POPULATION MOBILITY AND PUBLIC HEALTH RISK MAPPING

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

Dhangadhi Sub-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 4 November 2020, the number of cases stands at 47,059,867, including 1,207,327 deaths worldwide.[1]

In Nepal, the first case of COVID-19 was reported on 23 January 2020. As of 4 November 2020, the total number of confirmed cases in Nepal stands at 179,614 with over 100,000 newly detected cases in five weeks, and 1,004 deaths.[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)

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

This report will present the PMM results conducted in Dhangadhi Sub-Metropolitan City, Sudurpashchim Province between 14 and 21 August 2020.

1.2 MUNICIPALITY PROFILE

Dhangadhi Sub-Metropolitan City is situated in the Kailali District, in the far western region of Nepal. It was established in 1976 as Dhangadhi Municipality and promoted to Sub-Metropolitan City in 2015. At the altitude of 109 m above sea level, the municipality is 750 Km away from the capital city, Kathmandu. Situated in a plain, it covers a total of 261.75 Km sq. (see Map 1), and borders with Kailari Rural Municipality in the east, Mohana River in the west, Godawari and Gauriganga Municipality in the north, and India in the south. As per 2011 Nepal census, the population living in the area is 101,970 (51,439 men and 50,531 women).
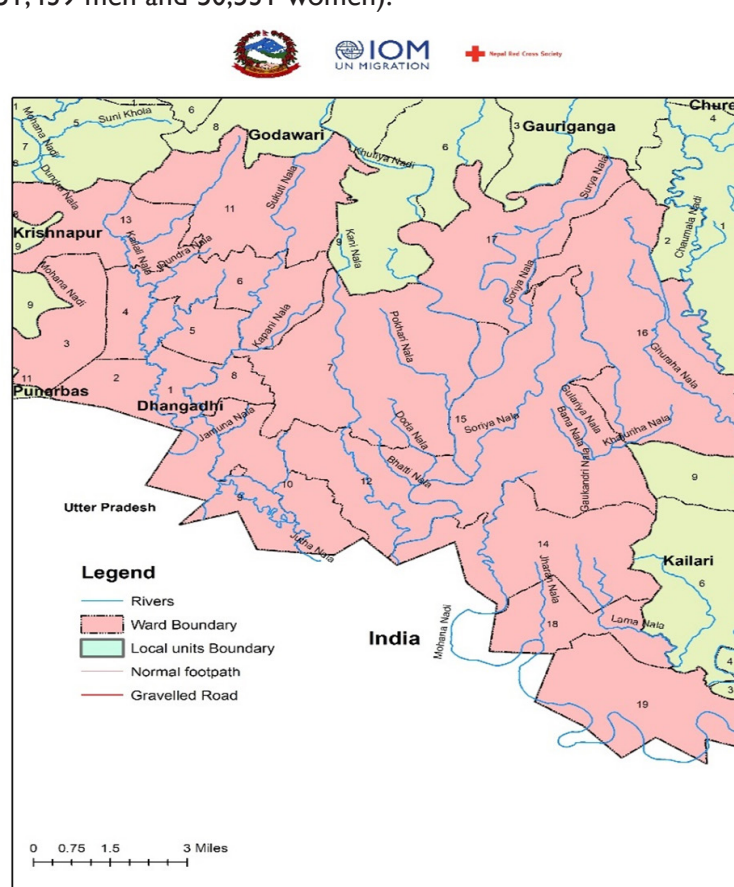
Map 1: Boundaries of Dhangadhi Sub-Metropolitan City, rivers and roads/paths. The map was used for the focus group discussions conducted as part of the PMM

The main sources of income, in order of relevance, are business, foreign employment, government services, labour work, and farming. The most common economic activities include sales at small shops and work in construction sites and factories. In Dhangadhi Sub-Metropolitan City there are a total of 8 urban health centres, including one zonal hospital and two health posts, for a total capacity of 150 beds. Registered health workers are 36, with 13 doctors, 9 nurses, 6 auxiliary nursing midwives, and 8 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 for the NRCS staff (15 people), who have supported the IOM PMM staff in the implementation of field activities (Picture 3 and 4). Standard Operating Procedures (SOPs) and Infection Prevention and Control (IPC) measures were observed by all participants and trainers throughout the sessions, which were also attended by Government representatives.

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

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

2.2 DATA COLLECTION

The method implemented in Dhangadhi Sub-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 Population Mobility Mapping Exercise in Dhangadhi Sub-Metropolitan City was conducted between 16 and 18 August 2020 and was comprised of 5 FGDs. A total of 25 KIs participated in the discussions, according to their respective category; 1) government representatives, 2) agency (specifically NGOs/INGOs) representatives, 3) community workers, 4) drivers, and 5) vendors.

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

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 5 and 6).

4. Due to restricted movement and lockdown, KIs were harder to reach and continuous coordination was necessary to utilize time efficiently and arrange dispatchment of enumerators to priority sites.

5. Despite the enforcement of SOPs and reminders for IPC measures, participants were often inattentive, especially during FGDs. A great deal of attention was put by the field team to make sure physical distancing was respected, people were wearing masks adequately and were using hand sanitizer frequently. Gloves, masks and hand sanitizer were provided by IOM to both the NRCS collaborators and KIs.

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

3. RESULTS

3.1 PHASE I

Following the data entry and consequent matrix analysis (see Annex 2), a total of 69 sites with high population mobility were selected for further assessments for Phase II. In particular, these are; 8 POEs, 8 Health Centres, 8 Traditional Healers, 10 Market Centres, 10 Transport Stations, 5 Places of Worship, 9 Migrant Worksites, 5 Schools and Colleges, and 6 Places of Entertainment (see Table 1.1).

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

POEs		
n	Name Site	Locality
1	Trinagar Chauki POE	Bhansar Tole
2	Jugeda POE	Jugeda
3	Basilica Mohan Naka POE	Bauliya Kheda
4	Bangra Katan POE	Bangra Katan
5	Triveni Ghat POE	Triveni Ghat
6	Kajariya Ghat POE	Bangra Katan
7	Fulbari POE	Fulbari
8	Nalka Ghat POE	Baiya Behandi

Health Centres		
n	Name Site	Locality
9	Seti Provincial Hospital	Hospital Line
10	Kailali Hospital	Hospital Line
11	Nisarga Hospital	Devotee Chowk
12	Maya Metro Hospital	Chatakpur
13	Eye Hospital	Chatakpur
14	CP Hospital Pvt Ltd	Main Road
15	Nawajiwan Hospital	Uttar Behandi
16	Main Road Hospital	Main Road

Traditional Healers	
n	Locality
17	Basanta Tole
18	Behandi
19	Durga Mandir
20	Ghuiyaghat
21	Hasanpur
22	Pashupati Tole
23	Taranagar
24	Setopul

Schools and Colleges		
n	Name Site	Locality
25	Kailali Multiple Campus School	Campus Chowk
26	Trinagar Ma. Vi. School	Main Road
27	Nast College	Uttar Behandi
28	Aishwarya Vidhya Niketan School	Hasanpur
29	Panchodaya Ma. Vi. School	Hasanpur

Entertainment Centres

n	Name Site	Locality
30	Joshi Cinema Hall	Main Road
31	Casino (Sathi Hotel)	Main Road
32	Deja Vu Dance Bar	Dhangadi Bazar
33	Fun Park	Bhansar Tole
34	Aircraft Museum	Hasanpur
35	Covered Hall	Hasanpur

Market Centres

n	Name Site	Locality
36	Bandevi Market	Bandevi
37	Buspark Market	Buspark
38	Chauraha Market	Chauraha
39	Dhangadhi Crossroad Market	Dhangadhi Crossroad
40	Dhangadhi Super Market	Dhangadhi Buspark
41	Hasanput Market	Hasanpur
42	L.N. Chowk Market	L. N. Chowk
43	Main Road Market	Main Road
44	Park Mode Market	Main Road
45	Traffic Chowk Market	Traffic Chowk

Migrant Worksites

n	Name Site	Locality
46	Akash Auto Service Center	New Bhansar Road
47	Chauraha	Chauraha
48	Dhangadhi Buspark	Main Buspark
49	Ghuiyaghat	Ghuiyaghat
50	KGN Bike Workshop	Chatakpur Chowk
51	KGN Metal Workshop	Chatakpur
52	Main Road Buspark	Main Road
53	Sabjimandi	Bandevi Tole
54	Tribehandi Embroidery	Dhangadhi Bajar

