Hospital Chowk	<10%	10%-30%	>50%	>50%	<10%	31%-50%	10%-30%

In Table 2.2, the population distribution of the medical personnel across the health centres where the study was conducted shows that; *Nobel Medical College Teaching Hospital* and *Neuro Hospital* account for the largest total of medical personnel (3,025 and 2,079, respectively), and the highest number of medical officers with a population distribution of 400 and 1,732, respectively. The majority of the health centres investigated have at least 2 and at most 1,732 staffs for almost all the sixteen (16) categories of health personnel listed in Table 2.2. Additionally, based on inpatient and outpatient population distribution, at *Nobel Medical College Teaching Hospital, Neuro Hospital,* and *Koshi Hospital,* the population of medical personnel is proportionate to the influxes of people, contrary to *Biratnagar Eye Hospital.* The latter, together with *Koshi Hospital* and *Golden Hospital,* overall have a limited number of medical personnel, probably due to the lower mobility of patients at these sites, still higher compared to Sudurpashchim Province and Lumbini Province. Consequently, all the health centres have at least 5 staff nurses (*Biratnagar Eye Hospital*), and at most 1,600 staff nurses (*Nobel Medical College Teaching Hospital*). Similarly, all the health centres have at least a pharmacist, lab technician (except for *Koshi Hospital*), nursing officer (except for *Neuro Hospital*), and radiographer (except for *Biratnagar Eye Hospital*).

Table 2.2: Population of medical personnel at the health centres

	Name of health centre / Type of health centre					
	Biratnagar Eye Hospital, Rani	Biratnagar Hospital, Bhrikuti Chowk	Golden Hospital, Hospital Chowk	Koshi Hospital, Hospital Chowk	Neuro Hospital, Jahada Road	Nobel Medical College Teaching Hospital, Kanchanbari
	Private	Private	Private	Government	Private	Private
Female Community Health Volunteer	0	0	0	0	0	0
Pharmacy Assistant	3	4	3	0	8	10
Public Health Nurse	2	35	2	0	0	0
Lab Assistant	8	5	5	0	7	19
Medical Recorder	5	4	2	0	2	40
Radiographer	0	7	3	2	7	40
Health Assistant	0	15	15	1	10	20
Pharmacist	2	4	5	2	3	60
Auxiliary Health Worker	2	9	30	0	29	24
Auxiliary Nursing Midwifery	40	22	30	8	6	0
Lab Technician	2	4	5	0	5	100
Office Helper	0	5	15	0	0	150
House Keeper	18	55	18	0	70	12
Nursing Officer	3	6	2	5	0	550
Staff Nurse	5	65	35	61	200	1,600
Medical Officer	16	32	15	80	1,732	400
Total Health Officers	106	272	185	159	2,079	3,025

Among the six (6) health centres investigated in Biratnagar Metropolitan City, five (5) are private and their primary purpose is to deliver special healthcare services. Only one (1) (*Koshi Hospital*) is a regional health centre, and attracts less patients compared to *Nobel Medical College Teaching Hospital* and *Biratnagar Hospital* in terms of number of inpatients admitted in ward. However, it is visited by more people than other health centres, in terms of people's influx per day (see Fig. 2.1 and 2.2). Most of the medical personnel in the municipality are trained at three (3) health centres (*Biratnagar Eye Hospital, Neuro Hospital,* and *Nobel Medical College Teaching Hospital*), and thus contribute greatly to the population density (see Table 2.3 and Fig. 2.1). Five (5) of the health centres (5/6) have recorded suspected COVID-19 cases, except for *Biratnagar Eye Hospital.* All the health centres have conducted training on IPC, and most of the health centres perform health screening for travellers or patients entering the facilities, except for *Koshi Hospital* and *Neuro Hospital.* Nearly all the health centres do 24/7 health screening (handwashing with soap and hand sanitizer), except for *Koshi Hospital* and *Neuro Hospital.* The majority have an emergency and

preparedness plan (5/6), except for *Koshi Hospital* (government), which lacks one and therefore has not tested it. At all the health centres, people wear masks at a percentage greater than 50 (see Table 2.3).

Table 2.3: Status of emergency preparedness plan, IPC, and health screening at the health centres

Name of health centre	Level of health system/service delivery	Suspected COVID-19 cases on site	Status of IPC training	Availability of health screening station	Availability of health screening station 24/7	Availability of emergency preparedness plan	Emergency preparedness plan last tested	Estimated percentage wearing mask
Biratnagar Eye Hospital, Rani	Tertiary/Academy Hospital	No	Yes, conducted	Available	Available	Available	Less than 3 months	>50%
Biratnagar Hospital, Bhrikuti Chowk	Private Hospital	Yes	Yes, conducted	Available	Available	Available	Less than 3 months	>50%
Golden Hospital, Hospital Chowk	Private Hospital	Yes	Yes, conducted	Available	Available	Available	Between 3 to 6 months	>50%
Koshi Hospital, Hospital Chowk	Regional/District Hospital	Yes	Yes, conducted	Not available	Not available	Not available	'	>50%
Neuro Hospital, Jahada Road	Tertiary/Academy Hospital, Private Clinic	Yes	Yes, conducted	Not available	Not available	Available	Less than 3 months	>50%
Nobel Medical College Teaching Hospital, Kanchanbari	Tertiary/Academy Hospital	Yes	Yes, conducted	Available	Available	Available	Less than 3 months	>50%

Most of the health centres do have functional thermometer to check body temperature (4/6) for both patients and visitors, except for *Koshi Hospital* and *Neuro Hospital.* There is the availability of water across all the health centres. Half of the health facilities (3/6) are busy throughout the week and the year, except for *Koshi Hospital, Neuro Hospital* and *Nobel Medical College Teaching Hospital* whose busiest days are Sunday, Monday, and Tuesday. Similarly, the busiest months at *Biratnagar Eye Hospital* are January, October, November, and December, while *Koshi Hospital* is busier in April, May, and June, at Neuro Hospital the busiest months are July, August, and September, whereas *Nobel Medical College Teaching Hospital* is busier in January and December. The most used health centres are *Nobel Medical College Teaching Hospital, Koshi Hospital* (government), and *Golden Hospital,* in order of importance (see Table 2.4). Most of the health facilities receive IPC supply (5/6), except for *Biratnagar Hospital,* and all the health centres are operational throughout the four seasons in Biratnagar Metropolitan City.

Table 2.4: Water facility, the busiest days/months, and name of the most used health centre

Name of health centre	Status of body temperature checking	Availability of water on site	Busiest day of the week	Busiest month of the year	Name of the most used health centre	Status of IPC supply	Seasonality
Biratnagar Eye Hospital, Rani	Available	Available	Every day	October, November, December, January	Koshi Hospital	Available	All seasons
Biratnagar Hospital, Bhrikuti Chowk	Available	Available	Every day	Every month	Nobel Medical College Teaching Hospital	Not available	All seasons
Golden Hospital, Hospital Chowk	Available	Available	Every day	Every month	Golden Hospital	Available	All seasons
Koshi Hospital, Hospital Chowk	Not available	Available	Sunday	April, May, June	Nobel Medical College Teaching Hospital	Available	All seasons
Neuro Hospital, Jahada Road	Not available	Available	Monday, Sunday, Tuesday	July, August, September	Koshi Hospital	Available	All seasons
Nobel Medical College Teaching Hospital, Kanchanbari	Available	Available	Sunday	December, January	Nobel Medical College Teaching Hospital	Available	All seasons

Two (2) main assessments were done to determine the modes of transport for emergency cases to the nearest POEs, and the most common means of transport to access the health centres. The findings revealed that private transport (motorbike or 3-wheel) and ambulance are mostly used to access the POEs, especially during emergency cases, with a percentage distribution of 18.8 each, respectively. These are followed by public transport (ricksaw) and by foot with an equal percentage distribution of 15.6 each (see Fig. 2.4). On the other hand, the health centres are mostly accessed by foot and motorbike (19.2% each), followed by car and minivan with a percentage distribution of 18.7 and 18.5, respectively, similarly to most of the sites investigated in the PMM project.

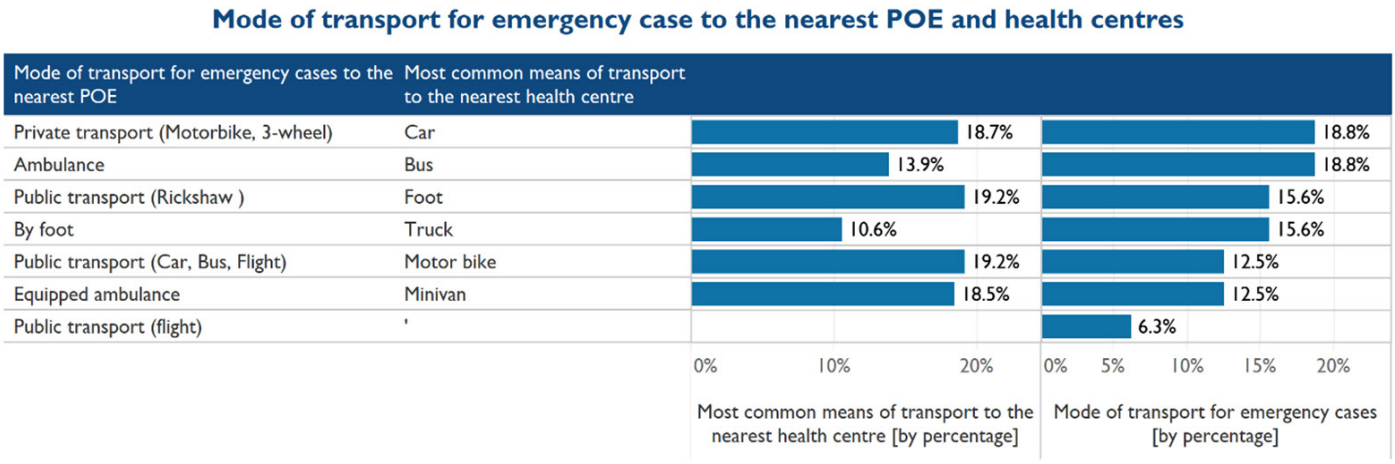


Fig. 2.4: Most common modes of transport to access the POEs during emergency cases from the health centres

In Fig. 2.5, the bars (right side) show the main purposes patients visit the health centres and the main purposes of visitors coming from India (left). The analysis shows that surgery and maternal delivery (13.5% each) are the major factors for people to seek healthcare. Secondly, typhoid, malaria, immunization, diarrhea, and antenatal and post-natal care (10.8% each), followed by COVID-19 and cholera (8.1% each), are the major reasons patients to go to the health centres. On the other hand, people coming from India mostly visit the health centres in Biratnagar Metropolitan City to treat and visit patients, with a percentage distribution of 38.5 each. This is followed by visiting health worker, teaching health worker and material and infrastructure maintenance, with an equal percentage distribution of 7.7 each. This means that people from India going to the health centres are medical practitioners whose primary objective is to treat or support the health service delivery in Nepal (see Fig. 2.5).

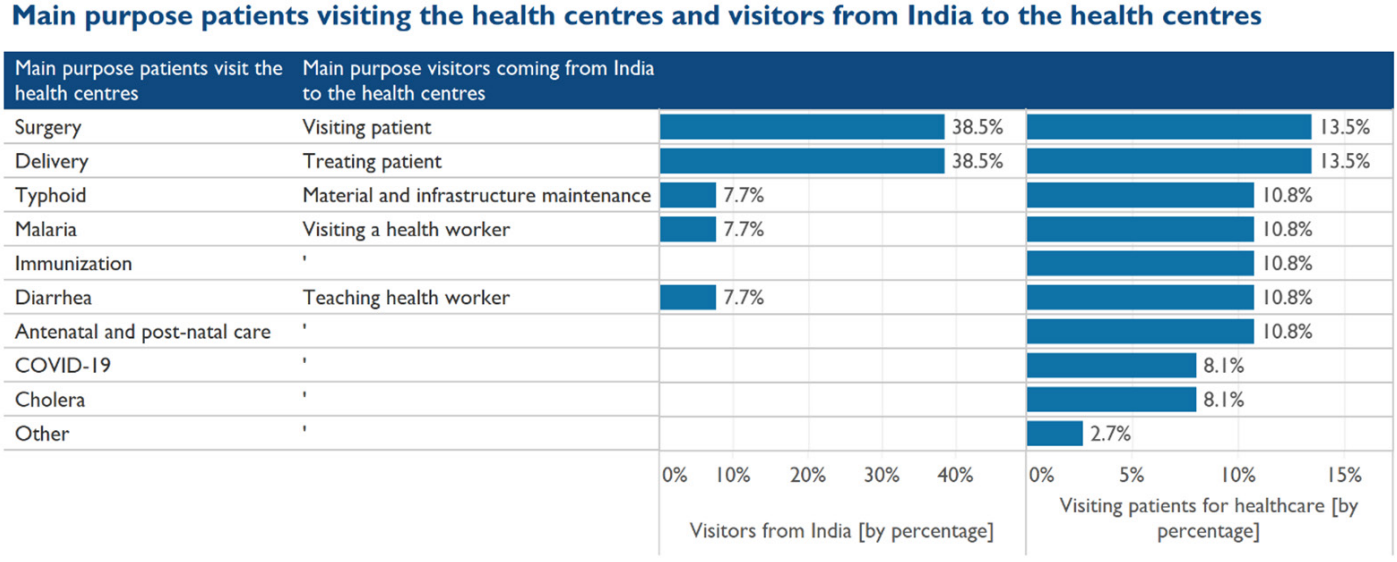


Fig. 2.5: Main reasons for patients and visitors' entry to the health centres

The analysis shows that at the health centres there are eleven (11) wards present and one (1) unnamed ward, with percentage distributions of; surgical, outpatient, medical, and emergency room (10.2% each), maternal/delivery, laboratory, laundry, intensive care, and pediatric (8.5% each), mortuary, kitchen, (6.8% each), and other ward (3.4% each) (see Fig. 2.6). Therefore, the largest wards at the health centres in Biratnagar Metropolitan City are outpatient, medical, surgical, and emergency room.

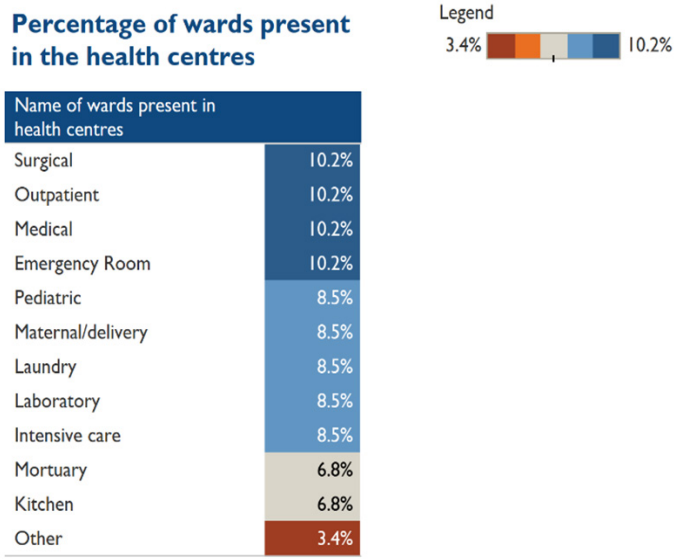


Fig. 2.6: Percentage distribution of wards present at the health centres

Fig. 2.7 shows the method of waste disposal and the type of toilet facilities at the various health centres in Biratnagar Metropolitan City. According to the chart, waste bins are available and regularly emptied, and account for the most common technique for disposal of waste (22.7% each). This is followed by burning pit (18.2%), placenta pit and incinerator, which carry an equal percentage distribution of 13.6 each, while ash pit is less significant (9.1%). Concerning the toilet facilities; flushing toilet and pour-flush latrine are the available types of toilet facilities at the health centres (12.5% and 87.5%, respectively). Therefore, the most adopted techniques for waste disposal at the health centres are waste bins (regularly emptied) and burning pit, and the available types of toilet facilities are flushing toilets and pour-flush latrines.

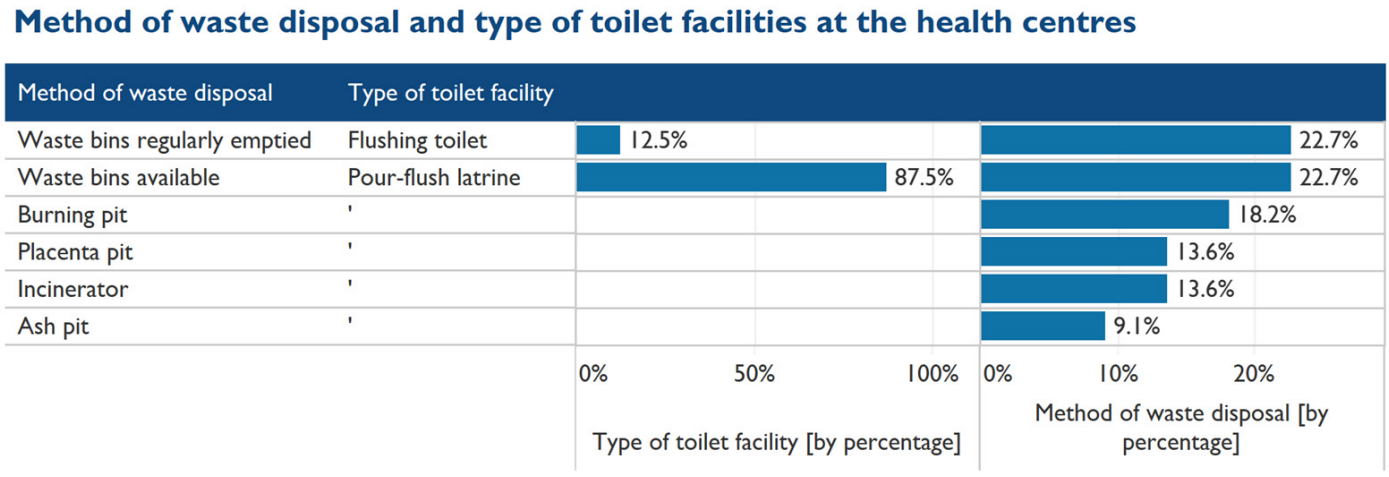


Fig. 2.7: Method of waste disposal and type of toilet facilities at the health centres

3.2.d TRADITIONAL HEALERS

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

According to the results obtained from the field observations, traditional healers in Biratnagar Metropolitan City attract noticeable number of people from both Nepal and India. The assessed traditional healers' compounds are open for visitors every day and throughout the year. However, Saturday and Tuesday are identified as the busiest days in terms of population mobility. Similarly, people's movement is higher during the months of October, November and December at the respective traditional healers' localities. The findings show that the population mobility is mainly from *Morang, Sunsari, Jhapa, Ilam, Dhankuta* and *Udayapur* districts. At the municipality level, people's movement to the investigated traditional healers mostly originates from *Biratnagar Metropolitan City, Urlabari Municipality, Pathari Sanishchare Municipality, Rangeli Municipality, Sunbarshi Municipality* and *Belbari Municipality.*

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

In terms of connectivity, *Hatkhola Mata* and *Hatkhola Dhami* are situated at *Hatkhola* locality in close proximity to each other, and are connected to *Buddha Marg* via *Hatkhola Road*. The nearest junctions and localities to these sites are *Jaljala Chowk, Gudri Chowk, Bargachhi Chowk* and *Satghumti*. Similarly, *Bhrikuti Chowk Baba (JS)* lies in *Bhrikuti Chowk,* which is linked to *Dharan Road*. The alternative routes to access this site are *DSP Road, Shankarpur Marg,* and *Chakrapani Marg*, and the nearest localities are identified as *Sanihat Chowk, Bargachhi Chowk, Tinpaini* and *Hatkhola*. Likewise, *Jharna Chowk Baba (MD Babar)* is situated at *Jharna Chowk* locality, which is associated with *Dharan Road* via *Sarada Marg* and with the nearest localities *Janpath Tole, Bhrikuti Chowk* and *Pichara*. This site is accessible by all kinds of vehicles. However, visitors use tricycles and motorbikes as modes of transport to reach this site. Similarly, *Hamro Chowk Mata (MDG)* and *Gauri Mandal Bhole Baba* are situated at *Hamro Chowk* and *Gauri Mandal* localities, respectively, in close proximity to each other. These sites are linked directly to *Dharan Road,* with the nearest localities recorded as *Hatkhola, Tinpaini, Bhrikuti Chowk* and *Satghumti*. As per the analysis from the mapping exercises, these sites are accessible by vehicle via several alternative vehicle routes, such as *Buddha Marg, Main Road (North)* and *Radha Krishna Marg*. Furthermore, *Kushal Tole Pathibharadevi Mata* and *Rampur Mata* are situated at *Kushal Tole* and *Rampur* localities, respectively, in close proximity to each other, and are connected to *Dharan Road* via *Kesaliya Marg*. The study shows that these sites are accessible by all kinds of vehicles, with the nearest localities recorded as *Janpath Tole, Satghumti, Jaljala Chowk* and *Pichara*.