Places of Worship

n	Name Site	Locality
55	Bandevi Bhagawati Temple	Main Road
56	Behada Baba Temple	Rampur
57	Laxmi Narayan Temple	L.N. Chowk
58	Nava Durga Anusthan	Nava Durga Tole
59	Shivapuri Dham	Uttar Behandi

Transport Stations		
n	**Name Site**	**Locality**
60	Auto Station	L. N. Chowk
61	Campus Chowk Bus Station	Campus Chowk
62	Chauraha Bus Station	Chauraha
63	Chauraha Taxi Station	Chauraha
64	Dhangadhi Crossroad Buspark	Dhangadhi Crossroad
65	Hospital Line Transport Station	Hospital Line
66	Magic Transport Station	Chauraha
67	Main Buspark	Main Buspark
68	Ratopul Bus Station	Ratopul
69	Tanker Station	Chatakpur

3.2 PHASE II

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

3.2.a MAPS
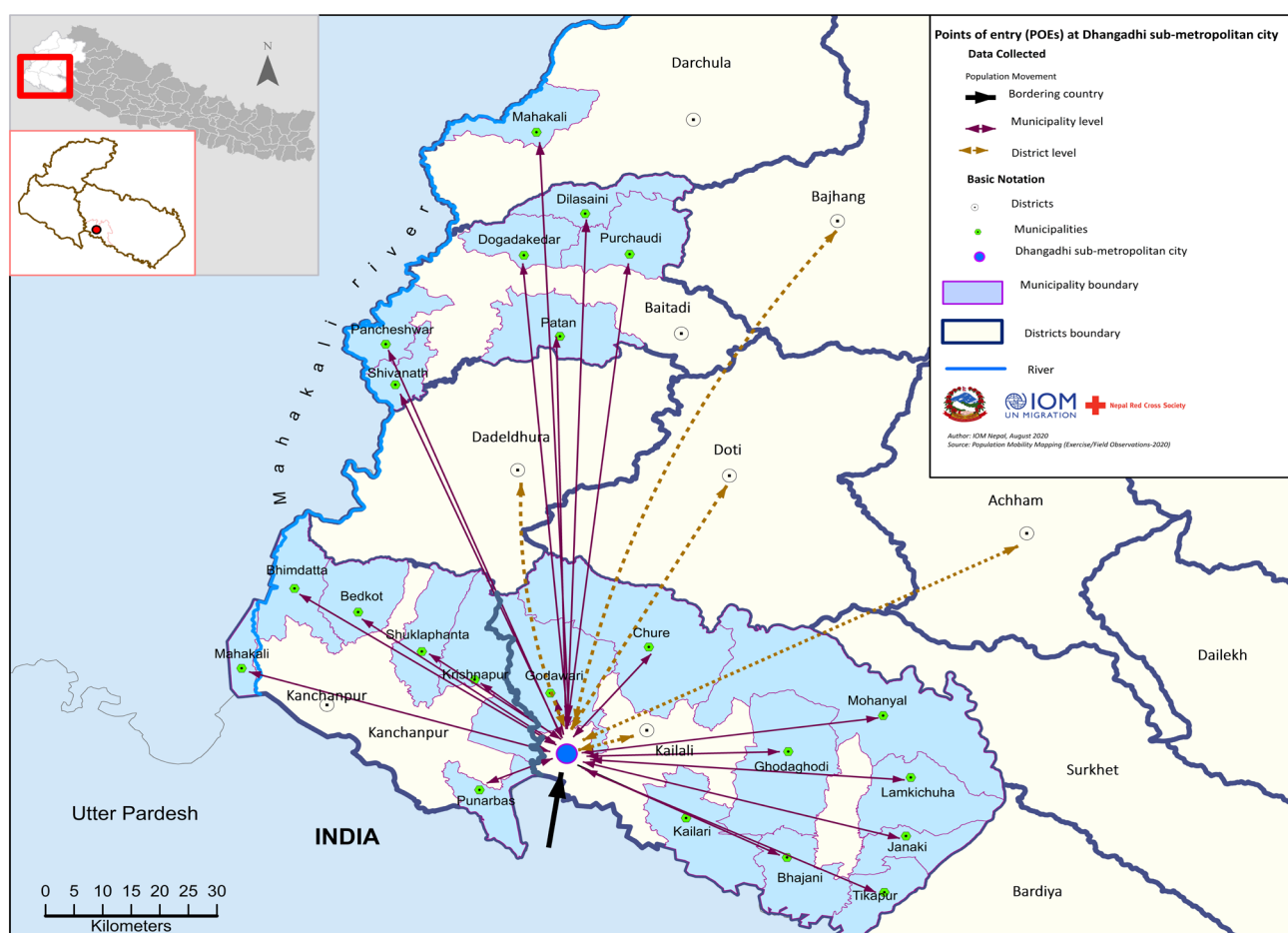
Map 2: Population movement from/to Dhangadhi Sub-Metropolitan City at the municipality, district and international level

Map 3: Identified vulnerable sites within the municipality boundary

Map 4: Accessibility and seasonality usage of identified vulnerable sites

Map 3 Legend:

Vulnerable sites
- ▲ Transport stations
- TH Traditional healers
- ◆ Entertainment centers
- ⬠ Worksops
- H Health centers
- ▢ Schools
- ◉ Markets
- ⬠ Migrant worksites
- ⚡ Points of entry
- — River
- ▬ PMM activity conduted
- — Main roads
- ▭ Ward boundary
- ▢ Local units

Author: IOM Nepal, August 2020
Source: Population Mobility Mapping (Exercise/Field Observations-2020)

Map 4 Legend:

Accessibility of the site
- ● Accessible by motorbike or on foot only
- ● Hardly accessible by vehicle
- ● Easily accessible by vehicle

Seasonality usage of the site
- ✕ All seasons
- ☑ Raining season only
- ◇ Spring only
- △ Summer only
- ▲ Winter only
- — River
- ▬ Land border
- — Main roads
- ▭ Ward boundary

Author: IOM Nepal, August 2020
Source: Population Mobility Mapping (Exercise/Field Observations-2020)

Map 5: Formal and informal POEs at the India-Nepal border (Dhangadhi Sub-Metropolitan City)

Field Observations: Kajariya POE (left) and site assessment (right)

3.2.b POINTS OF ENTRY (POEs)

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

The study reveals that the people who uses the POEs in Dhangadhi Sub-Metropolitan City mainly come from India and the destination districts are *Kailali, Doti, Dadeldhura, Baitadi* and *Achham*. Furthermore, the population mobility for these POEs are mainly from *Dhangadhi Sub-Metropolitan City, Tikapur Municipality, Kailari Rural Municipality* and *Lamki Chuha Municipality*. Population influx at the POEs occurs throughout the year, however the busiest days are Friday and Saturday.

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

The majority of the population crossing the border use *Trinagar Chauki POE* (Formal) to commute to their destinations through the main road *Bhimdatta Highway*, and reach the main junction called *Chauraha*. People also cross water landings (informal routes), such as *Triveni Ghat, Kagara, Fulbari, Kajariya Ghat* and *Basilika Mohan* POEs using other alternative routes to reach the respective transport stations from the main junction Chauraha to the destination districts. Most travellers use tricycle and minivan as mode of transportation to access POEs from the junctions, however, people walk to access the road due to unavailability of bridges at the water landings POEs (rivers).

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

Out of the eight (8) POEs identified in Dhangadhi Sub-Metropolitan City, only one – *Trinagar Chauki* – is a formal point of entry between Nepal and India. It is by far the most used in the municipality, with an average of 500 people crossing daily, and 600 in the busiest day (see Fig. 1) in both directions. Due to the high presence of rivers in the area, five (5) out of eight (8) POEs are water landing sites. On average, POEs are around 4 Km distant from the nearest health facility (public or private clinic, hospital or health post) with the closest at 2 Km (*Fulbari*) and the furthest at 10 Km (*Jugeda*). In *Fulbari, Trinagar Chauki*, and *Triveni Ghat*, half of the travellers come from India and half within Nepal neighbouring municipalities; whereas, in the remaining five (5) POEs 10 per cent each coming from India and 90 per cent are Nepalese citizens.