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

Eight (8) traditional healers at their respective localities were investigated in Biratnagar Metropolitan City. The largest population mobility of both patients and visitors to the traditional healers' compounds can be found at *Kushal Tole Pathibharadev Mata* and *Gauri Mandal Bhole Baba,* with an average entry flow per day of 100 each, while on the busiest day the number increases to 800 and 150 people, respectively. They are followed by *Jharna Chowk Baba, Hatkhola Dhami,* and *Hamro Chowk Mata,* with an equal distribution of 50 people each per day, respectively, and 70, 60, and 70 people, respectively, on the busiest day. The remaining three (3) localities receive a minimum of 20 people and a maximum of 40 people per day, while on the busiest days, the minimum entrance is 40 people and the maximum is 60. The majority of the traditional healers (5/8) treat people from other countries, notably India (*Kushal Tole Pathibharadev Mata, Gauri Mandal Bhole Baba, Hamro Chowk Mata, Hatkhola Mata*, and *Bhrikuti Chowk Baba*) with a minimal entry flow, except for *Gauri Mandal Bhole Baba* whose influx from India is 35 per cent. The remaining

localities (3/8) are visited by people from within the surrounding municipalities in Nepal (see Fig. 3.1).

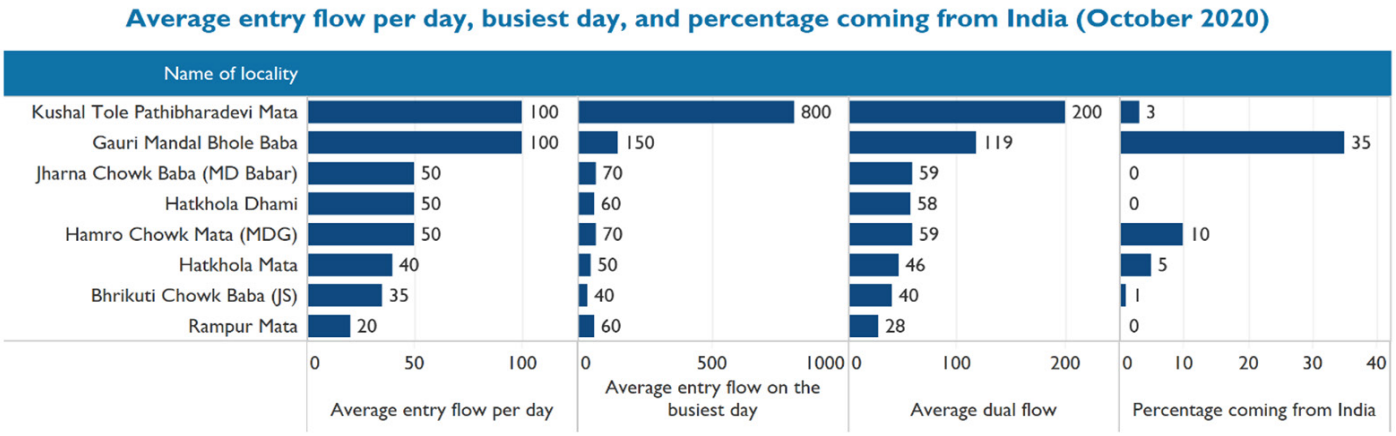


Fig. 3.1: Mobility patterns at the traditional healers' compounds

According to most of the respondents (7/8), patients seek alternative health care before visiting the traditional healers, except at *Rampur Mata* where the respondent was uncertain. The traditional healers' compounds are operational throughout the seasons and open to every denomination, except for *Gauri Mandal Bhole Baba* and *Bhrikuti Chowk Baba*. All the sites investigated are only open during day and not at night. The distance to the nearest health centres varies across each locality (see Fig. 3.2). *Kushal Tole Pathibharadevi Mata* is the farthest at about 4 Km, while *Gauri Mandal Bhole Baba* locality is 2 Km away, and *Rampur Mata, Hatkhola Dhami,* and *Bhrikuti Chowk Baba* share an equal proportion of 1 Km. The remaining three (3) localities have a minimum radius of 30 meters and a maximum radius of 700 meters. Similarly, the distance between the nearest referral centre and the health centres varies across the localities, although it is equal to the distance from the traditional healers to the health centres for some localities (*Kushal Tole Pathibharadevi Mata* and *Gauri Mandal Bhole Baba*). The farthest from the health centre to the referral centre is *Hatkhola Dhami* which is 6 Km away, and the closest distance is from *Jharna Chowk Baba* (10 meters).

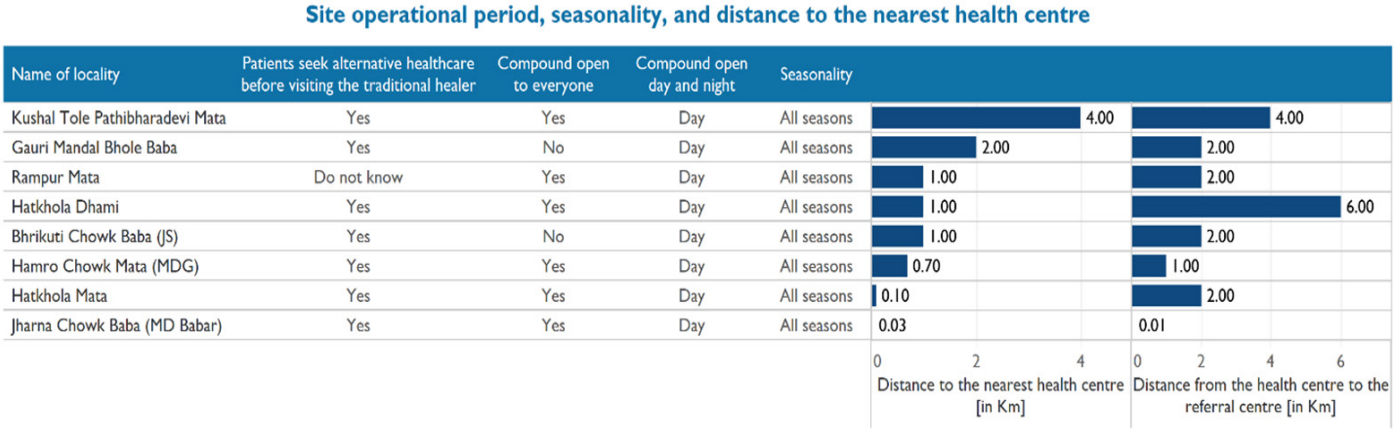


Fig. 3.2: Operational period, distance to the nearest health centre and referral centre

Waste management systems are an essential factor to determine the spaces of vulnerability of a specific site or general localities in relation to public health risks and capacity (see Table 3.1). Although the respondents asserted that they have a waste management system in place, however, the analysis shows the capacity of vulnerability spaces at the traditional healers' compounds as thus:

- There is inadequate waste disposal as some of the sites present with trash in the open and in large quantity (2/8), while most of the sites are tidy (6/8) in terms of trash.
- More than half of the sites show visibility of stagnant water on the floor in large quantity (5/8) which serves as a breeding place for mosquitoes.
- Most of the sites (7/8) have unwanted animals/insects visible in large quantity, except for *Bhrikuti Chowk Baba*.

The majority of the respondents asserted that between 15-35 per cent (4/8), greater than 50 per cent (2/8) and less than 10 per cent wear masks (2/8) at the traditional healers' compounds. Overall, between 20-40 per cent of people at the investigated compounds wear masks, whereas greater than 60 per cent do not. According to the KIs, the most used health centre in Biratnagar Metropolitan City is *Koshi Hospital* (6/8), except for *Gauri Mandal Bhole Baba* and *Hatkhola Mata* locality, whose most used health centre is *Nobel Medical College Teaching Hospital.*

Table 3.1: Waste management, environmental condition, and estimated percentage of people wearing masks at the traditional healers' compounds

Name of locality	Name of the most used health centre	Estimated percentage wearing mask	Availability of waste management system	Visibility of trash in the open	Visibility of stagnant water on the floor	Visibility of unwanted animals/insects
Bhrikuti Chowk Baba (JS)	Koshi Hospital	>50%	Available	No	No	No
Gauri Mandal Bhole Baba	Nobel Medical College Teaching Hospital	31%-50%	Available	No	No	Yes, in large quantity
Hamro Chowk Mata (MDG)	Koshi Hospital	>50%	Available	No	Yes, in large quantity	Yes, in large quantity
Hatkhola Dhami	Nobel Medical College Teaching Hospital	<10%	Available	No	Yes, in large quantity	Yes, in large quantity
Hatkhola Mata	Koshi Hospital	10%-30%	Available	No	Yes, in large quantity	Yes, in large quantity
Jharna Chowk Baba (MD Babar)	Koshi Hospital	<10%	Available	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity
Kushal Tole Pathibharadevi Mata	Koshi Hospital	10%-30%	Available	No	No	Yes, in large quantity
Rampur Mata	Koshi Hospital	10%-30%	Available	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity

The busiest day of the week varies across each locality, and only *Jharna Chowk Baba* is busy throughout the week. Half of the sites are busy throughout the year (4/8). Instead, at *Kushal Tole Pathibharadevi Mata* the busiest months are June and December, at *Bhrikuti Chowk Baba* are January, June, July, October, and November, at *Jharna Chowk Baba* the busiest month is July, and *Rampur Mata* is busier in October and November. There is the availability of water and toilet facilities at all the sites investigated, with half of the sites having at most 1 stall/drop hole and half of them with at most 2 stalls/drop holes. The most common type of toilet facilities is the pour-flush latrine (7/8), except at *Hamro Chowk Mata* locality (pit latrine and flushing toilet). Most of the localities have water facilities nearby for handwashing with soap, at most 200 meters away. In terms of the number of visitors per stall/drop hole ratio, it is higher in the following localities; *Kushal Tole Pathibharadevi Mata, Hatkhola Dhami, Hamro Chowk Mata*, and *Gauri Mandal Bhole Baba,* with a patients/visitors per stall/drop hole distribution ratio of 100:1 and 50:1, each, respectively (see Fig. 3.3).

Water and toilet facilities and busiest days/months at the traditional healer's compound

Name of locality	Busiest day of the week	Busiest month of the year	Availability of toilet nearby	Availability of water on site	Type of toilet available
Kushal Tole Pathibharadevi Mata	Saturday	June, December	Available	Available	Pour-flush latrine
Hatkhola Dhami	Saturday	Every month	Available	Available	Pour-flush latrine
Hamro Chowk Mata (MDG)	Tuesday, Saturday	Every month	Available	Available	Pit Latrine, flushing toilet
Gauri Mandal Bhole Baba	Saturday	Every month	Available	Available	Pour-flush latrine
Hatkhola Mata	Tuesday, Monday	Every month	Available	Available	Pour-flush latrine
Jharna Chowk Baba (MD Babar)	Every day	July	Available	Available	Pour-flush latrine
Bhrikuti Chowk Baba (JS)	Tuesday, Saturday	June, July, October, November, January	Available	Available	Pour-flush latrine
Rampur Mata	Monday, Saturday, Wednesday	October, November	Available	Available	Pour-flush latrine

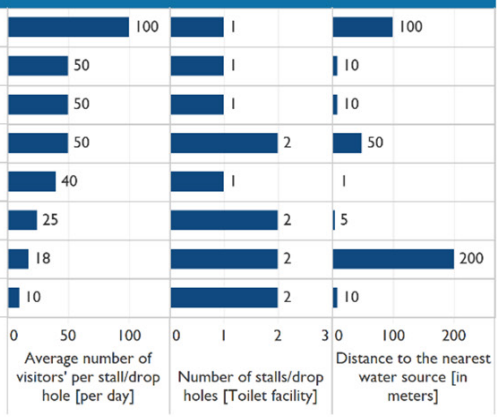


Fig. 3.3: Water and toilet facilities, the busiest days/months, and patients to stall/drop hole ratio

All the traditional healers use protective gears during their practices (8/8) where the study was conducted in Biratnagar Metropolitan City. This is important as these practices might contribute to the spread of contagious diseases within and outside the nearby communities, and eventually spread to other nations, as in the case of Ebola, COVID-19, and Influenza viruses[3]. Half of the traditional healers' compounds (4/8) are organized in sectors, and half are not (4/8), which account for the inadequate treatment of people seeking alternative healthcare, be it related to health or other. According to the respondents, most of the traditional healers do not have an isolated room to conduct their health practices (5/8), while at the remaining compounds it is available (3/8). Furthermore, the traditional healers do advice their patients to seek alternative health treatment after visiting the respective compounds in at least five (5) cases, namely; when they cannot cure the disease, serious illness, chest and orthopaedic problem, if the treatment takes too long to recover, and fractured or extreme bleeding and/or other complications. All the traditional healers' localities have a good or uninterrupted network for voice communication. There were two (2) suspected COVID-19 positive cases found on site at *Bhrikuti Chowk Baba* and *Kushal Tole Pathibharadevi Mata* (see Table 3.2).

Table 3.2: Use of protective gears, suspected COVID-19 cases, isolated room, sites organisation, and status of voice communication system at the traditional healers' compounds

Name of locality	Suspected COVID-19 cases on site	Use of protective materials during practices	Organisation of traditional healer's compound in sectors	Availability of isolated rooms during practices	Status of voice communication system	Situation traditional healers advice patients to seek alternative healthcare
Bhrikuti Chowk Baba (JS)	Yes	Yes	Not organised	Not available	Good (uninterrupted network)	When she cannot cure the disease
Gauri Mandal Bhole Baba	No	Yes	Organised	Not available	Good (uninterrupted network)	When she cannot cure the disease
Hamro Chowk Mata (MDG)	No	Yes	Organised	Available	Good (uninterrupted network)	Chest and orthopedic problem
Hatkhola Dhami	No	Yes	Organised	Available	Good (uninterrupted network)	Serious illness
Hatkhola Mata	No	Yes	Not organised	Available	Good (uninterrupted network)	When she cannot cure the disease
Jharna Chowk Baba (MD Babar)	Do not know	Yes	Not organised	Not available	Good (uninterrupted network)	If treatment takes too long to recover
Kushal Tole Pathibharadevi Mata	Yes	Yes	Organised	Not available	Good (uninterrupted network)	Fractured, extreme bleeding, and other complications
Rampur Mata	No	Yes	Not organised	Not available	Good (uninterrupted network)	When he cannot cure the disease

[3] *https://www.who.int/tdr/publications/tdr-research-publications/ritam/en/*

Fig. 3.4 shows the common diseases and practices performed by the traditional healers, as well as the main reasons people visit their compounds. According to the analysis, mental illness, lower abdominal pain, headache, and abdominal pain (14.3% each) are the most common diseases treated by the traditional healers. These are followed by other diseases and fever (11.4% each), skin diseases (8.6%), yellow fever (5.7%), measles and COVID-19 (2.9% each). The types of practices performed by the traditional healers, which account for the main reasons of patients' visits, in order of importance, include; divination (23.3%), protection, disease cure, and mental illness (16.7%), other diseases (13.3%), exorcism and love password (mohani) (6.7% each). Therefore, the most common diseases cured by the traditional healers are lower and abdominal pain, mental illness, and headache, and the most adopted health practices by the traditional healers in Biratnagar Metropolitan City are divination, protection, mental illness and different types of diseases cure.

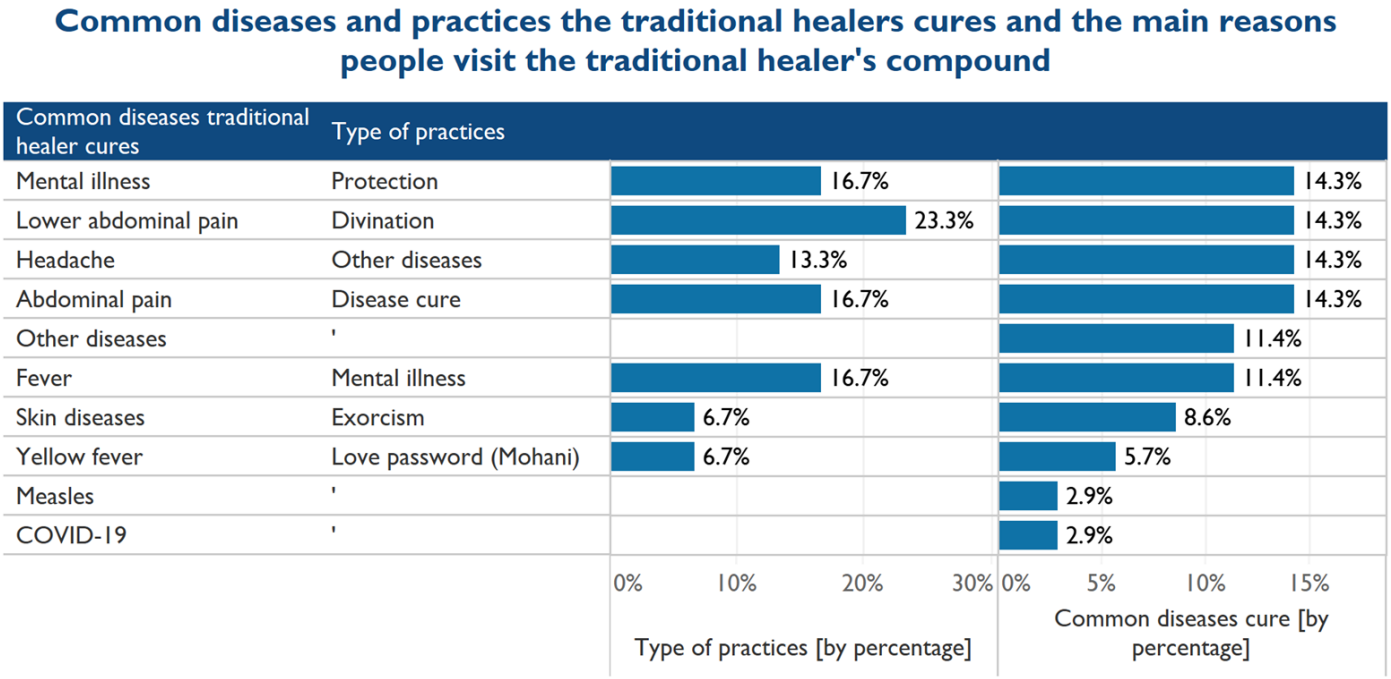


Fig. 3.4: Common diseases and health practices at the traditional healers' compounds

3.2.e SCHOOLS AND COLLEGES

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

The findings show that schools and colleges in Biratnagar Metropolitan City, largely attract students from localities and municipalities nearby. However, some of the assessed colleges also attract students from outside the country, namely India and Bangladesh. Regarding the population mobility at the investigated schools and colleges, these sites are open every day and throughout the year, except Saturdays and other public holidays.

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

Nobel Medical College Teaching Hospital and *Pokhariya Secondary School* are located at *Kanchanbari* and *Pokhariya*, respectively, which are connected to *Dharan Road* and are accessible by all kinds of vehicles. The nearest localities

to these schools and colleges are recorded as *Airport Area, Thulo Mill Chowk, Pipal Chowk, Buddha Chowk, Pokhariya* and *Kanchanbari*. Similarly, *St. Joseph Secondary School* is situated at *Tinpaini Chowk,* which is linked to *Sikshya Marga* and *Dharmabhakta Marg,* and the nearest localities are *Hatkhola, Bargachhi Chowk, Banjara Chowk* and *Sanihat Chowk*. Correspondingly, *Merryland College* and *Jamia Islamia Secondary School* are situated at *Hospital Chowk* and *Sarochiya* localities, respectively, in close proximity to each other, and are linked to *Dharan Road* through *Buddha Marg*. The alternative vehicle routes to access these schools are *Rangeli Marga, Main Road* and *Satyanarayan Marga,* with the nearest localities being *Tinpaini, Kanchanbari, Bargachhi Chowk* and *Jaljala Chowk*. Likewise, *Bal Kalyan Vidya Mandir School* lies in *Pichara* locality, which is linked to *Dharan Road* via *Buddha Bihar Marg*, and connected to other alternative routes, such as *Janpath Marga, Dharanidhar Marg* and *Kavi Lekhnath Marga*, with the nearest localities recorded as *Panchali Tole, Janpath Tole* and *Ganga Tole*. Furthermore, *Gautam Budha School* is located at *Rani* locality, which is connected to *Dharan Road* via *Bank Road* and also accessible by other alternative routes, such as *Rani Path, Rishikesh Marg,* and *Chemical Marg,* with the nearest localities being *Pani Tanki, Daraiya, Hansmukhi Tole* and *Ganga Tole*.

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

A total of seven (7) schools/colleges were investigated in Biratnagar Metropolitan City. Among them, four (4) are secondary schools and three (3) are tertiary educational institutions. The average attendance differs across the schools/colleges. *Bal Kalyan Vidya Mandir School, Merryland College,* and *Pokhariya Secondary School* account for the highest mobility with 3,000, 2,500, and 2,400 attendance per day, while on the busiest days the attendance of pupils/students increases to 3,100, 3,000, and 2,500, respectively. At the remaining four (4) schools, the daily average attendance ranges from 250 up to 1,100 (*Gautam Budha School* and *St. Joseph Secondary School*), whereas on the busiest days, they have a distribution of 300 and 1,500 pupils/students, respectively. Four (4) out of seven (7) schools/colleges have citizens from India as pupils/students, carrying a distribution of 1 per cent (*St. Joseph Secondary School, Gautam Budha School,* and *Jamia Islamia Secondary School*) and 25 per cent (*Nobel Medical College Teaching Hospital*). *Bal Kalyan Vidya Mandir School, Merryland College,* and *Pokhariya Secondary School* are the only institutions whose students/pupils are from within Biratnagar Metropolitan City (see Fig. 4.1).

Average attendance per day, busiest day, and percentage coming from India (October 2020)

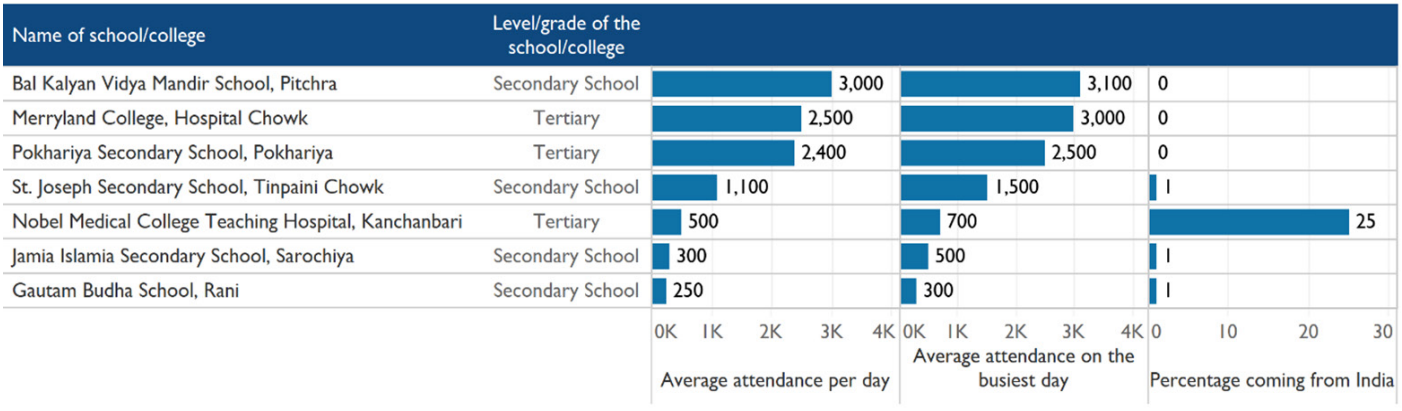


Fig. 4.1: Population mobility at the schools/colleges

Most of the schools investigated (5/7) have health agents or volunteers to address health related issues, except for *Jamia Islamia Secondary School* and *Gautam Budha School.* The nearest health centre differs across the respective schools and colleges, except for *Pokhariya Secondary School* and *Gautam Budha School,* whose nearest health centre is *Koshi Hospital.* There is the availability of water at all the schools and colleges investigated. The distance to the nearest water source ranges from a minimum of 5 meters (*Merryland College*) to a maximum of 1 Km (*Jamia Islamia Secondary School*). The farthest distance to the nearest health centre is from *St. Joseph Secondary School,* which is 4 Km away, followed by two (2) schools; *Pokhariya Secondary School* and *Bal Kalyan Vidya Mandir School,* with an equal distance of 3 Km. The closest is *Nobel Medical College Teaching Hospital,* which is only 200 meters away (see Fig. 4.2).

Availability of health agent, water, and distance to nearest health centre

Name of school/college	Name of the nearest health centre	Availability of health community worker/agent	Availability of water on site	Distance to the nearest health centre [in Km]	Distance to the nearest water source [in meters]
St. Joseph Secondary School, Tinpaini Chowk	Surakshya Hospital Pvt. Ltd.	Available	Available	4.0	20.0
Pokhariya Secondary School, Pokhariya	Koshi Hospital	Available	Available	3.0	200.0
Bal Kalyan Vidya Mandir School, Pitchra	Saptakoshi Nursing Home	Available	Available	3.0	10.0
Jamia Islamia Secondary School, Sarochiya	Koshi Hospital	Not available	Available	2.0	1,000.0
Gautam Budha School, Rani	Rani Health Post	Not available	Available	0.5	100.0
Merryland College, Hospital Chowk	Green Cross Hospital	Available	Available	0.4	5.0
Nobel Medical College Teaching Hospital, Kanchanbari	Nobel Medical College Teaching Hospital	Available	Available	0.2	100.0

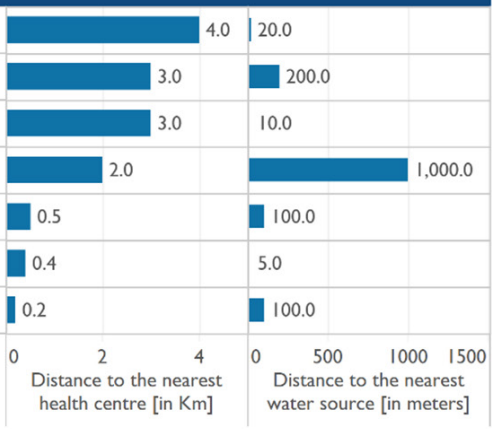


Fig. 4.2: Availability of health agent, and distances to the nearest health centre and water source

The number of classrooms varies across the schools. *Bal Kalyan Vidya Mandir School, Merryland College, Nobel Medical College Teaching Hospital* and *Gautam Budha School* account for the largest number of classrooms due to their high influx of pupils, with 110, 48, and 35 classrooms each, respectively (see Fig. 4.3). *Nobel Medical College Teaching Hospital, Bal Kalyan Vidya Mandir School, St. Joseph Secondary School* and *Merryland College* have the largest number of desks, with a maximum of 1,500 and a minimum of 530. The minimum number of pupils/students per desk is less than 1 (*Nobel Medical College Teaching Hospital*) and thus indicates that there are more desks than the total school population, whereas the maximum is 5 at *Pokhariya Secondary School* (government). Instead, *St. Joseph Secondary School* (private), *Jamia Islamia Secondary School* (community/religious) and *Merryland College* (private) have 2 students per desk each, and *Bal Kalyan Vidya Mandir School* and *Gautam Budha School,* which are both private institutions, have 3 each. *Pokhariya Secondary School* has the largest number of students/pupils per classroom (66), followed by *Bal Kalyan Vidya Mandir School* and *St. Joseph Secondary School,* with a distribution of 29 and 28 pupils/students per classroom, respectively. The remaining schools/colleges have at most 24 pupils/students, and at least 11 students/pupils per classroom. The number of desks per classroom accounts for the highest at *Nobel Medical College Teaching Hospital* (43), while the remaining schools/colleges have at most 16 desks, and at least 8 desks per classroom (see Fig. 4.3).

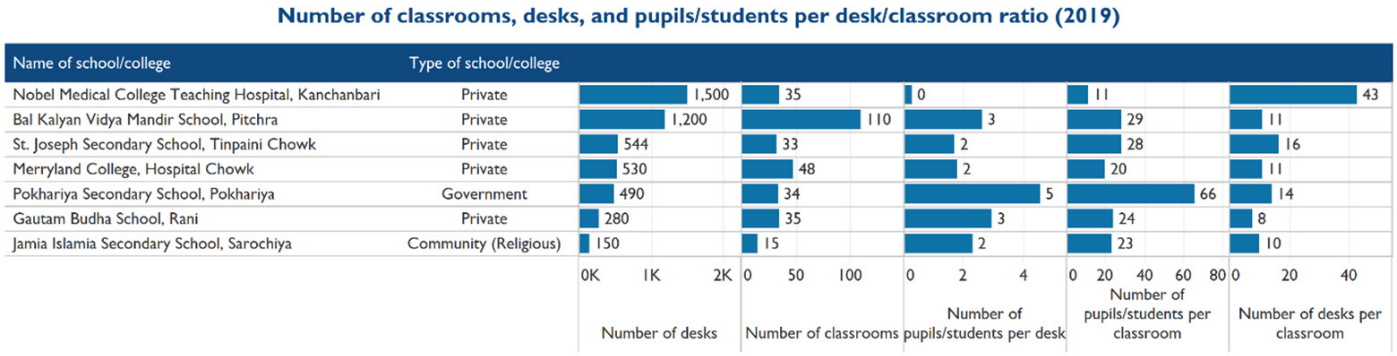


Fig. 4.3: Number of students/pupils, classrooms, and desk ratio

All the schools have separate toilet facilities for students/pupils and most of the teachers have separate toilet facilities for male and female (5/7), with the exception of *Merryland College* and *Jamia Islamia Secondary School*. *Bal Kalyan Vidya Mandir School* has the largest toilet facilities for both male and female students, with 40 each, respectively. This is followed by *Nobel Medical College Teaching Hospital,* with 20 for male and 25 for female. The remaining educational institutions have at least 3 stalls/drop holes for male, 4 stalls/drop holes for female, and at most 10 stalls/drop holes each for male and female. As for the teachers, *Bal Kalyan Vidya Mandir School* have equal toilet facilities for both male and female (10 each), and *St. Joseph Secondary School* has 30 for male and 25 for female, while the remaining schools have 2 each per gender (see Fig. 4.4).

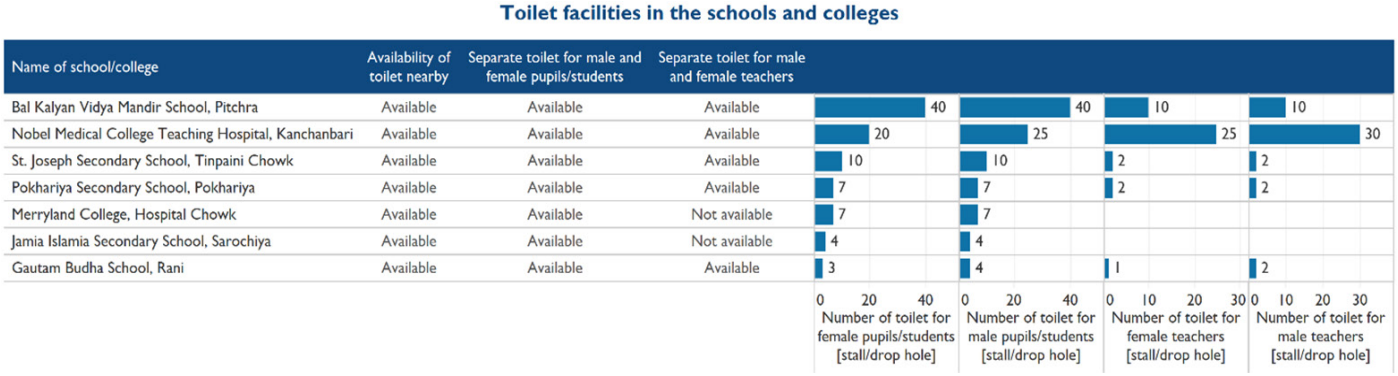


Fig. 4.4: Categories of toilet facilities at the schools/colleges

Fig. 4.5 shows the average number of students/pupils and teachers per stall/drop hole as of October 2020. *Pokhariya Secondary School* (government) and *Gautam Budha School* (private) account for the highest number of both male and female pupils/students per stall with 172 and 133, and 149 and 100, respectively. At the remaining five (5) schools, the maximum number of males per stall is 62, and the minimum is 10. Similarly, the maximum number of females per stall is 87 and the minimum is 8. Generally, there are more male students/pupils per stall than female students/pupils across the schools, except for *Merryland College* and *Jamia Islamia Secondary School.* This is as a result of the higher population distribution for male than for female pupils/students (see Fig. 4.3). Overall, the maximum number of students/pupils per stall is 160 (*Pokhariya Secondary School*), and the minimum number of students/pupils per stall is 9 (*Nobel Medical College Teaching Hospital*). As for the teachers, the maximum number of teachers per stall is 16 (*Pokhariya Secondary School*), and the minimum is 4 (*Nobel Medical College Teaching Hospital*). *Merryland College*

and *Jamia Islamia Secondary School* do not have separate toilets for male and female teachers. Overall, the analysis shows that the government school (*Pokhariya Secondary School*) has limited toilet facilities when compared to the population distributions across the other schools/colleges investigated.

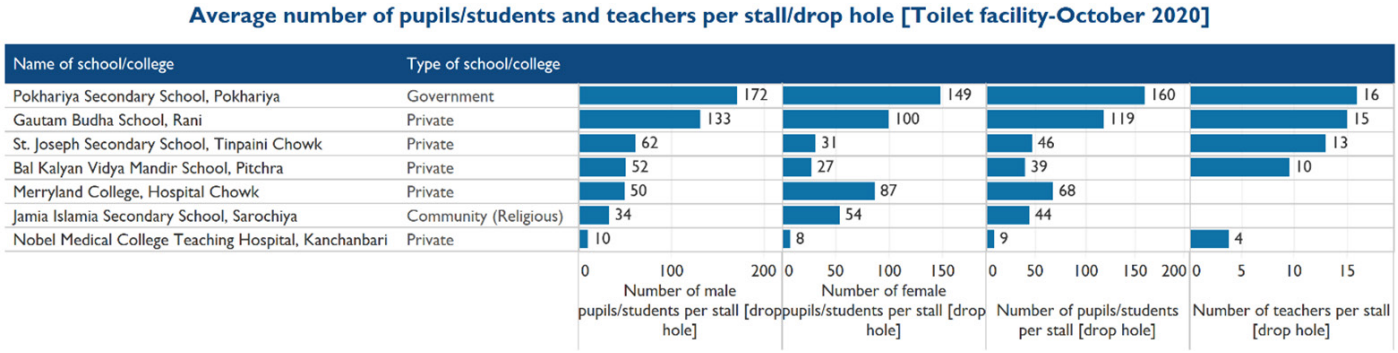


Fig. 4.5: Population of pupils/students and teachers per stall (drop hole) ratio

Fig. 4.6 shows the population distribution at the respective schools/colleges for the 2019/2020 academic year. The bar in blue colour shows the overall number enrolled in 2019, in orange is the number of female students, in green is the number of male students, in red is the number of pupils/students per teacher, and the bar in grey indicates the number of teachers at the schools/colleges. *Bal Kalyan Vidya Mandir School* and *Pokhariya Secondary School* are the most populated schools in Biratnagar Metropolitan City, with an outlier of 3,150 and 2,244 pupils enrolled in 2019, respectively. These are followed by *Merryland College, St. Joseph Secondary School,* and *Gautam Budha School,* with a student population distribution of 957, 929, and 830, respectively. According to the study, overall, the secondary institutions generally have a higher population compared to the tertiary institutions, except for *Pokhariya Secondary School.* In regard to male to female ratio, there are more male candidates than female across five (5) densely populated schools and nearly double the size of the female population, except for *Merryland College* and *Jamia Islamia Secondary School* where females are in slightly higher number than their male counterpart. The gender ratio reaches up to 992 more male than female pupils (*Bal Kalyan Vidya Mandir School*) and a maximum of 261 more females than males (*Merryland College*). In descending order, there are 35 pupils per teacher at *Pokhariya Secondary School,* 18 students per teacher at *Gautam Budha School* and *St. Joseph Secondary School* each, 17 students per teacher at *Bal Kalyan Vidya Mandir School,* closely followed by *Jamia Islamia Secondary School* with 13, 10 students per teacher at *Merryland College,* and 2 students per teacher at *Nobel Medical College Teaching Hospital.*

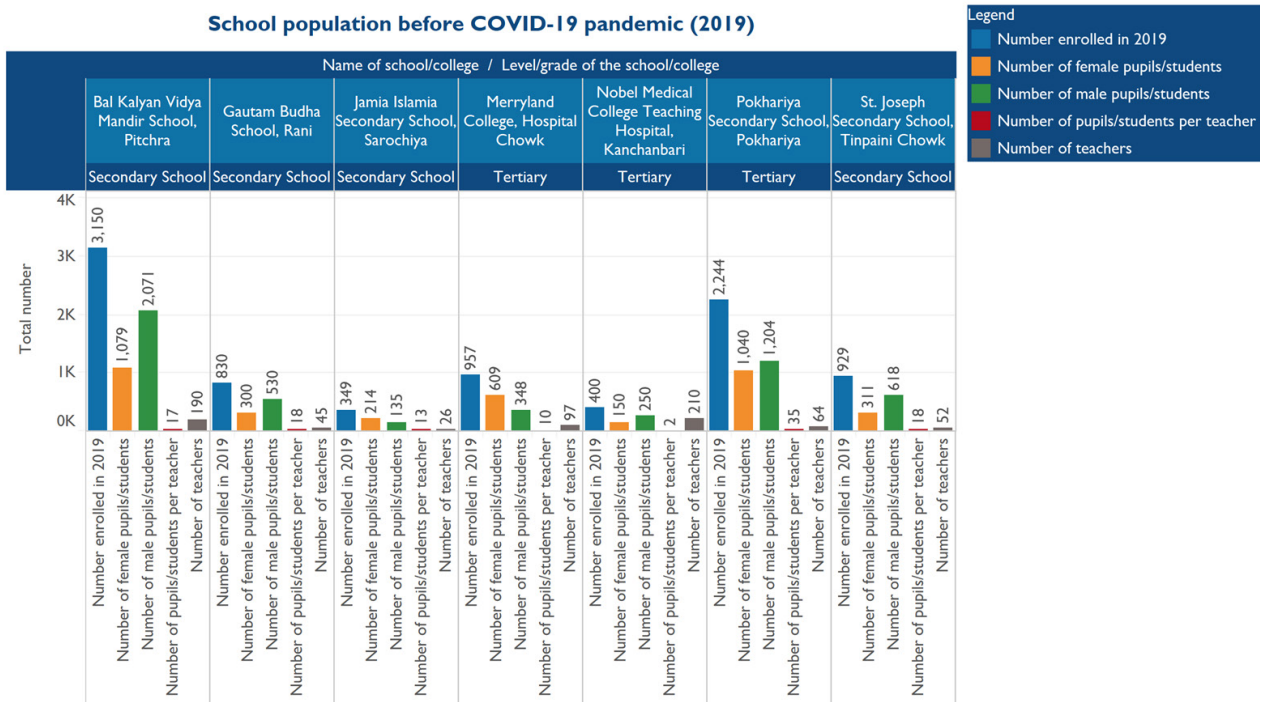


Fig. 4.6: Population distribution at the schools/colleges

In regard to mask-wearing practices, overall, greater than 50 per cent of the pupils/students wear masks at the respective schools, except for *Jamia Islamia Secondary School* and *Merryland College* whose percentage is between 31-50 per cent and less than 10 per cent, respectively. All the schools have isolated places dedicated for pupils/students when they get sick (7/7). The majority of the schools are busy throughout the week (except on the weekends) and are operational throughout the seasons, except for *Nobel Medical College Teaching Hospital* whose busiest day is Sunday, similarly to *St. Joseph Secondary School* which is also busier in May and June. There was a suspected COVID-19 positive case in *Nobel Medical College Teaching Hospital*, probably due to its bifunctional feature as both a school and hospital. All the schools and colleges do not have tracking matrix for visitors as part of contact tracing mechanisms. There are inadequate health screening stations (handwashing with soap, hand sanitizer, and body temperature checking) since only four (4) out of seven (7) schools/colleges have them in place (see Table 4.1).

Table 4.1: Health checks, tracking matrix, and schools/colleges seasonality

Name of school/college	Estimated percentage wearing mask	Suspected COVID-19 case on site	Availability of health screening station	Isolated place dedicated for sick pupils/students	Busiest day of the week	Busiest month of the year	Seasonality	Availability of record book/device for visitors
Bal Kalyan Vidya Mandir School, Pitchra	>50%	No	Available	Available	Every day	Every month	All seasons	Not available
Gautam Budha School, Rani	>50%	No	Available	Available	Every day	Every month	All seasons	Not available
Jamia Islamia Secondary School, Sarochiya	31%-50%	Do not know	Not available	Available	Every day	Every month	All seasons	Do not know
Merryland College, Hospital Chowk	<10%	No	Not available	Available	Every day	Every month	All seasons	Do not know
Nobel Medical College Teaching Hospital, Kanchanbari	>50%	Yes	Available	Available	Sunday	Every month	All seasons	Not available
Pokhariya Secondary School, Pokhariya	>50%	No	Not available	Available	Every day	Every month	All seasons	Not available
St. Joseph Secondary School, Tinpaini Chowk	>50%	Do not know	Available	Available	Sunday	June, May	All seasons	Not available

Based on the PMM findings in Biratnagar Metropolitan City, vulnerability can be determined by poor health systems and/or in terms of health infrastructure, and in particular, hygiene management. The waste management system is available but not adequate according to eye findings and the following parameters;

- Visibility of trash in the open (3/7) in limited quantity, except for *Bal Kalyan Vidya Mandir School, Gautam Budha School, Nobel Medical College Teaching Hospital,* and *Pokhariya Secondary School.*
- Visibility of stagnant water on the floor in limited quantity (5/7), except at *Gautam Budha School* and *Nobel Medical College Teaching Hospital,* especially during the rainy season.
- Visibility of unwanted animals/insects (7/7) in limited quantity at all the sites investigated.