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

Name of POE	Status of POE	Type of POE	Average entry flow per day	Average entry flow in the busiest day	Distance to the nearest health centre [in Km]	Percentage coming from India
Trinagar Chauki POE	Formal	Land border	500	600	3	50
Jugeda POE	Informal	Land border	100	400	10	10
Basilica Mohan Naka POE	Informal	Water landing (swimming/boat/by foot if shallow water)	100	200	2	10
Bangra Katan POE	Informal	Water landing (swimming/boat/by foot if shallow water)	100	100	5	10
Triveni Ghat POE	Informal	Water landing (swimming/boat/by foot if shallow water)	50	50	3	50
Kajariya Ghat POE	Informal	Water landing (swimming/boat/by foot if shallow water)	50	50	2	10
Nalka Ghat POE	Informal	Land border	20	20	5	10
Fulbari POE	Informal	Water landing (swimming/boat/by foot if shallow water)	20	20	2	50

Fig. 1.1: Mobility patterns across the POEs

The flow of people during the year differs according to the different location (see Table 1.2). Three (3) POEs – *Bangra Katan, Kajariya* and *Triveni Ghat* – are equally used throughout the year; whereas for instance, *Fulbari* is mainly crossed by people in March. Similarly, people's movement during the week varies according to the specific site. Four (4) POEs – *Jugeda, Bangra Katan, Kajariya* and *Triveni Ghat* – are accessed by a similar flow every day. Overall, the busiest days for most POEs fall in the weekend (Friday to Sunday). The main purpose for travellers to cross these POEs is employment, including illegal activities in the case of *Nalka Ghat*, followed by trade, commerce, cultural festival, farming, etc. Specifically, the results show that markets are the major factor for people mobility across POEs (5/8).

Table 1.2: Busiest days/months, reason for higher flow, and main purpose of travellers at the POEs

Name of POE	Busiest month of the year	Busiest day of the week	Main purpose of travel	Reason for busiest week/month
Bangra Katan POE	Every month	Every day	Trade / market / commerce, employment, visit of relatives and/or friends	Market day (sporadic or nomadic), meet relatives, play football
Basilica Mohan Naka POE	February, October, November	Every day	Visit of relatives and/or friends, trade / market / commerce, employment	Religious festivals, crusade, meet relatives, wedding
Fulbari POE	March	Saturday	Employment, trade / market / commerce	Farming
Jugeda POE	July, February, October, November	Every day	Employment, trade / market / commerce, Visit of relatives and/or friends	Market day (sporadic or nomadic), religious festivals, wedding, meet relatives
Kajariya Ghat POE	Every month	Every day	Employment, visit of relatives and/or friends, fishing	Farming market (set up in the locality - temporal or permanent), market day (sporadic or nomadic), swimming
Nalka Ghat POE	February, June, July, August, September, December	Wednesday, Tuesday, Thursday, Friday ,Saturday	Illegal work	Market day (sporadic or nomadic)
Trinagar Chauki POE	May, June, December	Friday, Saturday, Sunday, Monday	Employment, transportation, trade / market / commerce, industry / mining / plantation / timber, visit of relatives and/or friends, education health care	Cultural festivals, farming, religious festivals, meet relatives
Triveni Ghat POE	Every month	Every day	Employment, trade / market / commerce, visit of relatives and/or friends, health care	Cultural festivals, market day (sporadic or nomadic)

Fig. 1.2 (left) shows the percentage distribution of people's movement across the POEs. Employment, industry/mining/plantation/timber, and trade/market/commerce account for the major purposes of people's mobility (17.14% each). Conversely, fishing, healthcare, illegal activities, such as human trafficking and clandestine commerce, and family/friends' visit carry the lowest weight with an average of 12 per cent. On the other hand, Fig. 1.2 (right) shows the distribution of the main reasons people cross the POEs. Cultural festivals, market day (sporadic/nomadic), meeting of relatives, and religious festivals outweigh other reasons for inward movement, with an average of 15 per cent.

Main purpose people travel across the POEs

Main purpose people travel	
Employment	17.14%
Fishing	8.57%
Healthcare	14.29%
Illegal work	11.43%
Industry/Mining/Plantation/Timber	17.14%
Trade/Market/Commerce	17.14%
Visit Relative and Friends	14.29%

Reasons for the busiest days/months

Legend: 5.71% — 17.14%

Reason for Busiest Month	
Crusade	5.71%
Cultural festivals	17.14%
Farming	5.71%
Farming Market (temporal or permanent)	11.43%
Market day (sporadic or nomadic)	17.14%
Meet relatives	14.29%
Play Football	5.71%
Religious festivals	14.29%
Swimming	8.57%

Fig. 1.2: Percentage distribution of the reason/purpose for the busiest days/months across the POEs

The majority of POEs are accessed throughout the seasons, except for *Kajariya Ghat* and *Fulbari*, which are used in winter and spring only, respectively. At *Bangra Katan, Fulbari, Kajariya Ghat,* and *Trinagar Chauki* an estimate of 10-30 per cent of people across the POEs wears a mask. On the contrary, *Basilica Mohan Naka, Jugeda*, and *Triveni Ghat* POEs account for less than 10 per cent of people that wear masks, and greater than 50 per cent at *Nalka Ghat*. In terms of health facilities, *Seti provincial hospital* is the nearest and most used by people from the respective POEs (4/8). The most common means of transport to access POEs is the motor bike, although people walk long distances across all the informal crossing points. The unavailability of water (for drinking, handwashing and/or other purposes) at the POEs is eminent (5/8).

Table 1.3: Accessibility, water availability, seasonality, nearest hospital from the POEs and estimated percentage of people wearing masks

Name of POE	Name of the nearest health facility	Seasonality of POE	Estimated percentage people wearing mask at POE	Mode of transport across POEs	Availability of water at POE
Bangra Katan POE	Seti provincial hospital	All seasons	10%-30%	By motor bike, car, foot	Available
Basilica Mohan Naka POE	Fulbright health post	All seasons	<10%	By foot	Not available
Fulbari POE	Partiva clinic	Spring only	10%-30%	By motor bike, foot	Not available
Jugeda POE	Urban health clinic	All seasons	<10%	By foot	Not available
Kajariya Ghat POE	Ghuiyaghat health post	Winter only	10%-30%	By foot, motor bike	Not available
Nalka Ghat POE	Seti provincial hospital	All seasons	>50%	By foot	Not available
Trinagar Chauki POE	Seti provincial hospital	All seasons	10%-30%	By bus, minivan	Available
Triveni Ghat POE	Seti provincial hospital	All seasons	<10%	By foot	Available

Fig. 1.3 (left) shows further details on the accessibility of POEs in Dhangadhi Sub-Metropolitan City. Among the various modes of transport, the use of motor bike stands at 28.6 per cent, however, as a result of the harsh terrain and poor road infrastructure, people generally walk rather than drive a vehicle (42.9%). Furthermore, despite the presence of a network communication system, this is deficient and ineffective (71.4%). Similarly, sources of water and toilet facilities are inadequate across the POEs, with the highest percentage of 62.5 and 85.7, respectively (see Fig. 1.3, right).
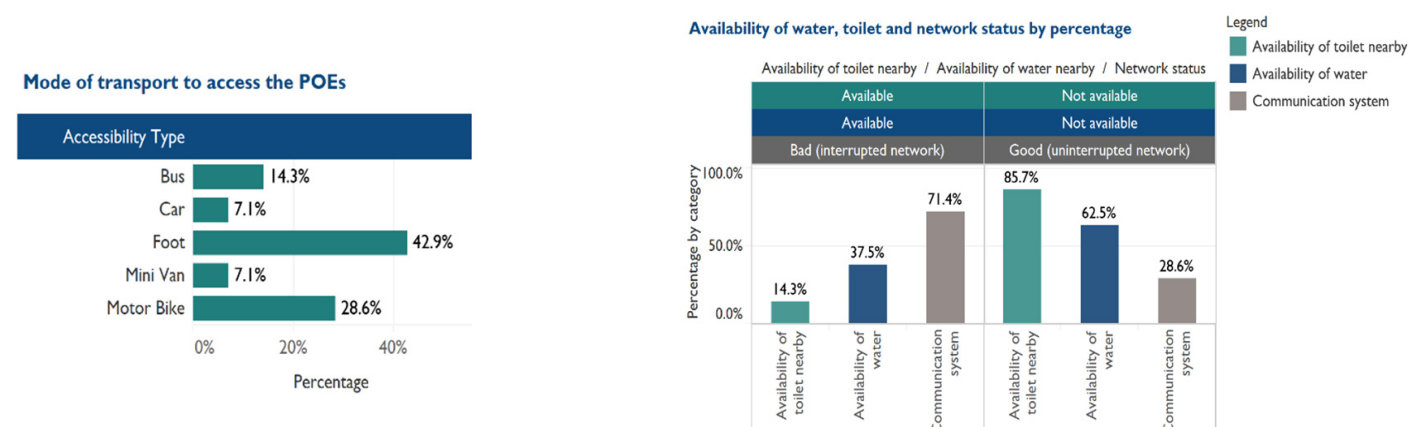
Fig. 1.3: Percentage distribution of modes of transport, water availability, toilet facilities, and network status