The most used health centre from the respective schools and colleges are *Koshi Hospital (5/7)* and *Nobel Medical College Teaching Hospital* (2/7). Most of the schools and colleges have cafeterias or food services for their pupils/ students and teachers, except for *Gautam Budha School* and *Jamia Islamia Secondary School* (Table 4.2).

Table 4.2: Waste management, food service, and the most used health centre

Name of school/college	Availability of waste management system	Visibility of trash in the open	Visibility of stagnant water on the floor	Visibility of unwanted animals/insects	Availability of cafeteria/food service	Name of the most used health centre
Bal Kalyan Vidya Mandir School, Pitchra	Do not know	No	Yes, limited	Yes, limited	Available	Koshi Hospital
Gautam Budha School, Rani	Not available	No	No	Yes, limited	Not available	Koshi Hospital
Jamia Islamia Secondary School, Sarochiya	Available	Yes, limited	Yes, limited	Yes, limited	Not available	Koshi Hospital
Merryland College, Hospital Chowk	Available	Yes, limited	Yes, limited	Yes, limited	Available	Koshi Hospital
Nobel Medical College Teaching Hospital, Kanchanbari	Not available	No	No	Yes, limited	Available	Nobel Medical College Teaching Hospital
Pokhariya Secondary School, Pokhariya	Not available	No	Yes, limited	Yes, limited	Available	Koshi Hospital
St. Joseph Secondary School, Tinpaini Chowk	Not available	Yes, limited	Yes, limited	Yes, limited	Available	Nobel Medical College Teaching Hospital

3.2.f ENTERTAINMENT CENTRES

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

The findings reveal that the entertainment centres in Biratnagar Metropolitan City are open to the public every day and throughout the year, except during government-imposed restriction orders to avoid congregations during pandemics or any other public health crisis. However, Friday and Saturday are recorded as the busiest days in terms of population mobility. In the same way, the busiest months at the investigated entertainment centres are January, October, November, and December. The study shows that the population mobility accounted for the respective entertainment centres is mainly from *Morang, Sunsari, Jhapa, Ilam,* and *Dhankuta* districts. At the municipality level, people's movement mostly originates in Biratnagar Metropolitan City and *Belbari Municipality, Urlabari Municipality, Pathari Sanishchare Municipality, Sunbarshi Municipality, Kanepokhari Rural Municipality, Jahada Rural Municipality* and *Rangeli Municipality.*

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

In terms of connectivity, *Food Festival Site, Central Mall, Eco Fountain Park* and *Sahid Rangasala* are located at the *Main Road, DSP Chowk, Sahid Marg* and *Hospital Chowk* localities, respectively, in close proximity to each other.

These sites are connected to the *Main Road* via several alternative routes, such as *Dharan Road, DSP Road,* and *Buddha Marg*, and the nearest localities are *Gudri Chowk, Sanihat Chowk, Hatkhola, Satghumti* and *Bhrikuti Chowk.* In the same way, *Himalayan Talkies Pvt. Ltd*. and *Geet Ghazal* are situated at *Mahendra Chowk* locality and are connected to *Dharan Road.* The alternative routes to access these sites are *Kesaliya Marg, Janpath Marg, Mahendra Marg* and *Buddha Marg,* with the nearest localities recorded as *Roadshes Chowk, Panchali Tole, Pichara* and *Satghumti*. Likewise, *Metro City Hotel* and *Hungry Cafe and Bar* are located at *Bus Park* locality, connected to *Dharan Road* via *Buddha Bihar Marg* and *Dharanidhar Marg*, with the nearest localities identified as *Roadshes Chowk, Gudri Chowk, Janpath Tole,* and *Panchali Tole*. Correspondingly, *City Cinema Hall* and *RK City Center* are situated at *Tinpaini* and *Hatkhola Chowk* localities, respectively, at an equidistance from each other. These sites are associated with the *Main Road (North)* and *Buddha Marg,* with the connectivity of alternative routes, such as *Sahid Marg, Rangeli Road* and *Bargachhi Marg*, and the nearest localities being *Hatkhola, Sanihat Chowk, Jaljala Chowk* and *Bargachhi Chowk. Bhatbhateni Supermarket* is located at *Satghumti* locality, which is linked to *Dharan Road.* The alternative routes to this site are *Satya Narayan Marg, Shiv Mandir Marg,* and *Rangeli Road*, with the nearest localities identified as *Jaljalamod, Hatkhola, Tinpaini* and *Main Road.* Furthermore, *Arun Cinema Hall* and *Deurali Hotel and Bar* are located at *Rani* locality, which is situated close to *Rani POE* (formal) and connected to *Dharan Road*. The major alternative routes to access these sites are *Rani Path* and *Raja Birat Marg,* and the nearest localities are recorded as *Rani, Hansmukhi Tole* and *Daraiya*. According to the analysis, the investigated entertainment centres are accessible by all kinds of vehicles. However, people from India and nearby localities mainly use tricycles, motorbikes and cars to access the respective sites.

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

According to the matrix analysis, thirteen (13) main entertainment centres in Biratnagar Metropolitan City fall under the localities with the largest influx of people, which is greater than the analysis obtained in all other municipalities in Sudurpashchim Province 7, Lumbini Province, and Province 1. *Central Mall* has the largest influx of people with 8,000 per day, and on the busiest day, the number increases to 15,000. This is followed by *RK City Centre* and *Sahid Rangasala* with 2,500 and 1,500 people per day, and 5,000 and 2,000 people on the busiest day, respectively (see Fig. 5.1). The remaining ten (10) sites receive a maximum of 350 people (*City Cinema Hall*) and a minimum of 50 people (*Metro City Hotel, Hungry Café and Bar,* and *Deurali Hotel and Bar*) per day. Except for *Central Mall,* which receives people from India, Bangladesh, and Afghanistan, most of the entertainment centres (12/13) receive people from India. *Deurali Hotel and Bar* is visited by the highest percentage of people from other countries (about 60%), followed by *Eco Fountain Park* and *Arun Cinema Hall* (about 50% each), and *City Cinema Hall* and *Geet Ghazal* (about 40% each). The remaining eight (8) entertainment centres receive a maximum of 30 per cent and a minimum of 5 per cent of people from India. This shows that among all the sites investigated for the PMM activities in Biratnagar Metropolitan City, the entertainment centres receive the largest influxes of people from India, with a minority coming from Afghanistan and Bangladesh.

Average entry flow per day, busiest day, and percentage coming from other country (October 2020)

Name of entertainment centre	People coming from other country	Average entry flow per day	Average entry flow on the busiest day	Average dual flow	Percentage coming from other country
Central Mall, DSP Chowk	India, Afghanistan, Bangladesh	8,000	15,000	9,154	30
RK City Center, Hatkhola Chowk	India	2,500	5,000	2,885	5
Sahid Rangasala, Hospital Chowk	India	1,500	2,000	1,654	10
City Cinema Hall, Tinpaini	India	350	450	385	40
Bhatbhateni Supermarket, Satghumti	India	300	400	331	25
Eco Fountain Park, Sahid Marg	India	250	700	304	50
Himalayan Talkies Pvt. Ltd., Mahendra Chowk	India	200	500	238	15
Food Festival Site, Main Road	India	200	500	238	30
Arun Cinema Hall, Rani	India	200	500	238	50
Geet Ghazal , Mahendra Chowk	India	80	100	88	40
Metro City Hotel, Buspark	India	50	80	56	20
Hungry Cafe and Bar, Buspark	None	50	150	62	10
Deurali Hotel and Bar, Rani	India	50	100	58	60

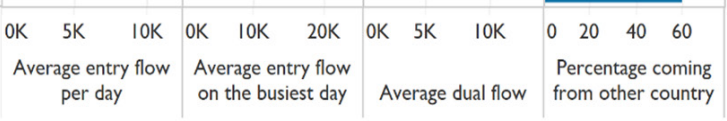


Fig. 5.1: Population mobility at the entertainment centres

Despite all the entertainment centres being operational throughout the seasons, except for *Eco Fountain Park* whose seasonality is winter and summer only, the majority of these sites do not check body temperature before visitors' entry (12/13), except for *RK City Centre*. Similarly, health screening stations (handwashing with soap and hand sanitizer) are absent (10/13), except for *City Cinema Hall, RK City Centre,* and *Hungry Café and Bar* (see Fig. 5.2). There is the availability of both water and toilet facilities nearby, except for *Eco Fountain Park* where water is not available and *Himalayan Talkies Pvt. Ltd.* where the respondent was unsure. Among the available toilet facilities, there is at least 1 stall/drop hole (*Hungry Café and Bar*) and at most 40 stalls/drop holes for visitors and staffs (*Food Festival Site*). The distance to the water sources is limited, with the farthest being 50 meters (*Central Mall*) and the closest 1 meter (*Arun Cinema Hall, Deurali Hotel and Bar, City Cinema Hall,* and *Metro City Hotel*). Similarly, the distance to the nearest health centre differs across the thirteen (13) entertainment centres, the most distant being *Arun Cinema Hall* (8 Km away) and the closest *Hungry Café and Bar* (less than 10 meters away).

Availability of health screening station, water and toilet facilities, and distance to the nearest health centre and water source

Name of entertainment centre	Availability of health screening station	Body temperature checking status	Availability of toilet nearby	Availability of water on site	Seasonality	Distance to the nearest health centre	Distance to the nearest water source [in meters]	Number of stalls/drop holes [Toilet facility]
Arun Cinema Hall, Rani	Not available	Not available	Available	Available	All seasons	8.00	1	4
Deurali Hotel and Bar, Rani	Not available	Not available	Available	Available	All seasons	6.00	1	4
Central Mall, DSP Chowk	Not available	Not available	Available	Available	All seasons	5.00	50	30
Eco Fountain Park, Sahid Marg	Not available	Not available	Available	Not available	Winter and summer only	2.00		2
City Cinema Hall, Tinpaini	Available	Not available	Available	Available	All seasons	1.50	1	12
RK City Center, Hatkhola Chowk	Available	Available	Available	Available	All seasons	1.00	5	20
Bhatbhateni Supermarket, Satghumti	Not available	Not available	Available	Available	All seasons	1.00	10	10
Metro City Hotel, Buspark	Not available	Not available	Available	Available	All seasons	0.50	1	15
Food Festival Site, Main Road	Not available	Not available	Available	Available	All seasons	0.50	15	40
Himalayan Talkies Pvt. Ltd., Mahendra Chowk	Not available	Not available	Available	Do not know	All seasons	0.40		6
Sahid Rangasala, Hospital Chowk	Not available	Not available	Available	Available	All seasons	0.02	3	9
Geet Ghazal , Mahendra Chowk	Not available	Not available	Available	Available	All seasons	0.02	20	8
Hungry Cafe and Bar, Buspark	Available	Not available	Available	Available	All seasons	0.00	2	1

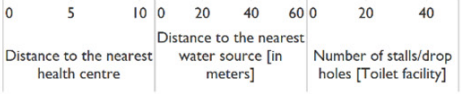


Fig. 5.2: Availability of health screening station, water and toilet facilities, and distances to the nearest health centre and water source

Table 5.1 shows the availability of community health workers or agents, presence of isolated rooms dedicated for sick people, the busiest days/months, and the nearest and most used health centre. There is no presence of community health workers/volunteers at all the entertainment centres. Seven (7) of the entertainment centres are busy throughout the year, and the remaining six (6) sites are busy between January, May, June, July, August, September, October, November, and December. Similarly, six (6) sites are busy throughout the week, and the remaining seven (7) are busier on Friday, Saturday, and Sunday. The nearest health centres differ across each site, except for *Arun Cinema Hall, Bhatbhateni Supermarket, Central Mall,* and *City Cinema Hall* whose nearest health centre is *Birat Medical College Teaching Hospital* and the most used health centres are *Koshi Hospital* and *Nobel Medical College Teaching Hospital.* Most of the entertainment centres do not have an isolated place dedicated for sick people (8/13), while the remaining five (5) sites have it on site.

Table 5.1: Availability of health worker, isolated room, the busiest days/months and the nearest and most used health centre

Name of entertainment centre	Presence of community health worker/agent for emergency cases	Busiest day of the week	Busiest month of the year	Isolated place dedicated for sick people	Name of the nearest health centre	Name of the most used health centre
Arun Cinema Hall, Rani	Not available	Saturday	Every month	Available	Birat Medical College Teaching Hospital	Nobel Medical College Teaching Hospital
Bhatbhateni Supermarket, Satghumti	Not available	Friday, Saturday	Every month	Not available	Birat Medical College Teaching Hospital	Koshi Hospital
Central Mall, DSP Chowk	Not available	Friday, Saturday	November, December, June, May	Available	Birat Medical College Teaching Hospital	Nobel Medical College Teaching Hospital
City Cinema Hall, Tinpaini	Not available	Every month	June, July, August, January, September	Not available	Birat Medical College Teaching Hospital	Koshi Hospital
Deurali Hotel and Bar, Rani	Not available	Sunday	Every month	Not available	Morang Sahakari Hospital	Neuro Hospital
Eco Fountain Park, Sahid Marg	Not available	Saturday, Friday	January, December	Not available	Koshi Hospital	Nobel Medical College Teaching Hospital
Food Festival Site, Main Road	Not available	Every month	Every month	Available	Koshi Hospital	Koshi Hospital
Geet Ghazal , Mahendra Chowk	Not available	Every month	Every month	Not available	Max Trauma Center	Sangita Pharmacy
Himalayan Talkies Pvt. Ltd., Mahendra Chowk	Not available	Saturday, Friday	October, November	Not available	Neuro Hospital	Koshi Hospital
Hungry Cafe and Bar, Buspark	Not available	Every month	Every month	Not available	Saptakoshi Hospital	Koshi Hospital
Metro City Hotel, Buspark	Not available	Every month	Every month	Available	Sagar Saurab Medical	Koshi Hospital
RK City Center, Hatkhola Chowk	Not available	Saturday	October, January, November	Available	RK Children Hospital	Koshi Hospital
Sahid Rangasala, Hospital Chowk	Not available	Every month	December	Not available	Koshi Hospital	Koshi Hospital

Twelve (12) of the entertainment centres have waste management systems, except for *Arun Cinema Hall.* Greater than 50 per cent (5/13) and between 18-38 percent of the people visiting the investigated entertainment centres wear masks, except at *Deurali Hotel and Bar* and *Hungry Café and Bar,* where the estimated percentage is less than 10 (see Table 5.2). Despite the availability of waste management systems, the following indicators are inadequate; visibility of unwanted animals/insects (10/13), visibility of trash in the open (5/13), and visibility of stagnant water on the floor (5/13). There is inadequate tracking of migrants and visitors across the entertainment centres (10/13), since three (3) sites record visitors on book/device (3/13).

Table 5.2: Hygiene and travellers' status at the entertainment centres

Name of entertainment centre	Estimated percentage wearing mask	Availability of record book/device for visitors	Availability of waste management system	Visibility of stagnant water on the floor	Visibility of trash in the open	Visibility of unwanted animals/insects
Arun Cinema Hall, Rani	31%-50%	Not available	Not available	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity
Bhatbhateni Supermarket, Satghumti	31%-50%	Not available	Available	No	No	No
Central Mall, DSP Chowk	>50%	Do not know	Available	No	No	Yes, in large quantity
City Cinema Hall, Tinpaini	>50%	Not available	Available	No	No	No
Deurali Hotel and Bar, Rani	>50%	Not available	Available	No	No	Yes, in large quantity
Eco Fountain Park, Sahid Marg	<10%	Not available	Available	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity
Food Festival Site, Main Road	10%-30%	Not available	Available	No	No	Yes, in large quantity
Geet Ghazal , Mahendra Chowk	<10%	Available	Available	No	Yes, in large quantity	No
Himalayan Talkies Pvt. Ltd., Mahendra Chowk	10%-30%	Not available	Available	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity
Hungry Cafe and Bar, Buspark	<10%	Not available	Available	No	No	Yes, in large quantity
Metro City Hotel, Buspark	10%-30%	Available	Available	Yes, in large quantity	No	Yes, in large quantity
RK City Center, Hatkhola Chowk	>50%	Available	Available	No	No	Yes, in large quantity
Sahid Rangasala, Hospital Chowk	>50%	Not available	Available	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity

3.2.g MARKET CENTRES

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

The analysis reveals that the investigated market centres in Biratnagar Metropolitan City attract a significant number of people from India. The respective markets are open every day and throughout the year. However, Saturday is observed as the busiest day when it comes to population mobility. In terms of the busiest months, October, November and December are recorded with higher people's flow. The study shows that the population mobility at the investigated markets is mainly from *Morang, Sunsari, Jhapa, Ilam, Udayapur* and *Dhankuta* districts. At the municipality level, people's movement mainly originates in *Biratnagar Metropolitan City* and from *Urlabari Municipality, Katahari Rural Municipality, Rangeli Municipality, Pathari Sanishchare Municipality,* and *Jahada Rural Municipality.*

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

In terms of connectivity, *Jaljalamod Market* is located at *Jaljalamod* locality, which lies at the junction of *Main Road* and *Rangeli Road.* Based on the findings, this market is identified as the biggest in Biratnagar Metropolitan City in terms of population mobility. It is accessible by alternative vehicle routes, such as *Buddha Marg* and *Dharan Road*, and the nearest localities are recorded as *Janapath Road, Hatkhola, Tinpaini* and *Madhumara.* Similarly, *Central Mall* is located at *DSP Road,* which is connected to the *Main Road (North)* and *Dharan Road*, with the nearest localities *Hatkhola, Tinpaini* and *Madhumara.* This market is also accessible by all kinds of vehicles, however, people from nearby localities and India mostly utilise tricycles, motorbikes and minivans to access this site. In the same way, *Main Road Market* is situated at the *Main Road*, which starts from *Roadshes Chowk* and reaches *Jaljala Chowk,* and is connected to *Dharan Road. Main Road Market* is also connected to several other routes, such as *Bhanubhakta Marg, Jahada Marg, Buddha Marg* and *Rangeli Road.* The nearest localities to this market are identified as *Panchali Tole, Pichara, Janapath Tole* and *Ganga Tole*. Correspondingly, *Gudri Market* is situated at *Gudri* locality, which is close to *Main Road Market* and connected to *Dharan Road* through *Buddha Marg.* This market is accessible by all kinds of vehicles and

the nearest localities are observed as *Panchali Tole, Pichara,* and *Janapath Tole*. Likewise, *Bhatbhateni Supermarket* is located at *Satghumti* locality, which is connected to *Dharan Road* and linked to *Rani POE* (formal). This market is accessible by other vehicle routes, such as *Satya Narayan Marg, Shiv Mandir Marg, Lekhnath Marg* and *Buddha Marg,* with the nearest localities being *Jaljalamod, Hatkhola, Tinpaini* and *Main Road.*

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

A total of five (5) market centres were investigated in Biratnagar Metropolitan City, based on the participatory mapping exercises and matrix analysis. Among these, *Jaljalamod Market* and *Central Mall* have the largest congregation of people with 10,000 and 8,000 people entering per day, and on the busiest day the numbers increase to 15,000 each, respectively (see Fig. 6.1). The remaining three (3) market centres receive a minimum of 2,000 people and a maximum of 5,000 per day, and on the busiest day a minimum of 4,000 people and a maximum of 10,000. Apparently, when compared to other municipalities in Sudurpashchim Province 7, Lumbini Province, and Province 1, the market centres in Biratnagar Metropolitan City account for the highest population mobility. Furthermore, all the marketplaces are visited by people from India, with *Central Mall* and *Bhatbhateni Supermarket* receiving visitors from China, Bangladesh, India, and Pakistan. On the other hand, at *Central Mall* and *Bhatbhateni Supermarket* have bifunctional sites for both market and entertainment because of the viscosity of the sites and the strategic environment its represent. The highest percentage of people from India is found at *Mainroad Market* (75%), followed by *Central Mall* (30%). *Jaljalamod Market* and *Bhatbhateni Supermarket* receive an equal amount of people from India, China, Bangladesh, Pakistan (25%) and from Nepal (75%). *Gudri Market* carries the lowest percentage of people coming from India (10%).