Among all the POEs in Dhangadhi Sub-Metropolitan City, only at *Trinagar Chauki*, special equipment to address health issues of international concern is available and an International Health Regulations (IHR) focal point, together with personnel for IPC are present. Similarly, at 7/8 POEs, community health workers are absent (see Table 1.4).

Table 1.4: Availability of health infrastructure and presence of professional health personnel at the POEs

Name of POE	Availability of special equipment to address health issues of PHEIC	Presence of IHR Focal point at POE	Presence of IHR Focalpoint in corresponding country	Presence of community health worker	Presence of personnel for IPC
Bangra Katan POE	Not available	Not available	Not available	Not available	Not available
Basilica Mohan Naka POE	Not available	Not available	Not available	Available	Not available
Fulbari POE	Not available	Not available	Not available	Not available	Not available
Jugeda POE	Not available	Not available	Not available	Not available	Not available
Kajariya Ghat POE	Not available	Not available	Not available	Not available	Not available
Nalka Ghat POE	Not available	Not available	Not available	Not available	Not available
Trinagar Chauki POE	Available	Available	Not available	Not available	Available
Triveni Ghat POE	Do not know	Do not know	Do not know	Not available	Not available

Fig. 1.4 describes in percentage the presence of IHR focal points in Nepal (pie chart on the right) and in the corresponding country (centre), notably India; together with the availability of special equipment to address health challenges of Public Health Emergency of International Concern (PHEIC) (pie chart on the left). Consequently, the assessment shows that an average of 80 per cent of all POEs has no adequate health infrastructure nor SOPs to address health challenges. This is important to note especially considering the location of border crossing points and their exposure to spread and transmission of infectious diseases.
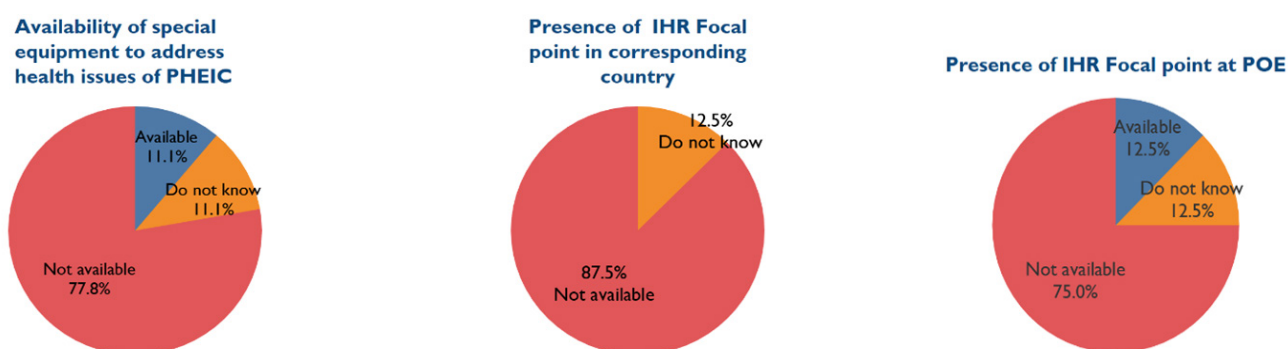
Fig. 1.4: Percentage distribution of health infrastructure status (special equipment to address health issues, IHR focal point at POE and in the corresponding country)

3.2.c HEALTH CENTRES

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

The investigation depicts that most of the visitors and patients come from the *Kailali, Doti, Achham, Bajura, Dadeldhura, Baitadi, Kanchanpur* and *Bajhang* districts. The health centres in Dhangadhi Sub-Metropolitan City are open every day, although the busiest day is Sunday. At the municipality level, the main origins of visitors and patients are *Dhangadhi Sub-Metropolitan City, Dasharathchanda Municipality, Punarbas Municipality, Bhimdatta Municipality, Mahakali Municipality, Shuklaphanta Municipality, Tikapur Municipality*, and *Godawari Municipality*.

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

In Dhangadhi Sub-Metropolitan City, almost all the health centres are accessible by vehicle since, after the determination and assessment of the priority sites location, they were found to lie near the main road, *Bhimdatta Highway*, and other routes accessible by vehicle. *Seti Provincial Hospital, Kailali Hospital,* and *Nawajiwan Hospital* are located on the same route connected to the near large locality, *Dhangadhi Bajar*. On the other hand, *Main Road Hospital, Maya Metro Hospital*, and *CP Hospital* are situated on *Bhimdatta Highway,* which connects other municipalities and districts as well.

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

In Dhangadhi Sub-Metropolitan City, the only government hospital – *Seti Provincial Hospital* – has the highest number of people admitted in the inpatient and outpatient wards, with 1,700 and 10,000 patients, respectively. Private health centres, such as *Eye Hospital, CP Hospital Pvt Ltd* and *Kailali Hospital*, in descending order of outpatient ward numbers, admit most patients (1,586, 1,500 and 900). The number of influx of people oscillates between 30 in *Main Road* and *Eye* hospitals, and 300 in *CP hospital Pvt Ltd*, for patients admitted in the inpatient ward. Three (3) hospitals, namely *Seti Provincial Hospital, Nawajiwan Hospital* and *Nisarga hospital and research centre Pvt Ltd* have 20 stalls (drop holes) available in terms of toilet facility. On average, the other hospitals only have around 5 stalls. It is worth mentioning that the analysis in Fig. 2.1 is based on data from the three months prior to the date of observation (August 2020).

Number of Inpatient and Outpatients based on the last three months (May-July 2020)

Name of Hospital	Type of Hospital	Average number of patients admitted in Inpataient Ward	Average number of Outpatient Ward	Number of stalls (drop holes) [Toilet facility]
Seti Provincial Hospital	Government hospital	1,700	10,000	20
Eye hospital	Private hospital	30	1,586	5
CP Hopital Pvt Ltd	Private ospital	300	1,500	
Kailali Hospital	Private hospital	150	900	3
Nawajiwan Hospital	Private hospital	70	250	20
Maya metro hospital	Private hospital	30	150	6
Main Road	Private hospital	90	130	5
NiSarga hospital and research centre pvt.ltd	Private hospital	60	70	20

Fig. 2.1: Number of inpatients, outpatients and stalls (toilet facility) at the health centres

The analysis shows that the waste management practices adopted by health facilities include; placenta, burning and ash pits, incinerator, and waste bins. The availability of waste bins and regular disposal of waste, both carry equal weight across the health centres (28.6%). Despite the incinerator being the most adequate system to manage waste, it presents a moderate percentage of 21.4 (see Fig. 2.2, left). Health centres are equally accessed by bicycle, minivan, motorbike and foot (18.2% each). A limited 13.6 per cent of patients reaches the facilities by truck or bus (see Fig. 2.2, right).