Average entry flow per day, busiest day, and percentage coming from other country (October 2020)

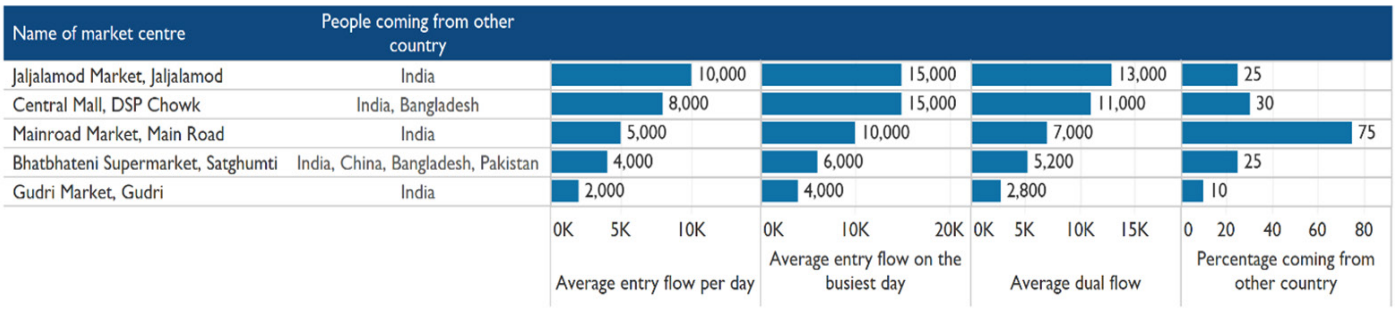


Fig. 6.1: Population mobility at the market centres

The waste management system was investigated as a determinant of vulnerability and capacity to respond to health threats across the various market centres. All the respondents (5/5) asserted that a waste management is in place. However, the following indicators show that the environment is untidy; visibility of unwanted animals/insects (5/5), trash in the open (5/5), and stagnant water on the floor (4/5). This shows that, although all the respondents agreed on the availability of a waste management system, this is not adequately managed, and thus facilitates the spread of contagious diseases among the community. Furthermore, most of the market centres have an isolated place dedicated to sick people (3/5), except for *Gudri Market* and *Jaljalamod Market*, which is especially worrying during a pandemic (see Table 6.1). On the other hand, all the market centres lack health authorities for emergency cases (5/5). At the market centres in Biratnagar Metropolitan City, similarly to some other municipalities, the majority of the people do not wear masks (less than 10%), except for *Bhatbhateni Supermarket* and *Jaljalamod Market* (greater than 50%).

Table 6.1: Waste management, health authority, and estimated percentage wearing masks at the entertainment centres

Name of market centre	Availability of waste management system	Availability of isolated place dedicated for sick people	Presence of health authority for emergency cases	Estimated percentage wearing mask	Visibility of trash in the open	Visibility of stagnant water on the floor	Visibility of unwanted animals/insects
Bhatbhateni Supermarket, Satghumti	Available	Available	Not available	>50%	Yes, in large quantity	Yes, limited	Yes, limited
Central Mall, DSP Chowk	Available	Available	Not available	>50%	Yes, in large quantity	No	Yes, limited
Gudri Market, Gudri	Available	Not available	Not available	<10%	Yes, limited	Yes, limited	Yes, in large quantity
Jaljalamod Market, Jaljalamod	Available	Not available	Not available	<10%	Yes, in large quantity	Yes, limited	Yes, limited
Mainroad Market, Main Road	Available	Available	Not available	<10%	Yes, limited	Yes, limited	Yes, limited

The study shows that most of the market centres have water and toilet facilities (4/5), except for *Jaljalamod Market.* There were suspected COVID-19 positive cases at *Gudri Market* and *Bhatbhateni Supermarket.* Most of the market centres investigated do not have health screening stations for handwashing with soap, hand sanitizer, and body temperature checking (4/5), except for *Central Mall,* with a screening station without thermometer for body temperature checking. The farthest distance to the nearest health centre is from *Central Market* (5 Km), followed by *Mainroad Market* which is 2.5 Km away, while the remaining three (3) sites are either 1 Km or 300 meters distant. The distance to the nearest water source from the market centres is not significant, with available water within a radius of 200 meters (see Fig. 6.2).

Availability of health screening station, basic hygiene, and distance to the nearest health centre and water source

Name of market centre	Suspected COVID-19 case on site	Availability of health screening station	Body temperature checking status	Availability of toilet nearby	Availability of water on site
Central Mall, DSP Chowk	No	Available	Do not know	Available	Available
Mainroad Market, Main Road	No	Not available	Not available	Available	Available
Gudri Market, Gudri	Yes	Not available	Not available	Available	Available
Bhatbhateni Supermarket, Satghumti	Yes	Not available	Not available	Available	Available
Jaljalamod Market, Jaljalamod	No	Not available	Not available	Not available	Not available

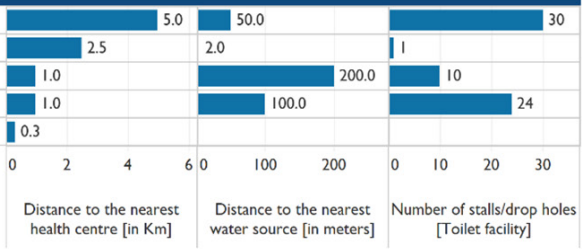


Fig. 6.2: Availability of water and toilet facilities, and distances to the nearest health centre and water source

The busiest days and months at the market centres differ across the sites. Specifically, the marketplaces are busier in the weekends (Friday to Sunday) and between June and December, except for *Jaljalmod Market*, which is equally busy throughout year. There is no availability of record books/devices or other techniques for tracking visitors or buyers at the respective market centres, and thus increase the chances for affected patients with COVID-19 to spread the disease or other diseases. All the sites are busy throughout the four seasons (winter, summer, spring, and rainy season). The nearest health centre differs across the market centres, based on the location of the sites. However, *Koshi Hospital* accounts for the most used health centre (4/5), likely due to its close proximity to the market centres, and being government-owned, the cost of medication is cheaper compared to other health centres.

Table 6.2: Tracking matrix, the busiest days/months, and the nearest and most used health centre

Name of market centre	Availability of record bood/device for buyers/visitors	Busiest day of the week	Busiest month of the year	Market seasonality	Name of the nearest health centre	Name of the most used health centre
Bhatbhateni Supermarket, Satghumti	Not available	Friday, Saturday	October, November, September, December	All seasons	Birat Medical College Teaching Hospital	Koshi Hospital
Central Mall, DSP Chowk	Do not know	Saturday	November, December, June, July	All seasons	Birat Medical College Teaching Hospital	Nobel Medical College Teaching Hospital
Gudri Market, Gudri	Not available	Saturday	September, October	All seasons	Neuro Hospital	Koshi Hospital
Jaljalamod Market, Jaljalamod	Not available	Saturday, Sunday, Friday	Every month	All seasons	Koshi Hospital	Koshi Hospital
Mainroad Market, Main Road	Not available	Sunday	December, November, October	All seasons	Koshi Hospital	Koshi Hospital

According to the analysis obtained, there are 4 (four) main layers of bars indicating food or goods sold at the various market centres. The first layer shows that meat/poultry, good/merchandise, fruits/vegetables, and fish account for the highest percentage (17.2% each). The second layer includes prepared foods and industrial chemicals (10.3% each). In the third layer, there are other related food items (6.9%), and in the fourth, canned food/drinks (3.4%). These findings revealed that meat/poultry, goods/merchandise, fruits/vegetables, and fish are the most sold items at the market centres in Biratnagar Metropolitan City (see Fig. 6.3).

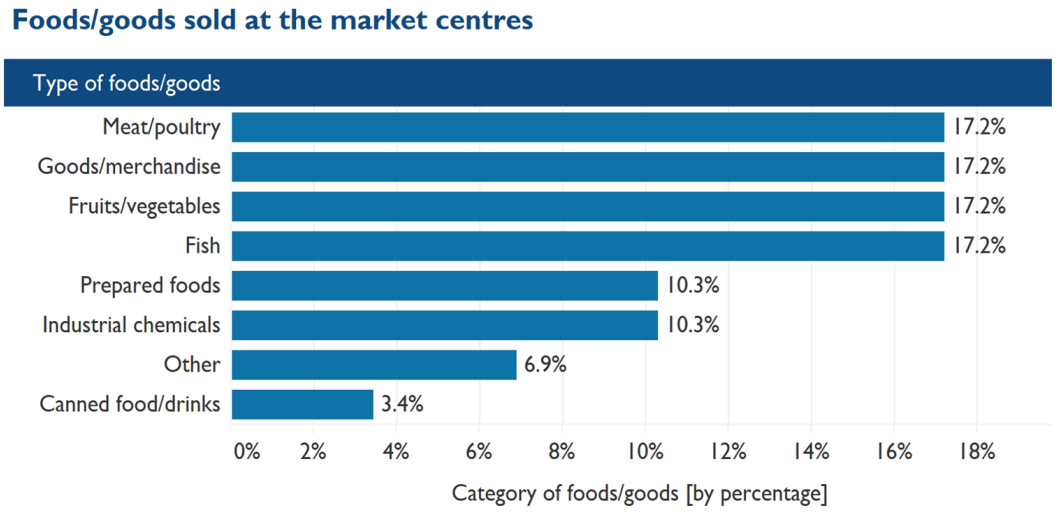


Fig. 6.3: Common foods/goods sold at the market centres

3.2.h MIGRANT WORKSITES

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

The analysis depicts that, in Biratnagar Metropolitan City, the population mobility at the investigated migrant worksites is mainly from Nepal as well as from India. The assessed migrant worksites are open or operational every day and throughout the year, however, Sunday, Monday and Tuesday are identified as the busiest days in terms of population mobility. Similarly, November and December are recorded as the busiest months of the year. According to the investigation results, population mobility at the respective sites mainly originates from *Morang, Sunsari, Jhapa, Ilam* and

Udayapur districts. At the municipality level, people's movement is identified mostly from Biratnagar Metropolitan City, *Urlabari Municipality, Katahari Rural Municipality, Damak Municipality, Belbari Municipality* and *Jahada Rural Municipality.*

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

In terms of connectivity of migrant worksites in Biratnagar Metropolitan City, *Bhatbhateni Supermarket* and *Shyam Copy Factory* are located at the *Satghumti* locality, which is linked to *Dharan Road* and connected to *Rani POE* (formal). The results show that this worksite is also accessible by other vehicle routes, such as *Satya Narayan Marg, Shiv Mandir Marg, Lekhnath Marg* and *Buddha Marg*, with the nearest localities being *Jaljalamod, Hatkhola, Tinpaini* and *Main Road.* Similarly, *Gudri Worker Gathering Area* and *Kanchanjanga Electronic Shop* are situated at *Gudri* and *Jaljalamod* localities, respectively, in close proximity to each other. The study shows that these sites are accessible by vehicle and connected to *Dharan Road* through the *Main Road* and *Buddha Marg.* The nearest localities to these migrant worksites are identified as *Panchali Tole, Pichara,* and *Janapath Tole*. Correspondingly, *Hulas Metal Factory* and *Sneak Appareals Pvt. Ltd*. are situated at *Mills Area* and *Rani* localities, respectively, in close proximity to each other and to *Rani POE* (formal). These sites are connected to the *Dharan Road* through *Rani Path* and *Mills Road* which are accessible by any kinds of vehicle. The nearest localities to these migrant worksites are observed as *Rani, Hansmukhi Tole, Daraiya* and *Ganga Tole.* Likewise, *Hatkhola Chowk Worker Gathering Area, Manakamana Laghu Udhyog, Rathi Group Aanapurna Cabel Factory* and *Raghupati Jute Mill* are situated at *Hatkhola* locality, which is linked to *Dharan Road* through *Buddha Marg* and *Ram Janaki Marg.* These migrant worksites are accessible by other alternative vehicle routes, such as *Geeta Marg, Masaan Ghat Road, Dharmabhakta Marg* and *Jay Nepal Marg*, and the nearest localities are *Tinpaini, Satghumti,* and *Madumara*. People who access these sites mostly use tricycles and motorbikes. In the same manner, *Chandra Shiva Rice Mill* is located at *Pokhariya* locality, which is linked to *Dharan Road* through the *Main Road,* with the nearest localities observed as *Airport Area, Kanchanbari,* and *Pipal Chowk.* Furthermore, *Bhumi Prasasan Worker Gathering Area* is located at *Bhumi Prasasan* locality, which is connected to *Dharan Road,* and accessible by vehicle, with the nearest localities identified as *Janpath Tole, Tinpaini, Satghumti* and *Hatkhola*.

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

In Biratnagar Metropolitan City, a total of twelve (12) migrant worksites were investigated, which is the highest across all the municipalities where the PMM activities were conducted. The largest influx of people can be found at *Bhatbhateni Supermarket* and *Bhumi Prasasan Worker Gathering Area,* with an average entry flow of 4,000 and 3,000 people per day, while on the busiest day, the numbers increase to 6,000 and 3,500 people (staffs and visitors), respectively. These are followed by *Raghupati Jute Mill* and *Hatkhola Chowk Worker Gathering Area,* with a population mobility of 500 people each per day, and 550 and 2,000 people on the busiest day, respectively. The remaining eight (8) sites have a minimum population mobility of 80 people (*Shyam Copy Factory*) and a maximum of 340 (*Sneak Appareals Pvt. Ltd.*). On the busiest day, the minimum influx is 100 people (*Shyam Copy Factory*) and the maximum is 350 (*Sneak Appareals Pvt. Ltd.*). Most of the migrant worksites investigated receive people from India (8/12), with the highest found at *Bhumi Prasasan Worker Gathering Area* (50%), while the remaining seven (7) receive a percentage distribution ranging between 2 and 30 per cent, and the remaining four (4) sites are only accessed by Nepalese nationals (see Fig. 7.1).

Average entry flow per day, busiest day, and percentage coming from other country (October 2020)

Name of migrant worksite	People coming from other country	Average entry flow per day	Average entry flow on the busiest day	Average dual flow	Percentage coming from other country
Bhatbhateni Supermarket, Satghumti	India, China, Bhutan, Bangladesh	4,000	6,000	4,500	30
Bhumi Prasasan Worker Gathering Area, Bhumi Prasasan	India	3,000	3,500	3,292	50
Raghupati Jute Mill, Hatkhola	India	500	550	546	25
Hatkhola Chowk Worker Gathering Area, Hatkhola Chowk	India	500	2,000	667	15
Sneak Appareals Pvt. Ltd., Rani	'	340	350	369	0
Gudri Worker Gathering Area, Gudri	India	200	250	221	30
Rathi Group Annapurna Cable Factory, Hatkhola	India	150	200	167	5
Manakamana Laghu Udhyog, Hatkhola	'	100	150	113	0
Kanchanjanga Electronic Shop, Jaljalamod	'	100	200	117	0
Hulas Metal Factory, Mills Area	India	100	150	113	10
Chandra Shiva Rice Mill, Pokhariya	India	100	200	117	2
Shyam Copy Factory, Satghumti	'	80	100	88	0
		0K 2K 4K 6K	2K 4K 6K 8K	0K 2K 4K 6K	0 20 40 60

Fig. 7.1: Population mobility at the migrant worksites

According to the findings, out of the twelve (12) migrant worksites, only have (4) have a health screening station with body temperature check (*Chandra Shiva Rice Mill, Manakamana Electronic Shop, Rathi Group Annapurna Cable Factory,* and *Sneak Appareals Pvt. Ltd.*), while most of the sites (8/12) sites lack such mechanisms. Eight (8) out of twelve (12) migrant worksites have a living accommodation for staff, except for *Bhumi Prasasan Worker Gathering Area, Gudri Worker Gathering Area, Hatkhola Chowk Worker Gathering Area,* and *Shyam Copy Factory.* The most used health centre from the respective migrant worksites differs across the locations, however, *Koshi Hospital* (6/12) and *Nobel Medical College Teaching Hospital* (3/12) are the most used. All the migrant worksites do not have electricity supply for their staffs and on site. Most of these sites are busy throughout the week (7/12), and the remaining five (5) sites' busiest days are Wednesday, Friday, Saturday and Sunday. Similarly, eight (8) of the sites are busy throughout the year (8/12), while at the remaining four (4) sites the period varies across the different localities, although most sites are busier in September, November, and December (see Table 7.1).

Table 7.1: Hygiene status and the busiest days/months at the migrant worksites

Name of migrant worksite	Availability of health screening station	Body temperature checking status	Availability of accommodation for staffs	Name of the most used health centre	Availability of electricity on site	Busiest day of the week	Busiest month of the year
Bhatbhateni Supermarket, Satghumti	Not available	Not available	Available	Koshi Hospital	Not available	Friday, Saturday	October, November, September, December
Bhumi Prasasan Worker Gathering Area, Bhumi Prasasan	Not available	Not available	Not available	Nobel Medical College Teaching Hospital	Not available	Every day	November, December
Chandra Shiva Rice Mill, Pokhariya	Available	Available	Available	Nobel Medical College Teaching Hospital	Not available	Every day	Every month
Gudri Worker Gathering Area, Gudri	Not available	Not available	Not available	Koshi Hospital	Not available	Every day	Every month
Hatkhola Chowk Worker Gathering Area, Hatkhola Chowk	Not available	Not available	Not available	Koshi Hospital	Not available	Sunday, Wednesday	December, November, May, April
Hulas Metal Factory, Mills Area	Not available	Not available	Available	Rani Health Post	Not available	Every day	Every month
Kanchanjanga Electronic Shop, Jaljalamod	Not available	Not available	Available	Neuro Hospital	Not available	Sunday	Every month
Manakamana Laghu Udhyog, Hatkhola	Available	Available	Available	Koshi Hospital	Not available	Every day	Every month
Raghupati Jute Mill, Hatkhola	Not available	Not available	Available	Koshi Hospital	Not available	Every day	Every month
Rathi Group Annapurna Cable Factory, Hatkhola	Available	Available	Available	Nobel Medical College Teaching Hospital	Not available	Sunday	August, September
Shyam Copy Factory, Satghumti	Not available	Not available	Not available	Koshi Hospital	Not available	Every day	Every month
Sneak Appareals Pvt. Ltd., Rani	Available	Available	Available	Saptakoshi Hospital	Not available	Friday	Every month

According to the analysis, most of the migrant worksites investigated have water and toilet facilities nearby (10/12), except for *Bhumi Prasasan Worker Gathering Area* and *Gudri Worker Gathering Area,* with a minimum of 1 stall/drop hole (*Kanchanjanga Electronic Shop*) and a maximum of 35 stalls/drop holes (*Rathi Group Annapurna Cable Factory*). The nearest health centre differs across the sites investigated, although *Koshi Hospital* is generally in closer proximity to the sites assessed (6/12). The farthest distance to the nearest health centre can be found at *Bhumi Prasasan Worker Gathering Area* (6 Km), followed by *Rathi Group Annapurna Cable Factory* and *Raghupati Jute Mill* at about 5 Km each (see Fig. 7.2). The remaining sites are located at a minimum of 500 meters (*Gudri Worker Gathering Area* and *Hatkhola Chowk Gathering Area*) and a maximum of 4 Km (*Sneak Appareals Pvt. Ltd.*). Most of the sites investigated have water nearby (less than 400 meters), except for *Sneak Appareals Pvt. Ltd.* which is 1 Km away. The staffs/visitors to stall/drop hole ratio differs across the migrant worksites, with a minimum of 4:1 (*Rathi Group Annapurna Cable Factory*) and a maximum of 167:1 (*Bhatbhateni Supermarket*).

Availability of toilet and water facilities, staffs/visitors per stall/drop hole ratio, and distance to the nearest health centre and water source (October 2020)

Name of migrant worksite	Name of the nearest health centre	Availability of toilet nearby	Availability of water on site	Distance to the nearest health centre [in Km]	Distance to the nearest water source [in meters]	Number of stalls/drop holes [Toilet facility]	Average number of staffs/visitors per stall/drop holes [per day]
Bhumi Prasasan Worker Gathering Area, Bhumi Prasasan	Saptakoshi Hospital	Not available	Not available	6.0			
Rathi Group Annapurna Cable Factory, Hatkhola	Koshi Hospital	Available	Available	5.0	1	35	4
Raghupati Jute Mill, Hatkhola	Koshi Hospital	Available	Available	5.0	20	10	50
Sneak Appareals Pvt. Ltd., Rani	Garima Polyclinic	Available	Available	4.0	1,000	12	28
Manakamana Laghu Udhyog, Hatkhola	Bhattarai Medical Hall	Available	Available	3.5	5	4	25
Chandra Shiva Rice Mill, Pokhariya	Nobel Medical College Teaching Hospital	Available	Available	1.5	20	8	13
Shyam Copy Factory, Satghumti	Koshi Hospital	Available	Available	1.0	400	2	40
Hulas Metal Factory, Mills Area	Rani Health Post	Available	Available	1.0	5	10	10
Bhatbhateni Supermarket, Satghumti	Birat Medical College Teaching Hospital	Available	Available	1.0	5	24	167
Kanchanjanga Electronic Shop, Jaljalamod	Koshi Hospital	Available	Available	0.5	1	1	100
Hatkhola Chowk Worker Gathering Area, Hatkhola Chowk	Koshi Hospital	Available	Available	0.5	8	4	125
Gudri Worker Gathering Area, Gudri	Koshi Hospital	Not available	Not available	0.5			

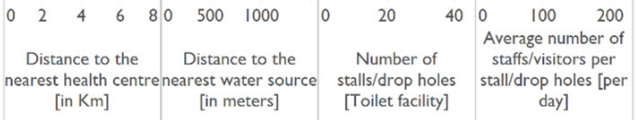


Fig. 7.2: Availability of water and toilet facilities, staffs/visitors to stall/drop hole ratio, and distance to the nearest health centre and water source

Most of the migrant worksites have a waste management system in place (8/12), and only a minority of the sites do not (4/12). Therefore, the waste management system is partially available and according to the respondents and eye findings, the following are inadequate;

- Visibility of trash in the open in large quantity (8/12), except for four (4) sites (*Bhatbhateni Supermarket, Bhumi Prasasan Worker Gathering Area, Gudri Worker Gathering Area,* and *Rathi Group Annapurna Cable Factory*).
- Half of the sites have visibility of stagnant water on the floor in large quantity (6/12), especially during the rainy season, while at half of the sites it is not present (6/12).
- Visibility of unwanted animals/insects (12/12) in large quantity at all the sites investigated.