Waste management at the health centres

Waste Disposal Type	
Ash pit	3.6%
Burning pit	7.1%
Incinerator	21.4%
Placenta pit	10.7%
Waste bins available	28.6%
Waste bins regularly emptied	28.6%

Legend
3.6% ▬▬▬ 28.6%

Mode of transport to access the health centre

Accessibility Type	
By Bus	13.6%
By Bicycle	18.2%
By Car	13.6%
By Foot	18.2%
By Minivan	18.2%
By Motorbike	18.2%
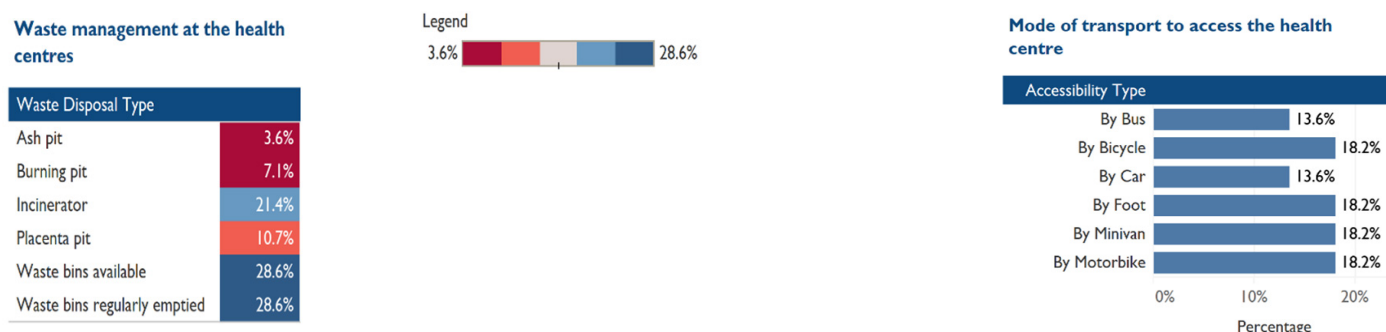
Fig. 2.2: Waste management and modes of transport to access the health centres

In Dhangadhi Sub-Metropolitan City, people are mostly affected by dengue, malaria and typhoid (12.1% each). Generally, patients go to the hospital for surgical treatment and diarrhea issues, with an equal weight of 10.6 per cent. COVID-19, influenza, antenatal and post-natal care are the third most common issues for which patients seek health care (9.1%).

Diseases affecting people and the main reason patients visit the health centres in Dhangadhi Sub-Metropolitan City

HIV/AIDS 7.6%
Antenatal & post-natal care 9.1%
Diarrhea 10.6%
COVID-19 9.1%
Influenza 9.1%
Typhoid 12.1%
Malaria 12.1%
Measles 7.6%
Surgery 10.6%
Dengue 12.1%
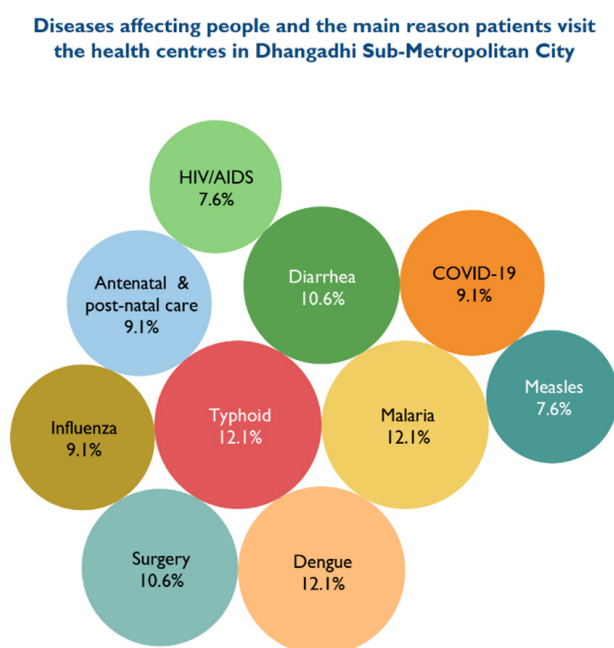
Fig. 2.3: Percentage distribution of health issues affecting people in Dhangadhi Sub-Metropolitan City

In terms of patients' flow, *Seti provincial hospital* has the highest average of people entering the facility per day (500); whereas *Maya metro hospital* has the highest average on the busiest day (2,000). *CP hospital Pvt. Ltd, Kailali hospital* and *Main road hospital* have the same amount of people entering the facilities daily and on the busiest days; 200, 100 and 70, respectively. *Nawajiwan hospital* is the second most accessed centre per day, with 220 incoming people (see Fig. 2.4).
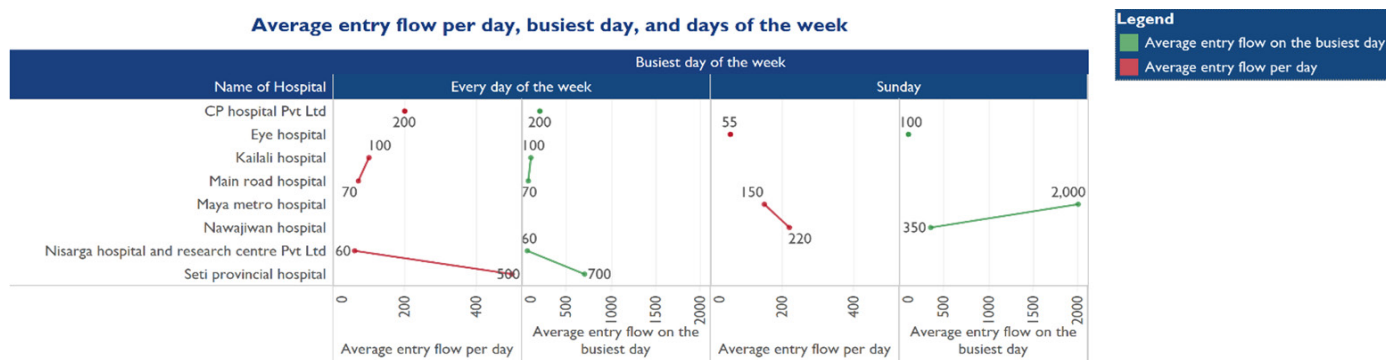
Fig. 2.4: Population mobility at the health centres

Fig. 2.5 shows a dual line with different indicators – the line in green colour indicates the distance to the nearest heath centre, whereas the line in yellow shows the distance to the nearest water source (inlcuding pumps, wells, the public water system or rain catchment) which is accessible by foot, motorbike, or car. *Main road hospital* and *CP hospital Pvt Ltd* are the furthest away from other health centres, at 5 Km. In terms of water accessibility, *Maya metro hospital* is 4 Km distant from the nearest water source, whereas the remaining health centres are at an average of 1.5 Km distance. The line in red shows the number of stalls (toilet facility) for patients, and the line in pink shows the number of stalls dedicated for staff members. On average, the number of stalls for patients are double the number of stalls for staffs across the health centres. *Seti provincial hospital, Nawajiwan hospital* and *Nisarga hospital and research centre Pvt Ltd* have the highest number of stalls for both patients and health personnel, with around 20 and 10 for the respective category, compared to an overall average of 5 stalls per group at the other health facilities.
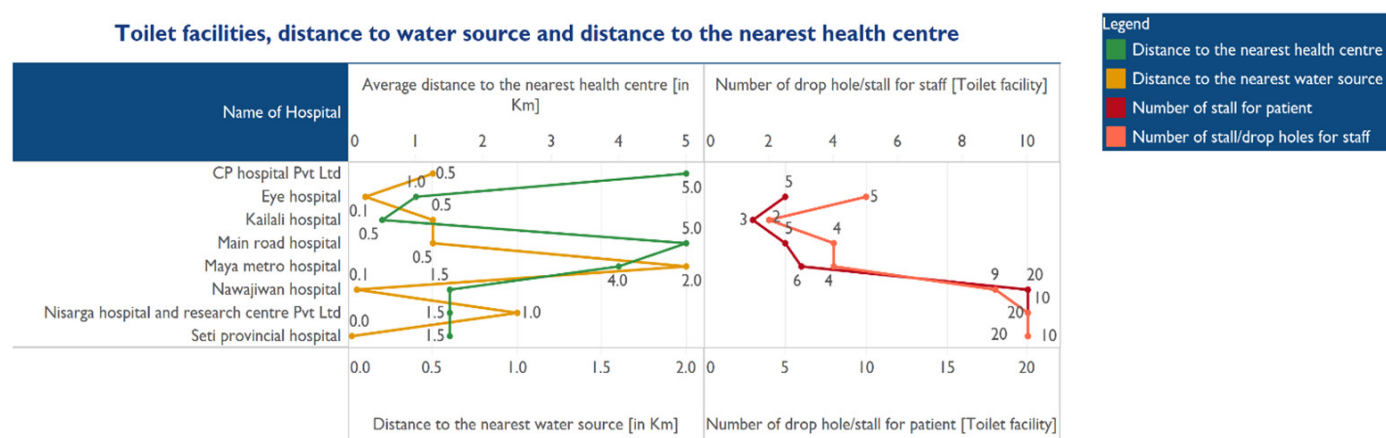
Fig. 2.5: Distance to the nearest water source and health centre, and number of stalls for staffs and patients