There were suspected COVID-19 positive cases at two (2) migrant worksites, namely *Bhatbhateni Supermarket* and *Hatkhola Chowk Gathering Area* (see Table 7.2).

Table 7.2: Waste management and suspected COVID-19 cases at the migrant worksites

Name of migrant worksite	Availability of waste management system	Suspected COVID-19 cases on site	Visibility of stagnant water on the floor	Visibility of trash in the open	Visibility of unwanted animals/insects
Bhatbhateni Supermarket, Satghumti	Available	Yes	No	No	Yes, in large quantity
Bhumi Prasasan Worker Gathering Area, Bhumi Prasasan	Available	No	No	No	Yes, in large quantity
Chandra Shiva Rice Mill, Pokhariya	Available	No	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity
Gudri Worker Gathering Area, Gudri	Available	No	No	No	Yes, in large quantity
Hatkhola Chowk Worker Gathering Area, Hatkhola Chowk	Not available	Yes	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity
Hulas Metal Factory, Mills Area	Available	No	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity
Kanchanjanga Electronic Shop, Jaljalamod	Not available	No	No	Yes, in large quantity	Yes, in large quantity
Manakamana Laghu Udhyog, Hatkhola	Not available	No	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity
Raghupati Jute Mill, Hatkhola	Not available	No	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity
Rathi Group Annapurna Cable Factory, Hatkhola	Available	Do not know	No	No	Yes, in large quantity
Shyam Copy Factory, Satghumti	Available	No	No	Yes, in large quantity	Yes, in large quantity
Sneak Appareals Pvt. Ltd., Rani	Available	No	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity

Most of the migrant worksites do not have a record tracking matrix, such as a record book or device for visitors (9/12), except for *Chandra Shiva Rice Mill, Raghupati Jute Mill*, and *Sneak Appareals Pvt. Ltd.* Most of the respondents (7/12) agreed that greater than 50 per cent of people wear masks on site, whereas three (3) respondents (3/12) reported the percentage at less than 10, and two (2) more stated that 20-40 per cent wear masks (see Table 7.3). Despite all these sites are operational throughout the seasons, they lack a community health worker/agent for emergency cases on site (12/12). According to the respondents, most people do seek alternative treatment when they are sick, especially clinic or hospital (9/12), traditional healer (5/12), pharmacy (5/12), home treatment (4/12), and religious leader (1/12), in order of importance. This shows that people seek alternative healthcare at clinic or hospital, traditional healer, and pharmacy when they get sick (see Table 7.3).

Table 7.3: Tracking visitors/travellers and estimated percentage wearing masks at the migrant worksites

Name of migrant worksite	Estimated percentage wearing mask	Seasonality	Availability of record book/device for visitors	Availability of community health worker/agent	Where people go to when they get sick
Bhatbhateni Supermarket, Satghumti	>50%	All seasons	Not available	Not available	Clinic or Hospital
Bhumi Prasasan Worker Gathering Area, Bhumi Prasasan	<10%	All seasons	Not available	Not available	Pharmacy, Clinic or Hospital, Traditional Healer, Home Treatment
Chandra Shiva Rice Mill, Pokhariya	>50%	All seasons	Available	Not available	Clinic or Hospital
Gudri Worker Gathering Area, Gudri	10%-30%	All seasons	Not available	Not available	Home Treatment, Pharmacy, Traditional Healer
Hatkhola Chowk Worker Gathering Area, Hatkhola Chowk	>50%	All seasons	Not available	Not available	Pharmacy, Traditional Healer, Clinic or Hospital
Hulas Metal Factory, Mills Area	>50%	All seasons	Not available	Not available	Clinic or Hospital
Kanchanjanga Electronic Shop, Jaljalamod	<10%	All seasons	Not available	Not available	Pharmacy
Manakamana Laghu Udhyog, Hatkhola	31%-50%	All seasons	Not available	Not available	Traditional Healer, Pharmacy, Religious Leader ,Clinic or Hospital, Home Treatment
Raghupati Jute Mill, Hatkhola	>50%	All seasons	Available	Not available	Clinic or Hospital
Rathi Group Annapurna Cable Factory, Hatkhola	>50%	All seasons	Not available	Not available	Traditional Healer, Pharmacy, Home Treatment
Shyam Copy Factory, Satghumti	>50%	All seasons	Not available	Not available	Clinic or Hospital
Sneak Appareals Pvt. Ltd., Rani	<10%	All seasons	Available	Not available	Clinic or Hospital

The main activities conducted at the migrant worksites in Biratnagar Metropolitan City are factory and other activities, which need to be investigated further if phase III of the project should take effect. Among these, factory accounts for the largest percentage with 45.8, similar to the majority of the municipalities where the study was conducted, followed by other unnamed activities with 20.8 per cent, and thus similar to the majority of the municipalities where the study was conducted but contray in terms of the uncertain activities that were not listed in other locations. Next to this (bars on the right side), are timber logging and agricultural activities with an equal percentage distribution of 12.5 each, respectivley (see Fig. 7.3). There are three (3) types of accommodation for staffs at the migrant worksites, namely; concrete, zinc, and wooden house, with a percentage distribution of 60, 30, and 10, respectively, contrary to the results obtained in most of the municipalities where the survey was conducted (wooden house).

Type of migrant activities and available accommodation at the migrant worksite

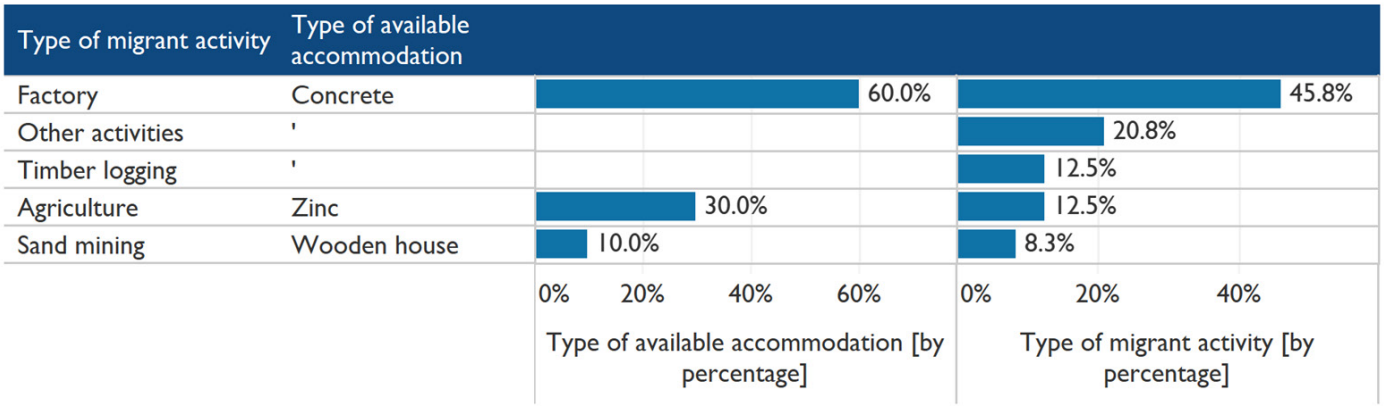


Fig. 7.3: Type of activity and accommodation at the migrant worksites

3.2.i TRANSPORT STATIONS

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

The study depicts that most of the population mobility among the investigated sites is accounted for at the transport stations in Biratnagar Metropolitan City. The respective transport stations are operational every day and throughout the year. However, Sunday is identified as the busiest day in terms of entry flow. In the same way, people's movement at these transport stations is higher in January. According to the results obtained from the field observations, population mobility at the transport stations is mostly from *Morang, Sunsari, Jhapa, Ilam, Udayapur, Panchthar, Dhankuta, Bhojpur* and *Tehrathum* districts. At the municipality level, people's movement to the assessed transport stations mainly originates in *Biratnagar Metropolitan City* and from *Jahada Rural Municipality, Belbari Municipality, Damak Municipality, Urlabari Municipality, Birtamode Municipality* and *Katahari Rural Municipality.*

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

In terms of connectivity, *Rani Bus Park* is situated at *Rani* locality, which lies in close proximity to *Rani POE* (formal) and is linked to *Dharan Road.* The alternative routes to access this transport station are observed as *Raja Birat Marg,*

Rani Path and *Raghupati Marg*. As per the results obtained from the field survey, this transport station is accessible by all kinds of vehicles, with people from India mostly using tricycles. The nearest localities to this transport station are identified as *Hansmukhi Tole, Daraiya, Roadshesh Chowk,* and *Laliguras Tole*. Consistently, *Rangeli Bus Park* is located at *Hatkhola Chowk* locality and connected with *Buddha Marg*. The alternative vehicle routes to access this site are *Main Road, Dharmabhakta Marg* and *Madhumara Path*, with the nearest localities observed as *Tinpaini, Satghumti,* and *Madumara*. Similarly, *Taxi Park Station* and *Biratnagar Bus Park* are situated at *Mahendra Chowk* and *Bus Park* localities, respectively, in close proximity to each other. Both these sites are connected to *Dharan Road* by several alternative routes, such as *Mahendra Marg, Himalaya Road, Buddha Bihar Marg* and *Janpath Marg*. The nearest localities to these sites are *Gudri Chowk, Jaljala Chowk* and *Roadshesh Chowk*. Furthermore, *Nobel Park Bus Station* is located at *Nobel Park* locality, which is connected to *Dharan Road* via *Airport Road* and *Kanchanbari Road*. The nearest localities to this transport station are *Airport Area, Thulo Mill Chowk, Pipal Chowk, Buddha Chowk* and *Pokhariya*.

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

Five (5) transport stations were investigated in Biratnagar Metropolitan City. Comparatively, overall, the investigated sites have a higher mobility than most of the transport stations at the other municipalities where the study was conducted. *Rani Buspark* and *Rangeli Buspark* have the largest mobility with 5,000 and 4,000 people per day, while on the busiest day, the numbers add up to 8,000 people each, respectively. Surprisingly, at *Rangeli Buspark* (4,000 people per day) the mobility which is less than *Rani Buspark* (5,000 people per day), on the busiest day, average entry flow is equal (8,000 people each). At the remaining three (3) transport stations, people's movement is at most 1,500 and at least 400 people per day, and on the busiest days, the movement of people is at most 1,800 and at least 500. Most of the transport stations receive people from India (4/5), except for *Taxi Park Station,* which is only accessed by Nepalese nationals. The highest influx of people coming from India is found at *Rani Buspark,* where half of the population is from India (50%) and half is made of Nepalese nationals (50%). The remaining three (3) sites receive at most 10 per cent and at least 5 per cent from India (see Fig. 8.1). This further supports the hypotheses the researchers made in Sudurpashchim Province and Lumbini Province that the majority of the transport stations across various sites investigated have the highest population mobility, except for some POEs where the population mobility is greater than at the transport stations.

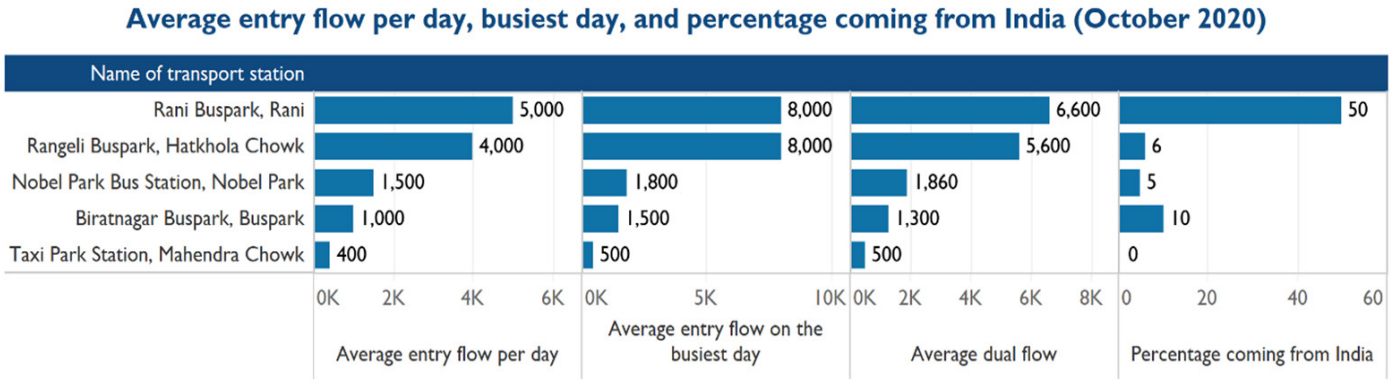


Fig. 8.1: Population mobility at the transport stations

In terms of basic facilities, such as the availability of toilet and water on site, the busiest days/months, and the tracking matrix to trace people that might be affected by the COVID-19 pandemic, were investigated. The analysis shows that there is inadequate availability of toilet facilities (2/5), except for *Rangeli Buspark, Biratnagar Buspark,* and *Nobel Park Bus Station,* which have a distribution of stalls/drop holes of 5, 4, and 2, respectively, despite the huge population mobility (over 5,000 people per day). Similarly, there is either limited (3/5) or inadequate availability of water facilities across the sites (2/5) for hand washing and after using the toilets. It is concerning that, despite having a higher population mobility compared to other sites, *Rani Buspark* has no toilet facility. The farthest distance to the nearest health centre is from *Rani Buspark* and *Taxi Park Station* with a distribution distances of 7 and 5 Km, respectively, while the shortest distance is from *Nobel Park Bus Station* (approximately 20 meters). The distance to the nearest water source is limited, within a radius of 10 meters. There were suspected COVID-19 positive cases found at *Rani Buspark, Rangeli Buspark,* and *Nobel Park Bus Station* (see Fig. 8.2).

Availability of water and toilet facilities, busiest day/month, and distance to the nearest health centre and water source

Name of transport station	Availability of toilet nearby	Availability of water on site	Busiest day of the week	Busiest month of the year	Suspected COVID-19 cases on site
Rani Buspark, Rani	Not available	Not available	Every day	Every month	Yes
Taxi Park Station, Mahendra Chowk	Not available	Not available	Saturday	January	Do not know
Rangeli Buspark, Hatkhola Chowk	Available	Available	Sunday, Wednesday	December, November, May	Yes
Biratnagar Buspark, Buspark	Available	Available	Every day	Every month	Do not know
Nobel Park Bus Station, Nobel Park	Available	Not available	Sunday	Every month	Yes

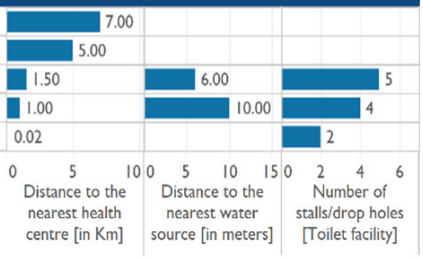


Fig. 8.2: Availability of water and toilet facilities, the busiest days/months, and distances to the nearest health centre and water source

The nearest health centre from the respective sites are *Koshi Hospital* (2/5), *Neuro Hospital* (2/5) and *Nobel Medical College Teaching Hospital* (1/5). There is no availability of isolated places for sick people nor community health workers/agents, especially for emergency cases (5/5). The following indicators are completely absent at the transport stations; availability of health screening stations, such as handwashing stations and hand sanitizer (5/5), body temperature checking (5/5). The majority of the sites are operational throughout the four seasons (summer, spring, winter, and rainy season), except for *Biratnagar Buspark* and *Taxi Park Station* whose seasonality falls in winter and summer only. Similarly, all the transport stations investigated do not have a record book/device for travellers or visitors (5/5), and hence lack a contact tracing mechanism if someone is affected by the COVID-19 pandemic (see Table 8.1).

Table 8.1: Health screening and tracking travellers' status at the transport stations

Name of transport station	Name of the nearest health centre	Isolated place dedicated for sick people	Availability of health screening station	Body temperature checking status	Availability of community health worker/agent for emergency cases	Seasonality	Availability of record book/device for travellers
Biratnagar Buspark, Buspark	Neuro Hospital	Do not know	Not available	Not available	Not available	Winter and summer only	Not available
Nobel Park Bus Station, Nobel Park	Nobel Medical College Teaching Hospital	Not available	Not available	Not available	Not available	All seasons	Not available
Rangeli Buspark, Hatkhola Chowk	Koshi Hospital	Not available	Not available	Not available	Not available	All seasons	Not available
Rani Buspark, Rani	Koshi Hospital	Not available	Not available	Not available	Not available	All seasons	Not available
Taxi Park Station, Mahendra Chowk	Neuro Hospital	Not available	Not available	Not available	Not available	Winter and summer only	Not available

Most of the transport stations do not have waste management systems in place (3/5), except for *Biratnagar Buspark* and *Nobel Park Bus Station.* Therefore, there are challenges in controlling waste, such as the visibility of trash in the open (3/5), stagnant water on the floor (4/5), and visibility of unwanted animals/insects (4/5), which contribute to the transmission of diseases from animals to humans. Greater than 50 per cent of people at these sites wear masks (2/5), while according to the respondents, the remaining stations share an equal estimated percentage of between 24-43. The most used health centre from the respective sites differs, however, *Koshi Hospital* and *Nobel Medical College Teaching Hospital* account for the most used health centres (see Table 8.2).

Table 8.2: Waste management and estimated percentage wearing mask at the transport stations

Name of transport station	Estimated percentage wearing mask	Availability of waste management system	Visibility of trash in the open	Visibility of stagnant water on the floor	Visibility of unwanted animals/insects	Name of the most used health centre
Biratnagar Buspark, Buspark	31%-50%	Available	No	Yes, in large quantity	Yes, in large quantity	Koshi Hospital
Nobel Park Bus Station, Nobel Park	>50%	Available	No	No	No	Nobel Medical College Teaching Hospital
Rangeli Buspark, Hatkhola Chowk	10%-30%	Not available	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity	Golden Hospital
Rani Buspark, Rani	>50%	Not available	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity	Koshi Hospital
Taxi Park Station, Mahendra Chowk	31%-50%	Not available	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity	Nobel Medical College Teaching Hospital

3.2.j PLACES OF WORSHIP

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

According to the results obtained from the participatory mapping exercises and field observations, the majority of the investigated places of worship attract a significant number of people. The places of worship are open to the public every day and throughout the year. However, Tuesday, Friday and Saturday are recorded as the busiest days in terms of population mobility. In the same way, April and December are observed as the busiest months at the assessed places of worship. The training dataset at both phases (I & II) shows that the population mobility at these sites is mainly from *Morang, Sunsari, Jhapa, Ilam, Udayapur* and *Dhankuta* districts. At the municipality level, people's movement originates from *Biratnagar Metropolitan City, Katahari Rural Municipality, Rangeli Municipality,* and *Jahada Rural Municipality.*

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

Shree Satya Narayan Mandir, Shree Ganesh Mandir and *Kali Mandir* are located at the *Main Road* and *Jaljalamod* localities, respectively, in close proximity to each other, and parallel to the south-east of Biratnagar Metropolitan City. These places of worship are connected to the *Main Road (North)* and *Buddha Marg* with several alternative vehicle routes, such as *Satya Narayan Marg, Rangeli Road, DSP Road* and *Dharan Road.* The nearest localities to these sites are observed as *Bhrikuti Chowk, Jaljala Chowk, Gudri Chowk,* and *Janpath Tole.* Similarly, *Radha Krishna Madir* is situated at *Tinpaini* locality, which is connected to the *Main Road (North)* through several alternative routes, such as *Radha Krishna Marg, Panchakanya Marg,* and *Bargachhi Marg,* with the nearest localities and junctions being *Tinpaini Chowk, Sanihat Chowk, Banjara Chowk* and *Hatkhola.* Likewise, *Lakshmi Narayan Temple* is situated at *Panchali* locality, which is linked to *Dharan Road*

via *Dharanidhar Marg, Panchali Marg* and *Mahayagya Marg,* with the nearest localities identified as *Roadshesh Chowk, Janapath Tole, Pichara* and *Ganga Tole*. Likewise, *Balaji Babosa Mandir* is situated at *Tintoliya* locality, which is connected to *Tintoliya Marg*, followed by the *Main Road (South)* and *Dharan Road,* and the nearest localities are *Pipal Chowk, Prativa Chowk, Ganga Tole,* and *Roadshesh Chowk.* In the same way, *Sarochiya Jamun Mosque* and *Gausiya Rajaiya Mustafa Jame Masjid* are situated at *Sarochiya* and *Dhobiyari* localities, respectively, in close proximity to each other, and are connected to *Dharan Road,* with the nearest localities being *Jaljala Chowk, Gudri Chowk, Satghumti,* and *Brikuti Chowk*. Furthermore, *Durga Mandir* is located at *Rani* locality, which is linked to *Rani Path* and near *Rani POE* (formal). The alternative routes to access this site are recorded as *Dharan Road* and *Raja Birat Marg,* and the nearest localities are *Pichara, Panchali Tole, Ganga Tole* and *Hansmukhi Tole*. The analysis shows that the investigated places of worship in Biratnagar Metropolitan City are accessible by all kinds of vehicles. However, people mainly use tricycles and motorbikes as modes of transport to access the respective sites.

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

Nine (9) places of worship were investigated in Biratnagar Metropolitan City, as determined by the matrix analysis. Among the assessed sites, the largest population is found at *Shree Satya Mandir* and *Kali Mandir*, with a population distribution of 800 and 150 people per day, and 1,000 and 500 people on the busiest day, respectively. At the remaining seven (7) sites, the highest influx of people per day is 125 (*Lakshmi Narayan Temple*), and the lowest is 40 (*Balaji Babosa Mandir*). On the busiest day, the minimum entry flow is 100 people and the maximum is 150. Most of the places of worship are visited by people from India (6/9), whereas at the remaining three (3) places of worship, people come from within the municipality and/or bordering municipalities in Nepal. The largest influx of people from India can be found at *Durga Mandir* and *Shree Satya Narayan Mandir* with a percentage distribution of 40 and 25, respectively, while the remaining receive at most 5 per cent (see Fig. 8.1).

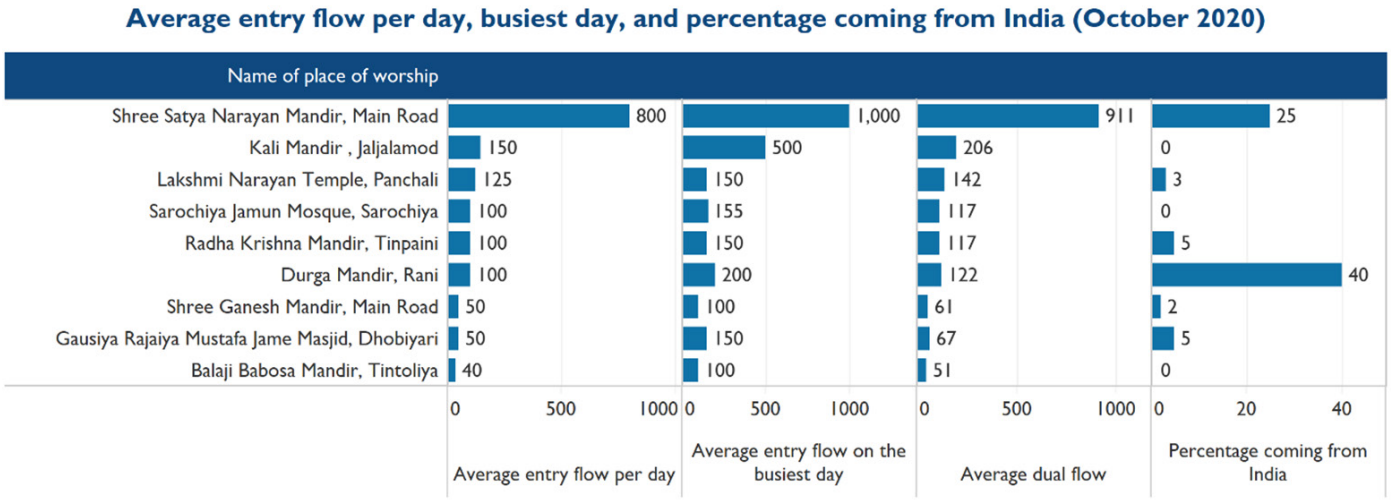


Fig. 9.1: Population mobility at the places of worship

According to the analysis, the nearest health centre from the places of worship differs across their locations, although *Koshi Hospital* accounts for the nearest (3/9), followed by *Golden Hospital* (2/9). At all the places of worship investigated, there is neither a tracking matrix for visitors (record book/device), nor health screening, nor hand washing stations, nor the availability of body temperature checking (see Table 9.1). Suspected COVID-19 cases were reported only at one (1) site, *Shree Ganesh Mandir*. Overall, the estimated percentage of people wearing masks

at these sites is less than 10 and between 20-40. This shows that more than half of the people do not wear masks when visiting the respective places of worship (6/9). The busiest days of the week are Tuesday, Friday, and Saturday, except for *Lakshmi Narayan Temple* and *Shree Satya Narayan Mandir,* which are busy throughout the week. The busiest months of the year differ across the places of worship investigated. In terms of seasonality, all the sites are operational throughout the seasons (winter, summer, spring, and rainy season).

Table 9.1: Health screening, tracking matrix, and the busiest days/months at the places of worship

Name of place of worship	Name of the nearest health centre	Availability of record book/device for visitors	Availability of health screening station	Body temperature checking status	Suspected COVID-19 case on site	Estimated percentage wearing mask	Busiest month of the year	Busiest day of the week	Seasonality
Balaji Babosa Mandir, Tintoliya	Neuro Hospital	Not available	Not available	Not available	Do not know	<10%	December	Tuesday	All seasons
Durga Mandir, Rani	Rani Health Post	Not available	Not available	Not available	No	<10%	June, July	Saturday	All seasons
Gausiya Rajaiya Mustafa Jame Masjid, Dhobiyari	Koshi Hospital	Not available	Not available	Not available	No	<10%	March, April	Friday	All seasons
Kali Mandir , Jaljalamod	Koshi Hospital	Not available	Not available	Not available	No	>50%	June	Saturday	All seasons
Lakshmi Narayan Temple, Panchali	Saptakoshi Nursing Home	Not available	Not available	Not available	No	<10%	October, November, December	Every day	All seasons
Radha Krishna Mandir, Tinpaini	Noulakha Dental Care	Not available	Not available	Not available	No	>50%	April, May	Saturday	All seasons
Sarochiya Jamun Mosque, Sarochiya	Golden Hospital	Not available	Not available	Not available	No	10%-30%	April	Friday	All seasons
Shree Ganesh Mandir, Main Road	Golden Hospital	Not available	Not available	Not available	Yes	>50%	December, September, January	Tuesday	Winter only
Shree Satya Narayan Mandir, Main Road	Koshi Hospital	Not available	Not available	Not available	No	31%-50%	October, November, May	Every day	All seasons

At the places of worship, there are waste management systems in place, except at *Lakshmi Narayan Temple*, however, these are inadequate due to the following;

- Visibility of trash in the open in large quantity (3/9), while the remaining sites are tidy (6/9).
- Visibility of stagnant water on the floor (4/9), which encourages mosquitoes to breed, especially during the rainy season.
- Visibility of unwanted animals/insects in large quantity at all the sites investigated (9/9).

Furthermore, water and toilet facilities are available at all the sites, with at most 25 stalls/drop holes (*Lakshmi Narayan Temple*) and at least 1 stall/drop hole (*Balaji Babosa Mandir* and *Shree Ganesh Mandir*). People at these sites seek alternative healthcare when they get sick, such as clinic or hospital and traditional healer, in ascending order. The longest distance to the nearest health centre from the places of worship can be found at *Durga Mandir* and *Radha Krishna Mandir,* about 7 and 3 Km away, respectively. The remaining places of worship are at most 2 Km and at least 20 meters away. The distance to the nearest water source from all the sites investigated is limited, within a radius of 200 meters (see Fig. 9.2).

Waste management system, water and toilet facilities, and distance to the nearest health centre and water source

Name of place of worship	Availability of waste management system	Visibility of trash in the open	Visibility of stagnant water on the floor	Visibility of unwanted animals/insects	Places people go to when they get sick	Availability of toilet nearby	Availability of water on site	Distance to the nearest health centre [in Km]	Distance to the nearest water source [in meters]	Number of stalls/drop holes [Toilet facility]
Durga Mandir, Rani	Available	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity	Clinic or Hospital	Not available	Available	7.00	20	
Radha Krishna Mandir, Tinpaini	Available	No	No	Yes, in large quantity	Clinic or Hospital Traditional Healer	Available	Available	3.00	100	5
Lakshmi Narayan Temple, Panchali	Not available	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity	Clinic or Hospital	Available	Available	2.00	1	25
Balaji Babosa Mandir, Tintoliya	Available	No	No	Yes, in large quantity	Clinic or Hospital	Available	Available	2.00	10	1
Shree Satya Narayan Mandir, Main Road	Available	No	No	Yes, in large quantity	Clinic or Hospital	Available	Available	1.00	6	2
Kali Mandir , Jaljalamod	Available	No	No	Yes, in large quantity	Clinic or Hospital	Available	Available	0.50	1	10
Gausiya Rajaiya Mustafa Jame Masjid, ..	Available	Yes, in large quantity	Yes, in large quantity	Yes, in large quantity	Traditional Healer Clinic or Hospital	Available	Available	0.50	200	5
Sarochiya Jamun Mosque, Sarochiya	Available	No	No	Yes, in large quantity	Clinic or Hospital	Available	Available	0.05	200	4
Shree Ganesh Mandir, Main Road	Available	No	Yes, in large quantity	Yes, in large quantity	Clinic or Hospital	Available	Available	0.02	7	1

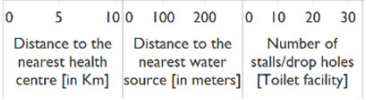


Fig. 9.2: Waste management, toilet and water facilities, and distances to the nearest health centre and water source

3.2.k OTHER PLACES

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

According to the results obtained from the participatory mapping exercises and field observations, some other sites were identified where high congregations of people take place. These congregation sites are open to the public every day and throughout the year, except during government-imposed restrictions. The study shows that the population mobility at the respective sites are mainly from *Morang, Sunsari, Jhapa, Ilam* and *Udaypur* districts. At the municipality level, people's movement mostly originates in *Biratnagar Metropolitan City* and from *Jahada Rural Municipality, Urlabari Municipality, Birtamode Municipality,* and *Damak Municipality.*

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

In terms of the connectivity, *Hotel Big* is located at *Roadshesh Chowk*, which is connected to *Dharan Road* and *Main Road.* This site is accessible by all kinds of vehicles, and associated with several alternative routes, such as *Dharanidhar Marg, Sakti Marg* and *Buddha Marg,* with the nearest localities being *Panchali Tole, Ganga Tole, Pichara* and *Janpath Tole*. Likewise, *Puspalal Junction* is located at *Puspalal Chowk* locality, which is connected to the *Main Road (North)* and *Biratnagar Road,* and the nearest localities are *Buddha Chowk, Hamro Chowk* and *Sagarmatha Chowk.* The analysis shows that the investigated sites are accessible by all kinds of vehicles, however, people mainly use tricycles and motorbikes as modes of transport to reach these sites.

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

There were only two (2) 'Other Places' with high population mobility in Biratnagar Metropolitan City, namely *Puspalal Junction,* located at *Puspalal Chowk* and *Hotel Big,* located at *Rodeses Chowk.* On average, the population mobility is 1,000 and 500 people per day, and 1,500 and 600 people on the busiest day, respectively. Both these sites are

visited by a minority of people coming from India (5%). Congregations at these sites mainly occur as a result of cultural and religious festivals. The two (2) sites are busy throughout the week and months, except for *Puspalal Junction*, whose busiest months of the year fall in January, April, June, and July.

Waste management, estimated percentage of people wearing masks, and distance to the nearest health centre

According to the respondents, the nearest health centre from *Puspalal Junction* and *Hotel Big* is *Saptakoshi Hospital* and *Nobel Medical College Teaching Hospital,* respectively. The estimated percentage of people wearing masks at these sites is between 31-50. Despite the availability of a waste management system at *Puspalal Junction* and *Hotel Big,* there is inadequate control of waste disposal due to the following; visibility of trash in the open and stagnant water on the floor, as well as presence of unwanted animals/insects within the surroundings of *Puspalal Junction*, contrary to *Hotel Big*, where there is an adequate waste disposal system. The distance to the nearest health centres from these sites (*Puspalal Junction* and *Hotel Big*) is about 500 meters and 1.5 Km, respectively.

Health screening and basic facilities at 'Other Places' in Biratnagar Metropolitan City

Water and toilet facilities are available nearby, about 500 meters and 100 meters from *Puspalal Junction* and *Hotel Big,* respectively. There are 47 stalls/drop holes (toilet facilities) at *Hotel Big* and only 5 stalls/drop holes (toilet facilities) at *Puspalal Junction*. The following are completely missing with respect to health infrastructure; health screening station, temperature checking or functional thermometers, hand sanitizer, and other screening techniques that help mitigate the spread of the COVID-19 pandemic. There is either interrupted network system or no voice communication system at *Puspalal Junction*, while *Hotel Big* has an uninterrupted voice communication system/Global System Mobile (GSM) communication. In terms for tracking people's movement, record books/devices for visitors/travellers are present at *Hotel Big* but lacking at *Puspalal Junction.*

3.3 GENERAL ANALYSIS

This section of the report indicates the general analysis of all common variables or indicators where 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
7. Common infectious diseases affecting people
8. Main purposes people travel across the sites

Fig. 10.1 shows the percentage distribution of various indicators for all the sites in Biratnagar Metropolitan City, related to the concept of vulnerability capacity analysis. The pie charts show the communication system (top left), the presence of unwanted animals/insects (bottom left), various sources of water (top right), and the most used modes of transport (bottom right).

The most common means of voice communication system (GSM) involves phones or text messages (54.9%), followed by the use of internet to access emails and social media technologies (41.5%). The remaining two (UHF/VHF radio and no communication) are not significant. However, it is important to note that, according to the findings, some of the sites where there is better communication are the majority of the health centres, entertainment centres, transport stations, and some places of worship. The main source of water is pump, which accounts for the highest percentage (44.5%), followed by the public water system (26.1%). The remaining 29.4 per cent is shared by other sources of water, such as delivery by truck or vehicle, river water, and rain catchment.

The visibility of animals across all the sites was validated, although based on the community setting in Nepal, people live with domestic animals, such as cows, goats, and buffalos. As a result, these animals fall into the category of 'wanted animals' as people commonly live with them, and also in terms of proportion, it varies across each municipality. Mosquitoes, flies/months, ants/beetles, and cockroaches carry the largest share in the chart, with a percentage of 27.7, 24.6, 24.1, and 22.1, respectively. According to the analysis, the sites are mainly reached by foot and motorbike, with a percentage distribution of 19.7 each, and thus similar to the result obtained in the other municipalities in Sudurpashchim Province and Lumbini Province. Other modes of transport include cars, buses, minivans, and trucks. At some sites, especially the POEs, places of worship, and traditional healers' compounds, accessibility by foot or vehicle is difficult and, in most cases, people walk long distances to reach their respective destinations.

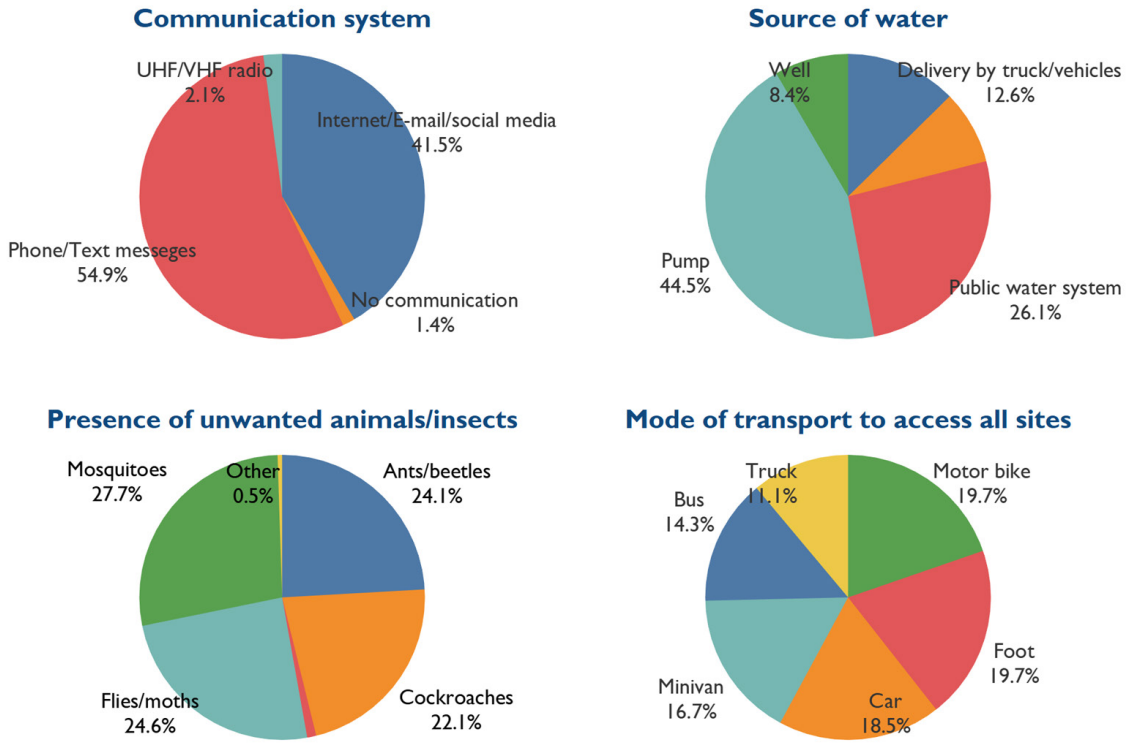


Fig. 10.1: Communication system, source of water, mode of transport, and unwanted animals/insects for all sites

Fig. 10.2 shows the places from which people seek alternative healthcare when they fall ill. Most people seek help from clinics or hospitals, traditional healers, and home treatment and pharmacy, with a percentage distribution of 55.6, 15.6, and 13.3 each, respectively. Other alternative treatments, such as religious leaders, do not carry a significant weight (2.2%). It is worth noting that, although most people do seek support from health professionals, in areas where the accessibility to health centres is difficult as well as the availability of health infrastructure along closest corridors, people tend to rely on immediate alternative treatment (traditional healer), as well as other alternative means. Conversely, the main reasons behind the population influxes were investigated at the respective sites. The findings revealed that congregations of people are due to the following; market day (sporadic or nomadic) (16.7%), cultural festivals (13.6%), religious festivals (12.7%), markets set up in the locality (permanent or temporal basis) (10.9%), meeting relatives and crusades (9.0% each), and worship services either in Temples, Mosques or Churches (8.1%). This shows that the population mobility pattern in Biratnagar Metropolitan City is highly affected by economic and cultural/religious activities, including cultural and religious festivals.

Places people go to when they get sick and reasons for the busiest days/months

Reason for the busiest day/month	Places people go to when they get sick
Market day (sporadic or nomadic)	Home treatment
Cultural festivals	'
Religious festivals	Religious leader
Market (set up in the locality - temporal or permanent)	Traditional healer
Meet relatives	'
Crusade	Clinic or hospital
Worship services/Temple/Church/Mosque	Pharmacy
Cinema	'
Play football	'
Wedding	'
Farming	'
Swimming	'
Funerals	'
Others	'

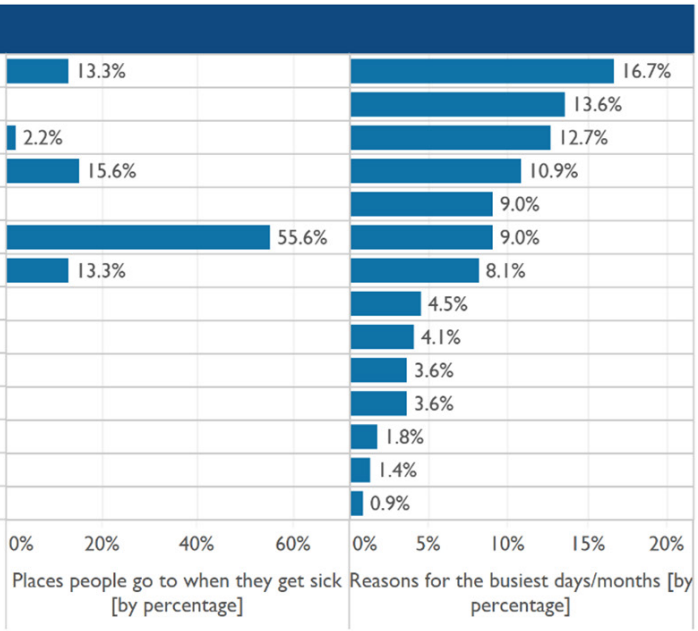


Fig. 10.2: Major reasons for the busiest days/months and places people go to when they get sick

Fig. 10.3 shows the common infectious diseases affecting people in Biratnagar Metropolitan City, and some of the procedures to follow for COVID-19 suspected cases. During a pandemic or an outbreak, there are always concerns on how people should respond to emergency cases of affected people. The list of procedures was evaluated in percentage based on respondents' feedback as follows; call or notify on-site authorities (28.7%), isolate the patient (24.5%), call the emergency hotline (23.9%), counsel and calm the patient (18.6%), in order of importance. Lastly, the other two variables indicate that the respondents either do not know what to do or perhaps adopted other procedures different from the standard SOPs and IPC measures (see Fig. 11.3). Overall, this means that people are generally aware of the techniques or procedures to follow if someone is affected by COVID-19. Although we have analysed some of the common diseases affecting people at specific sites, such as the health centres, the aim was to find out what is the proportion for the entire municipality. The study revealed that typhoid and malaria, dengue and COVID-19 are the major diseases affecting people in Biratnagar Metropolitan City, with a percentage distribution of

20.7, and 17.2 each, respectively. Therefore, typhoid, malaria, and dengue are the most prevalent diseases prior to and during the pandemic, as of October 2020.