According to health officers at the various hospitals, an estimated percentage was predicted for people who seek health care somewhere else before going to the hospital. Overall, according to the results obtained from four (4) out of seven (7) hospitals (see Table 2.1), less than 10 per cent of people are first cared at home, first. Similarly, six (6) out of seven (7) hospitals have stated that less than 10 per cent of people seek care from religious leaders. A significant percentage of people seem to prefer private hospitals (between 10 and 50 per cent). Furthermore, according to two (2) hospitals, more than half of the patients go to the pharmacy prior to health facilities. Traditional healers are chosen over religious leaders, with percentages which oscillate between 10 and 50 per cent. The majority of the hospitals have agreed that up to 50 per cent seek care elsewhere before going to the hospital.

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

Name of Hospital	Care at home	Care at other public health places	Care at private hospital	Care from religious leaders	Care at the pharmacy	Care at the traditional healer	Care elsewhere
CP hospital Pvt Ltd	<10%	<10%	31%-50%	<10%	<10%	<10%	31%-50%
Kailali hospital	10%-30%	31%-50%	31%-50%	<10%	>50%	10%-30%	31%-50%
Main road hospital	<10%	10%-30%	10%-30%	<10%	<10%	<10%	10%-30%
Maya metro hospital	<10%	<10%	<10%	<10%	<10%	<10%	<10%
Nawajiwan hospital	31%-50%	31%-50%	>50%	31%-50%	>50%	31%-50%	>50%
Nisarga hospital and research centre Pvt Ltd	<10%	10%-30%	10%-30%	<10%	10%-30%	10%-30%	<10%
Seti provincial hospital	10%-30%	>50%	<10%	<10%	31%-50%	<10%	31%-50%

In Fig. 2.6, the line in yellow shows the number of auxiliary health workers, and the line in blue indicates the number of auxiliary nursing midwives. The green line refers to the number of health assistants, the orange line to the number of lab technicians, in red is the number of medical officers, and the grey line indicated the number of nursing officers. *Maya metro hospital* has the highest number of total health personnel out of the eight (8) hospitals investigated, and accounts for 147 staffs, followed by *Seti provincial hospital* (64). However, *Nisarga hospital and research centre Pvt Ltd* is by far the health centre with the highest number of medical officers (6), compared to 1 or 2 in other hospitals. Generally, nurses – auxiliary midwives and nursing officers – are the largest category among health personnel and across health centres. It has to be noted that the number of health personnel at each hospital mainly depends on the size of the hospital.
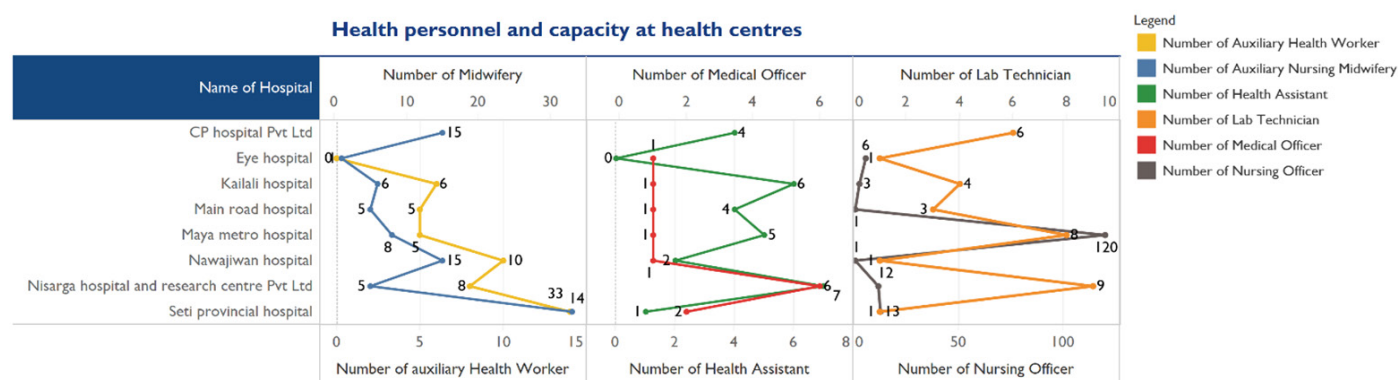
Fig. 2.6: Health personnel at the health centres by category

All the assessed hospitals have waste mangement system available and health screenings are conducted 24/7. Five (5) out of seven (7) hospitals have tested their emergency prepardness plan and have IPC measures in place. Approximately 43 per cent of the hospitals (3/7 hospitals) have tested their emergency preparedness plan less than 3 months from the date of observation. Similalry, around 29 per cent (2/7 hospitals) have conducted the test between 6 to 9 months from the date of observation, or over 9 months. Two hospitals – *Kailali hospital* and *Maya metro hospital* – have not yet tested their emergency preparedness plan and have no IPC training nor equipments available (see Table 2.2).

Table 2.2: Status of emergency preparedness plan, IPC, and health screening at the health centres

Name of Hospital	Availability of waste management system	Presence of health screenings 24/7	Emergency preparedness plan status	IPC Status	Emergency preparedness plan last tested
CP hospital Pvt Ltd	Available	Available	Yes, tested	Available	Between 6 to 9 months
Kailali hospital	Available	Available	Not tested	Not available	Not tested
Main road hospital	Available	Available	Yes, tested	Available	Less than 3 months
Maya metro hospital	Available	Available	Not tested	Not available	Not tested
Nawajiwan hospital	Available	Available	Yes, tested	Available	Less than 3 months
Nisarga hospital and research centre Pvt Ltd	Available	Available	Yes, tested	Available	Less than 3 months
Seti provincial hospital	Available	Available	Yes, tested	Available	Over 9 months

3.2.d TRADITIONAL HEALERS

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

The traditional healers' compounds in Dhangadhi Sub-Metropolitan City are open throughout the year, although the busiest day is Saturday. According to the study, visitors from the nearest districts come to visit these sites, and mostly originate from *Kanchanpur, Achham, Bajura, Bajhang, Dadeldhura, Baitadi* and *Doti* districts. At the municipality level, population mobility to these sites comes from *Godawari Municipality, Ghodaghodi Municipality, Bhajani Municipality, Lamki Chuha Municipality,* and *Tikapur Municipality.*

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

The study shows all the traditional healers in Dhangadhi Sub-Metropolitan City are accessible by vehicle and people mostly use tricycle and bicycle to access these sites from the main junction, *Dhangadhi Bajar.* Traditional healers from *Basanta Tole, Behandi, Pashupati Tole* and *Ghuiyaghat* are connected to the main road *Bhimdatta Highway,* however, other alternative walkways are also available to reach these sites. All the investigated traditional healers' compounds are situated in large localities, namely *Basanta Tole, Behandi, Pashupati Tole, Hasanpur,* and *Ghuiyaghat.*

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

Traditional healers were interviewed at eight (8) different localities in Dhangadhi Sub-Metropolitan City (see Fig. 3.1). The dual axis describes the entry average flow per day (red line) and on the busiest days (blue line). *Pashupati Tole* location has the highest mobility both on normal and busy days. Alternatively, *Setopul, Hasanpur,* and *Basanta Tole* locations have an average of 53 patients visiting the traditional healers per day, whereas the remaining locations have an average entry flow of 24 patients per day. People coming from other countries, notably India, this account for 50 and 20 per cent at *Pashupati Tole* and *Basanta Tole,* respectively.

Average entry flow per day, busiest days, and percentage coming from India to the Traditional Healer's compound
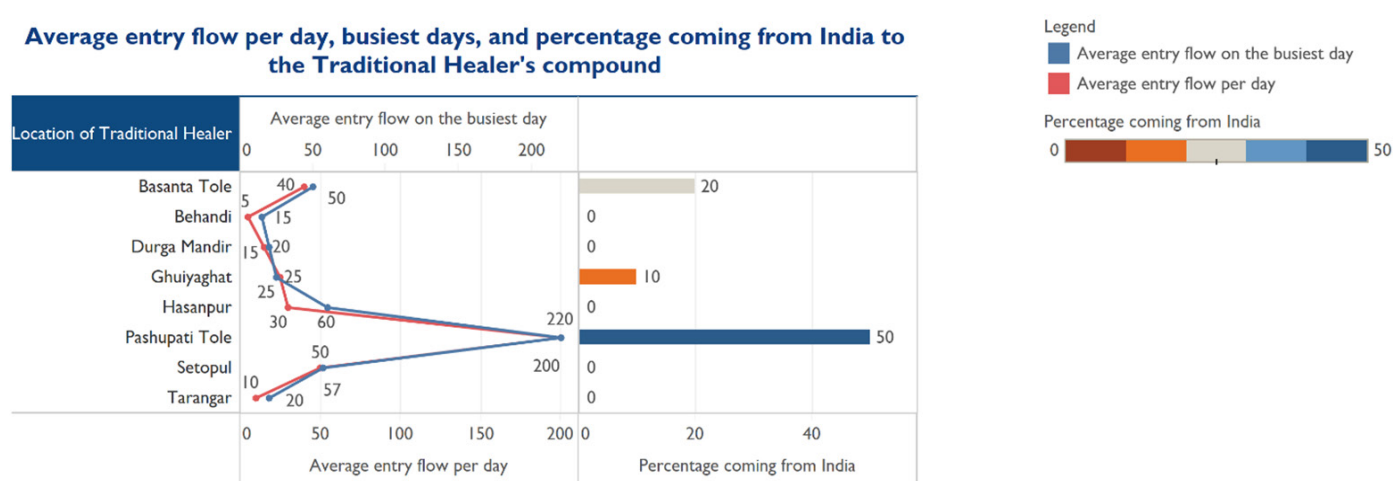
Fig. 3.1: Population mobility at the traditional healers

The eight (8) traditional healers interviewed in Dhangadhi Sub-Metropolitan City were found to be equally busy throughout the year and open every day. Specifically, the locations of *Ghuiyaghat* and *Pashupati Tole* are open to patients day and night. The vast majority of the traditional healers (7/8) – except at *Setopul* locality – do advice patients to seek health care at health centres. According to the findings, all the traditional healers have toilets nearby. Half of the respondents have stated that patients do wear masks, whereas the remaining reported 10-30 per cent, except at *Behandi*, where the estimated percentage falls less than 10. One traditional healer reported to have had a COVID-19 suspected case at his/her premise. The average distance from the traditional healers to the nearest health centre is 1.45 Km, and travel time to be reached is 0.5 hours.

Traditional Healer's basic health practices during COVID-19 and accessibility to the nearest health centre

Location of Traditional Healer	Advice patient to seek care at the health centre	Availability of toilet nearby	Compound opening day/night	Estimated percentage wearing mask	Seasonality	Suspected COVID-19 case	Distance to the nearest health centre [in Km]
Basanta Tole	Yes	Available	Day	>50%	All seasons	No	0.5 / 2.0
Behandi	Yes	Available	Day	<10%	All seasons	No	1.0
Durga Mandir	Yes	Available	Day	>50%	All seasons	Yes	0.1 / 0.3
Ghuiyaghat	Yes	Available	Day and Night	10%-30%	All seasons	No	0.2 / 0.5
Hasanpur	Yes	Available	Day	>50%	All seasons	No	0.5 / 2.0
Pashupati Tole	Yes	Available	Day and Night	31%-50%	All seasons	No	0.3 / 1.0
Setopul	No	Available	Day	>50%	All seasons	No	0.5 / 2.0
Tarangar	Yes	Available	Day	>50%	All seasons	No	0.5 / 2.0

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

According to field assessments, the following are the diseases suffered by people who seek help from the traditional healers, in descending order of percentage; fever, diarrhea, skin diseases, mental cure, headache, and others. Fever and diarrhea carry the highest weight with 15.9 and 13.6 per cent, respectively. In terms of accessibility to the traditional healer's compounds, motor bikes, minivans, and cars account for the highest percentage with 28.6, 21.4, and 21.4, respectively (see Fig. 3.3).

Diseases and health issues addressed by traditional healers

Name of Diseases	
Fever	15.9%
Diarrhea	13.6%
Skin diseases	11.4%
Mental Cure	11.4%
Headache	11.4%
Lower abdominal pain	9.1%
Abdominal pain	9.1%
Yellow fever	6.8%
STI	6.8%
Snake bite	4.5%

Percentage
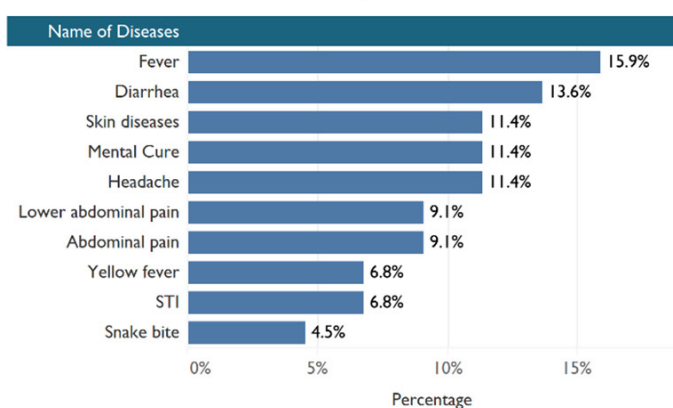
Mode of transport to access the traditional healer's compound

Mode of Transport	
By Motor bike	28.6%
By Minivan	21.4%
By car	21.4%
By Bus	17.9%
By Truck	10.7%

Percentage
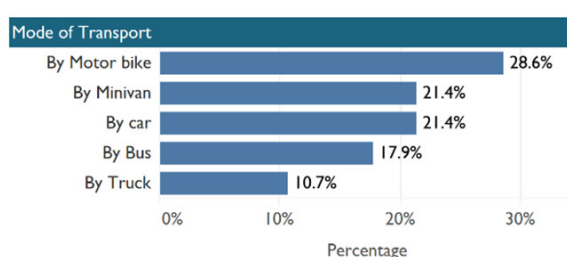
Fig. 3.3: Diseases addressed by the traditional healers (left) and modes of transport to access the sites (right)

The findings show that the majority of the traditional healers have a waste management system in place. The source of water comes from pumps and the public water system, with 75 and 25 per cent, respectively, while 50 per cent accounts for the visibility of stagnant water on the floor (see Fig. 3.4, top). Divination is the most common practice performed by the traditional healers (36.4%). This is followed by the treatment of body and mental issues, protection, and others. Fever is the main health issue for which patients seek help from the traditional healers (27.3%). Other diseases are less common, especially skin diseases (13.6%), snake bites and lower abdominal pain (9.1% each).