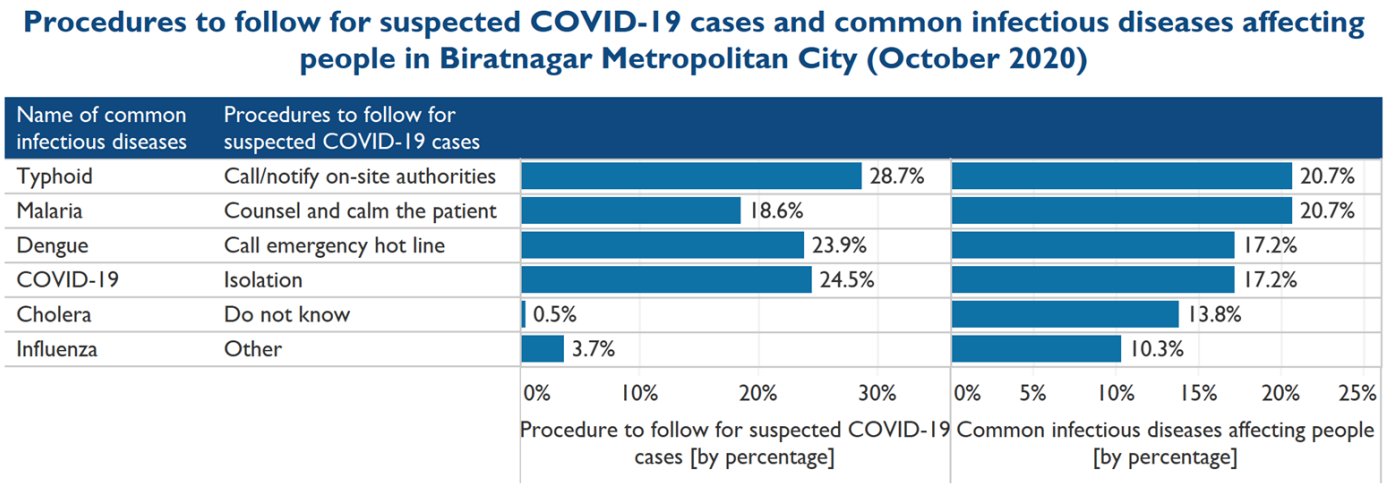


Fig. 10.3: Procedures for COVID-19 and common infectious diseases affecting people in the municipality

The major reasons for people's movement across the BCPs/POEs and other sites with high mobility were also explored and identified as follows; trade/market/commerce, employment, visit of relatives and/or friends and industry/mining/plantation/timber account for the highest, with a percentage distribution of 18.6, 15.7, and 14.3 each, respectively, similar to the findings obtained in other municipalities, except for employment, visit of relatives or friends, and industrial activities. These are followed by; healthcare, transportation, educational purposes and other related matters, in order of importance (see Fig. 10.4).

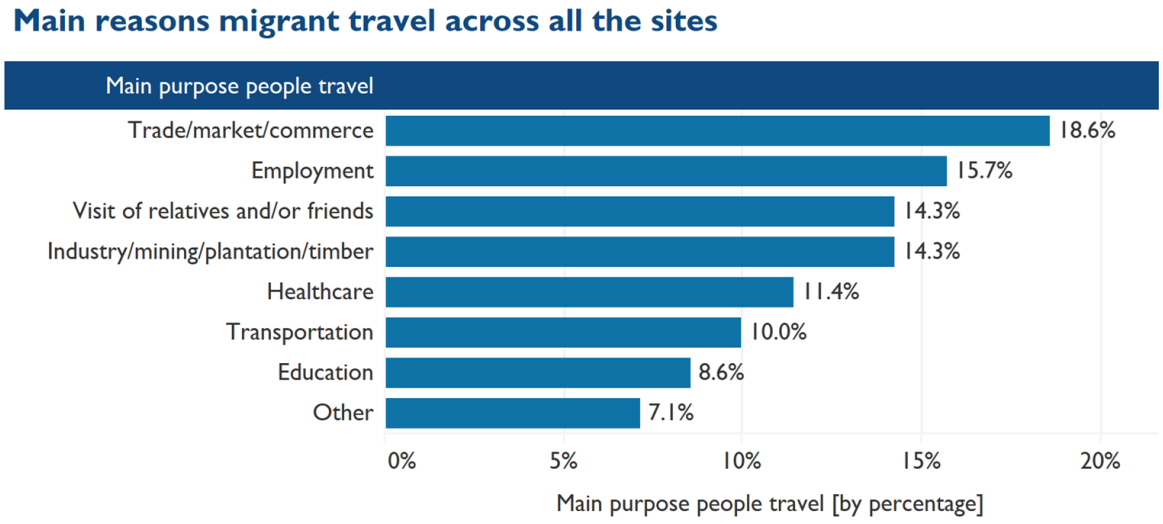


Fig. 10.4: Main purposes for people's mobility across all the sites

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)

Thirteen (13) land border POEs were investigated in Biratnagar Metropolitan City, with only two (2) formal crossing points (*ICP Int. POE* and *Rani Int. POE*). However, two (2) informal POEs (*Hatkhola POE* and *Milan Chowk POE*) have a higher population mobility with 20,000 and 5,000 people per day, respectively, and 25,000 and 7,000 on the busiest day. Nearly, all the assessed POEs are crossed by people coming from India (between 10-90%), except for *Milan Chowk POE* and *Ikrai POE*. According to the respondents, the most used health centres are *Koshi Hospital* and *Nobel Medical College Teaching Hospital*, despite not always being the closest health facilities to the respective POEs. Most of the POEs are busy throughout the week but people's movement is higher in certain months of the year. It is concerning that, despite the high population mobility, the majority of the POEs do not have water (8/13) nor toilet facilities (12/13) present on site for drinking, handwashing, and use after toilet. Similarly, only six (6) sites have electricity available. Across the POEs, there is no IHR focal point based at POEs or municipality level nor in the correspond country, India (except for *Ikrai POE* and *Milan Chowk POE*), nor community health workers or volunteers (except at *Rani Int. POE* and *ICP Int. POE*). The distance to the nearest health centre ranges from a maximum of 9 Km (*Rani Int. POE*) to a minimum of 100 meters (*Milan Chowk POE*). Nearly, all the POEs (12/13) lack health screening stations (handwashing station and hand sanitizer) and for body temperature checking, while none has a tracking matrix (record book/device and or other technique of tracking people's movement) for visitors and travellers for contact tracing. Despite being operational throughout the seasons and having reported suspected COVID-19 positive cases at four (4) POEs (*Hatkhola POE, ICP Int. POE, Kesaliya Pul POE,* and *Milan Chowk POE*), the estimated percentage of people wearing masks is not adequate (generally less than 50%).

Health centres

Among the six (6) health centres assessed in Biratnagar Metropolitan City, only one (1) is a government hospital (*Koshi Hospital*), whereas the remaining are private health facilities. The largest, in terms of entry flow, is the public *Koshi Hospital* with 2,500 people per day and 3,000 on the busiest. This facility receives the second lowest percentage of people coming from India (10%). However, all the health centres are visited by people from India (between 7-45%) and are operational 24/7. Despite having the lowest number in the inpatient ward (150), *Biratnagar Eye Hospital* has the highest number of outpatients (25,000) based on the last three months (July-September 2020). Outpatients are generally in higher numbers compared to inpatients, except for *Golden Hospital*. The status of toilet facilities depends on whether the number of stalls/drop holes are assessed for patients or staffs. The best equipped toilet facilities for staffs are found at *Biratnagar Eye Hospital, Koshi Hospital,* and *Biratnagar Hospital* (3:1, 11:1, and 14:1, respectively). However, in terms of patients to stall/drop hole ratio, the best equipped are *Neuro Hospital* and *Nobel Medical College Teaching Hospital* (3:1 and 4:1, respectively), and the least equipped is *Koshi Hospital,* with the highest number of patients per stall/drop hole (71). The sources of water are generally situated close-by, within a radius of 300 meters;

whereas the distance from the respective health centre to the nearest referral centre reaches up to 5 Km for *Koshi Hospital*. The health centre with the highest population of medical personnel is *Nobel Medical College Teaching Hospital* (3,025), followed by *Neuro Hospital* (2,079) and account for the highest for all the health centres investigated in PMM project. Despite the high population mobility and the number of patients, *Koshi Hospital* has the second lowest population of medical personnel (159). All the health centres have conducted IPC training and have an emergency preparedness plan in place, except for *Koshi Hospital.* Five (5) out of six (6) health centres investigated, reported a suspected COVID-19 positive cases. Based on the analysis, the health infrastructure and screening stations are generally adequate across the health centres, although some parameters are insufficient at *Koshi Hospital* and *Neuro Hospital* (e.g. health screening station, body temperature checking). According to the findings, people from India accessing the health centres in Biratnagar Metropolitan City are mostly medical practitioners visiting or treating patients in Nepal, similarly to the results obtained in other municipalities where the study was conducted. In terms of wards, the largest at the facilities assessed are surgical, outpatient, medical, and emergency room.

Traditional Healers

A total of eight (8) traditional healers' compounds were investigated, with a population mobility ranging from 20-100 per day, and 40-800 on the busiest days. The majority of the compounds are visited by people from India, with the most significant percentage found at *Gauri Mandal Bhole Baba* (35%). Compared to other sites, the distance to the nearest health centres is relatively higher from the traditional healers (between 1-6 Km), which is similar to the distance between the health centre and the nearest referral centre. Despite the wide availability of waste management systems, these are inadequate, proved by the visibility of trash in the open, stagnant water on the floor, and unwanted animals/insects. The busiest day of the week varies according to the respective traditional healer; however, they are generally busier on Saturdays throughout the year. All the traditional healer's compounds assessed have water and toilet facilities available (mainly pour-flush latrine). The highest number of visitors per stall/drop hole can be found at *Kushai Tole Pathibharadevi Mata* (100:1), followed by *Hatkhola Dhami, Hamro Chowk Mata,* and *Gauri Mandal Bhole* (50:1 each). All the interviewed traditional healers (100%) reported to use protective materials during their practices, contrary to the results obtained in other municipalities. In terms of diseases, the most common treated by the traditional healers are mental illness, lower abdominal pain and headache; whereas, the practice mostly performed is divination.

Schools and Colleges

Seven (7) schools and colleges were assessed in Biratnagar Metropolitan City, of which four (4) are secondary schools, and three (3) are tertiary educational institutions. Among them, the most populated are *Bal Kalyan Vidya Mandir School* and *Merryland College,* with an average daily attendance of 3,000 and 2,500, respectively. Although four (4) schools are attended by people from India, the percentage distribution is not significant (1%), except at *Nobel Medical College Teaching Hospital* (25%). The majority of the schools and colleges have health community workers or agents available on site (71%), contrary to the findings obtained in other municipalities in Sudurpashchim Province and Lumbini Province. Water is widely available across the sites, within a radius of 200 meters, except for *Jamia Islamia Secondary School,* which is 1 Km away from the nearest water source. The highest numbers of desks are found at *Nobel Medical College Teaching Hospital* and *Bal Kalyan Vidya Mandir School,* the latter also having the highest number of classrooms (110). The largest numbers of pupils/students per desk and classrooms are reported at *Pokhariya Secondary School* (5 and 66, respectively). Toilet facilities are present on site at all the educational institutions and

are separate for male and female pupils/students, and for teachers, except for *Merryland College* and *Jamia Islamia Secondary School.* Poorly equipped toilet facilities in terms of students and teachers to stall ratio, both female and male, are found at *Pokhariya Secondary School* (160:1 for students, 16:1 for teachers) and *Gautam Budha School* (119:1 for pupils, and 15:1 for teachers). The male to female pupils/students ratio varies across the sites, the majority of the schools (71%) have more male than female pupils (100-992 difference). Despite being operational throughout the four seasons (winter, summer, rainy, and spring) and generally busy throughout the year, there is wide unavailability of tracking matrix which can be used for contact tracing for visitors suspected for COVID-19 cases, while health screening stations (handwashing and hand sanitizer) are missing at three (3) sites. However, all the schools and colleges have isolated places for sick pupils/students, contrary to the results from other investigated municipalities where the studies were conducted. Waste management systems are mostly absent, and therefore, there is the visibility of stagnant water on the floor (71%), trash in the open (43%), and unwanted animals/insects across all the sites (100%).

Entertainment Centres

A significant number of entertainment centres (13) were assessed in Biratnagar Metropolitan City due to their location in areas with high population mobility. Specifically, *Central Mall* stands out in terms of entry flow on a daily basis (8,000), which reaches up to 15,000 on the busiest day. This is followed by *RK City Center* (2,500 people per day and 5,000 on the busiest), and *Sahid Rangasala* (1,500 people per day and 2,000 on the busiest). All the entertainment centres are visited by people from India (between 5-60%), and a minority are coming from Afghanistan and Bangladesh (*Central Mall*). Despite being generally operational throughout the four seasons, the majority of the sites lack health screening stations (handwashing and hand sanitizer) with approximately 77 per cent and body temperature checking (92%). Similarly, community health workers/agents are absent at all the centres, and isolated places dedicated for sick people, as well as tracking matrix for visitors, are unavailable at most of the sites (61% and 62%, respectively).

Market Centres

The five (5) market centres were identified during the study have high entry flows, between 2,000-10,000 people per day, and 4,000-15,000 on the busiest days. The most popular marketplaces in terms of population mobility (*Jaljalamod Market, Central Mall* and *Mainroad Market*) are also visited by the highest percentage of people coming from India (between 25-75%). Visitors at the markets also come from Bangladesh, China, and Pakistan. Health authorities in charge of emergency cases are completely absent across the sites, together with body temperature checking, and health screening stations (handwashing and hand sanitizer), except for *Central Mall.* This is viewed in respect of the huge population mobility at the assessed market centres. Although waste management systems are available, there is visibility of trash (100%), stagnant water (80%) and unwanted animals/insects across the sites, either in large or limited quantity. Water and toilet facilities are widely available, except at *Jaljalamod Market.* Different kinds of food and goods are sold at the marketplaces, in order of relevance; meat/poultry, goods/merchandise, fruits/vegetables, and fish.

Migrant Worksites

Twelve (12) migrant worksites were invested in Biratnagar Metropolitan City, with the largest in terms of population mobility being *Bhatbhateni Supermarket* (4,000 people per day and 6,000 on the busiest day). The majority of the sites (66.7%) are accessed by people from outside Nepal, with a percentage ranging from 5 to 50 per cent. Health screening stations (handwashing with soap and hand sanitizer) and body temperature checking are available only at four (4) migrant worksites. Water and toilet facilities are widely available, expect at *Bhumi Prasan Worker Gathering*

Area and *Gudri Worker Gathering Area*. Similarly to other sites, despite the presence of waste management systems (66.7%), the migrant worksites still presented visibility of stagnant water on the floor (50%), trash (66.7%), and unwanted animals/insects (100%). None of the sites has a community health worker/agent for emergency cases present on site, and only three (3) have a tracking matrix system (record book/devices for contact tracing mechanism) in place (*Chandra Shiva Rice Mill, Raghupati Jute Mill,* and *Sneak Appareals Pvt. Ltd.*). A suspected COVID-19 positive case was reported at *Hatkhola Chowk Worker Gathering Area*. The majority of the migrant worksites (66.7%) have living accommodation for their staff and the most common types include; concrete, zinc, and wooden house, in descending order.

Transport Stations

Similar to other municipalities, the transport stations in Biratnagar Metropolitan City are accessed by a high number of people, up to 5,000 per day and 8,000 on the busiest day (*Rani Buspark*). All the stations are visited by travellers from India (between 5-50%), except for *Taxi Park Station*. By inductive analysis, it is concerning that more than half of the transportations have no water (60%) nor toilet facilities on site (40%), and when present, these are not adequate (2-5 stalls/drop holes). Similar to the traditional healers, the distance to the nearest health centre is generally significant (between 1-7 Km), except for *Nobel Park Bus Station* (20 meters away). Suspected COVID-19 positive cases were reported at three (3) sites (*Rani Buspark, Rangeli Buspark,* and *Nobel Park Bus Station*). None of the stations have isolated places dedicated for sick individuals, nor community health workers/agents present on site, nor health screening stations (handwashing with soap and hand sanitizer), nor body temperature checking, nor do they keep records of travellers. Similar to other sites, only two (2) transport stations have a waste management system available, however, this is deficient due to the visibility of trash (60%), stagnant water (80%) and unwanted animals/insects (80%).

Places of Worship

Nine (9) places of worship were investigated in Biratnagar Metropolitan City, with the most popular, in terms of population mobility, being *Shree Satya Narayan Mandir,* with 800 people per day, and 1,000 on the busiest day. The majority of the places of worship (66.7%) are visited by people coming from India, with a percentage distribution between 2-40, while the remaining visitors come from Nepal. None of the sites have health screening stations (handwashing with soap and hand sanitizer), nor body temperature checking, nor do they keep records of their visitors, despite being generally operational throughout the four seasons. One COVID-19 suspected positive case was reported at *Shree Ganesh Mandir.* Toilet facilities and water for drinking or handwashing with soap or use after toilet are widely available, with a maximum of 25 stalls (*Lakshmi Narayan Temple*) and a minimum of 1 (*Balaji Babosa Mandir* and *Shree Ganesh Mandir*).

Other Places

Two (2) other places were assessed, *Puspalal Junction* and *Hotel Big*. The entry flow is between 500-1,000 people per day, and 600-1,500 on the busiest days. Both these sites are mostly visited by Nepalese nationals, and only a minority of people coming from India (5%). Toilets and water facilities for drinking or handwashing with soap or use after toilet are widely available, with the farthest distance to the nearest water source being only 500 meters (*Puspalal Junction*). None has community a health screening stations present on site, nor body temperature checking, nor tracking matrix for visitors (except for *Hotel Big*). The estimated percentage of people wearing masks at these sites is between 31-50.

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 health centre is *Koshi Hospital* and *Nobel Medical College Teaching Hospital,* despite not always being the nearest from the sites assessed.
- Inadequate or no presence of health authorities/agents dedicated for sick people, as well isolation rooms for ill people at the vast number of sites were the study was conducted.
- Despite the presence of waste management systems, often, they are not adequate, and consequently affect the sanitary conditions of already vulnerable locations in terms of population mobility.
- Several means of transport are used to travel from/to/within Biratnagar Metropolitan City. Travel by foot is substantial across the sites, and equal to the use of motorbikes, and followed by cars, minivans, and buses, in descending order magnitude.
- Tracking matrix (books/devices) which can be use to monitor people's flow are almost completely absent.
- There is availability of toilet facilities and water (use after toilet, handwashing or drinking) in most of the sites where the study was conducted, mainly based on pumps and the public water system.
- People generally understand and are aware of the procedures to follow if someone is affected by COVID-19. However, the percentage of people wearing masks is not satisfactory, especially places of worship, traditional healers, and POEs (around 20-40%).
- There is insufficient presence of health screening stations, including hand washing with soap, hand sanitizer and IPC, at the vast majority of 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.
- The majority of the assessed sites are open throughout the year and operational throughout the seasons, though their busiest period varies depending on their category and location.
- In terms of population mobility patterns, at the district level, they mainly originate from *Morang, Jhapa, Sunsari, Ilam* and *Panchthar*; whereas at the municipality level, people's movement emanates from *Biratnagar Metropolitan City* and from *Rangeli Municipality, Budhiganga Rural Municipality, Ratuwamai Municipality, Sunbarshi Municipality and Katahari Rural Municipality.*
- A large number of the sites investigated are situated near or connected to the main road *Dharan Road* through several alternative routes.

4.2 RECOMMENDATIONS

PMM has allowed us to better grasp the dynamics and characteristics of human mobility in Biratnagar Metropolitan City. 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) pieces, 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 disease, 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

	Group Weight	10	10	20	15	10
	Individual Indicator Weight	10	10	20	15	10
Shows Location		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
Buspark	210		0	0	0	0	190
Jahada Road	195		0	0	0	195	0
Mahendra Chowk	149		0	0	0	15	90
Tinpaini Chowk	148		0	10	100	0	0
Main Road	110		60	0	0	0	0
Bhrikuti Chowk	105		0	0	0	105	0
Sarochiya	100		0	0	0	0	0
Aap Bagaicha	80		80	0	0	0	0
Rampur	80		0	0	80	0	0
Malaya Road	80		0	80	0	0	0
Dhat	77		0	0	0	0	0
Islampur	76		0	0	0	0	0
Bishal Chowk	70		0	0	0	0	0
Roadcess	65		0	20	0	0	10
Jharna Chowk	60		0	0	60	0	0
Ban Bibhag Chowk	60		0	0	60	0	0
Jogbani	53		0	0	0	0	0
Hatkhola	48		0	20	0	0	0
Keshaliya	43		0	0	0	0	0
Amanagar	40		0	0	40	0	0
Pipal Marg	40		0	0	0	0	0
Pancholi	40		0	0	0	0	0
Daraiya	40		0	40	0	0	0
Hanumandas Road	40		0	0	0	0	0
Sanimandir Chowk	40		0	0	0	0	0

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