Availability of waste management, source of water, and visibility of stagnant water on the floor

Availability of Waste Management System	Visibility of Stagnant Water on the Floor	Source of Water	Percentage by waste management	Percentage by stagnant water on the floor	Source of water by percentage
Available	Visible	Pump	62.5%	50.0%	75.0%
Not available	Not visible	Public water system	37.5%	50.0%	25.0%
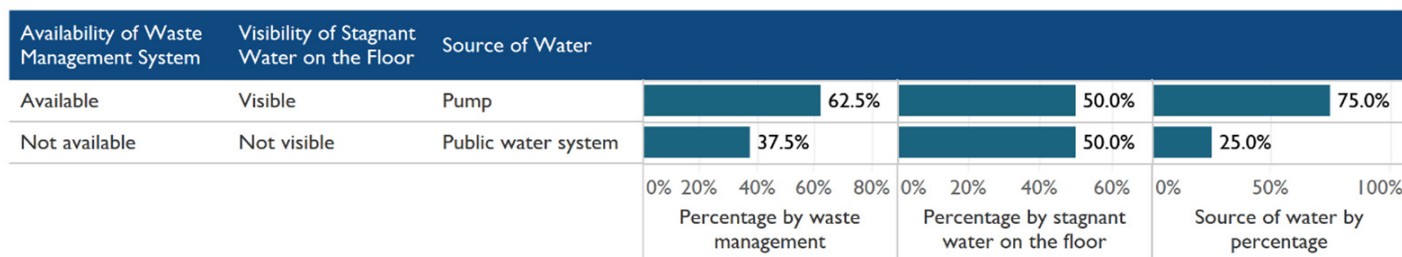
Type of practices and the main reason people go to the traditional healer's compound

Type of Practices	Name of Diseases	Practices by percentage	Diseases patients seek by percentage
Divination	Fever	36.4%	27.3%
Disease cure	Snake bite	18.2%	9.1%
Protection	Skin diseases	13.6%	13.6%
Mental Cure	Diarrhea	13.6%	22.7%
Love Password (Mohani)	Headache	9.1%	18.2%
Exorcism	Lower abdominal pain	9.1%	9.1%
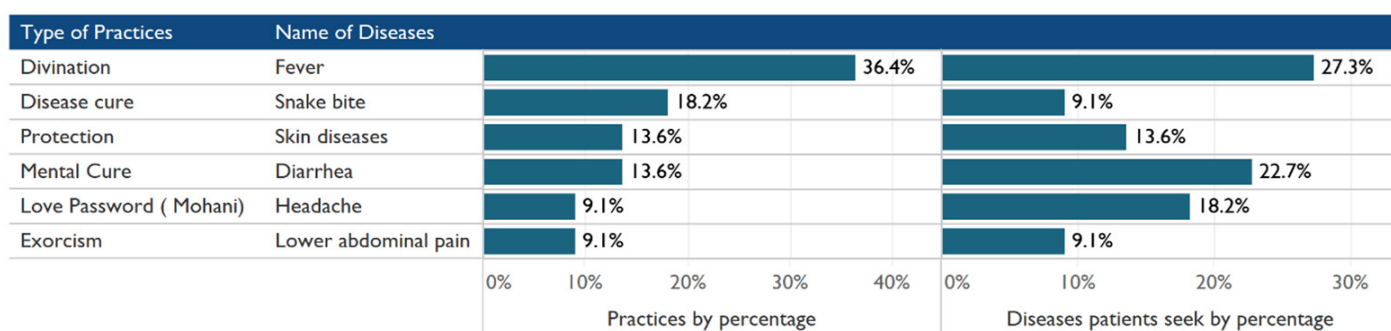
Fig. 3.4: Waste management and water availability (top), and traditional healers' practices and most common diseases (bottom)

The analysis indicates the presence of unwanted animals/insects which was investigated to determine the probability of animals transmitting diseases to humans. Flies/moths, ants/beetles and mosquitoes were identified by the KIs with percentages of 15, 25 and 30, in ascending order (see Fig. 3.5). According to direct observations, other animals are visible, such as cows, buffalos and dogs, just to name a few. Fig. 3.5 also shows the distribution by percentage of the major

reasons for patients to visit the traditional healers, which are linked to a number of events across the municipality. Religious festivals and visits of relatives carry percentages of 40 and 26.7, respectively, while the remaining events carry an average of around 16 per cent.

Unwanted insects/animals and corresponding events for people seeking care from the traditional healers

Name of Unwanted Animals/Insects	Corresponding Events	Percentage of unwanted insects/animals	Percentage by corresponding events
Mosquitoes	Religious festivals	30.0%	40.0%
Cockroaches	Wedding	30.0%	20.0%
Ants/beetles	Crusade	25.0%	13.3%
Flies/moths	Meet relatives	15.0%	26.7%
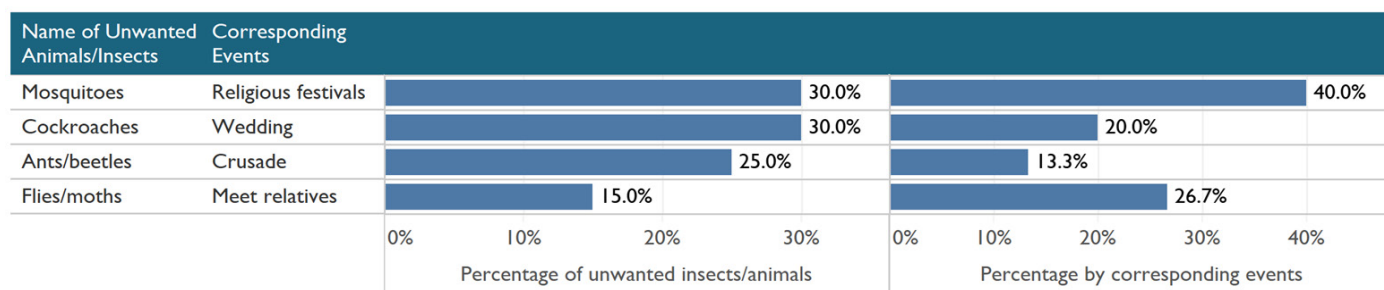
Fig. 3.5: Presence of unwanted animals/insects and corresponding events for the busiest days/months

3.2.e SCHOOLS AND COLLEGES

Population Mobility Pattern (who, where they come from, where they go)
According to the study results, the schools in Dhangadhi Sub-Metropolitan City largely attract students from the close-by localities. However, colleges attract students from nearby municipalities and districts as well. The investigated schools and colleges are open six days a week, except Saturday, and throughout the year, although the busiest months are January, April, June, and October.

Connectivity (link with the main community, route, accessibility, mode of transport, seasonality, communication)
Among the schools and colleges assessed in Dhangadhi Sub-Metropolitan City, *Kailali Multiple Campus* and *Nast College* lie within the same localities and are connected through the main road *Bhimdatta Highway* with close-by localities, *Shivanagar, Hasanpur, Setopul* and *Campus Chowk Buspark*. Subsequently, *Aishworya Vidhya Niketan HSS* is connected to the road *Uttar Mukhe Marg*, which lies in the *Taranagar* locality. This locality is situated near the largest locality, *Hasanpur*, and it is accessible by bus, truck, minivan, car and motorcycle.

Vulnerability/Capacity Analysis (in front of a risk of spread of communicable diseases)
The most used health centre according to the school/college authorities is *Seti provincial hospital*, except for *Nast College*, whose representative stated *Nawajiwan Hospital* as the most used health facility. The nearest distance from the schools/colleges to the health centre is 0.2 Km (*Nast College*), compared to the farthest being 2 Km in the case of *Kailali Multiple Campus*. From this site, students travel for 1 hour by vehicle to reach the nearest health centre. The average attendance per day in *Kailali Multiple Campus* is 12,000, followed by *Trinagar Ma. Vi. School* with 1,228. The remaining education centres have far less mobility, ranging from 70 to 25 people per day.

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

Name of School/College	Most used Health Centre	Average Flow Per Day	Distance to the nearest health centre [in Km]	Time taken to reach to the nearest health centre [in Hrs]
Kailali Multiple Campus	Seti Provincial Hospital	12,000	2.0	1.0
Trinagar Ma.Vi. School	Seti Provincial Hospital	1,228	0.3	0.8
Nast College	Nawajiwan Hospital	70	0.2	0.1
Panchodaya Ma.Vi. School	Seti Provincial Hospital	60	0.5	0.1
Aishwarya Vidhya Niketan	Seti Provincial Hospital	25	0.5	0.1

Fig. 4.1: Population mobility at the schools/colleges

In schools/colleges, the assessment revealed that there is distribution of separate toilets according to gender, for both categories of students/pupils and teachers. *Nast College, Aishwarya Vidhya Niketan*, and *Kailali Multiple Campus* have the highest number of toilet facilities, with an average of 22, for both male and female students/pupils (see Fig 4.2). However, *Nast College* have more toilet facilities than *Kailali Multiple Campus*, which has the largest population influx. In terms of number of students per toilet, *Kailali Multiple Campus* has the highest number of students using the same toilet, one (1) toilet for over 600 female pupils and one (1) toilet for over 500 male pupils. This is closely followed by *Trinagar Ma. Vi. School* (1 toilet for almost 350 female students and 1 toilet for 500 males). *Nast College* is the best equipped with toilet facilities with only 13 female students using the same toilet and one (1) toilet for 15 males (see Fig. 4.2 and 4.3).
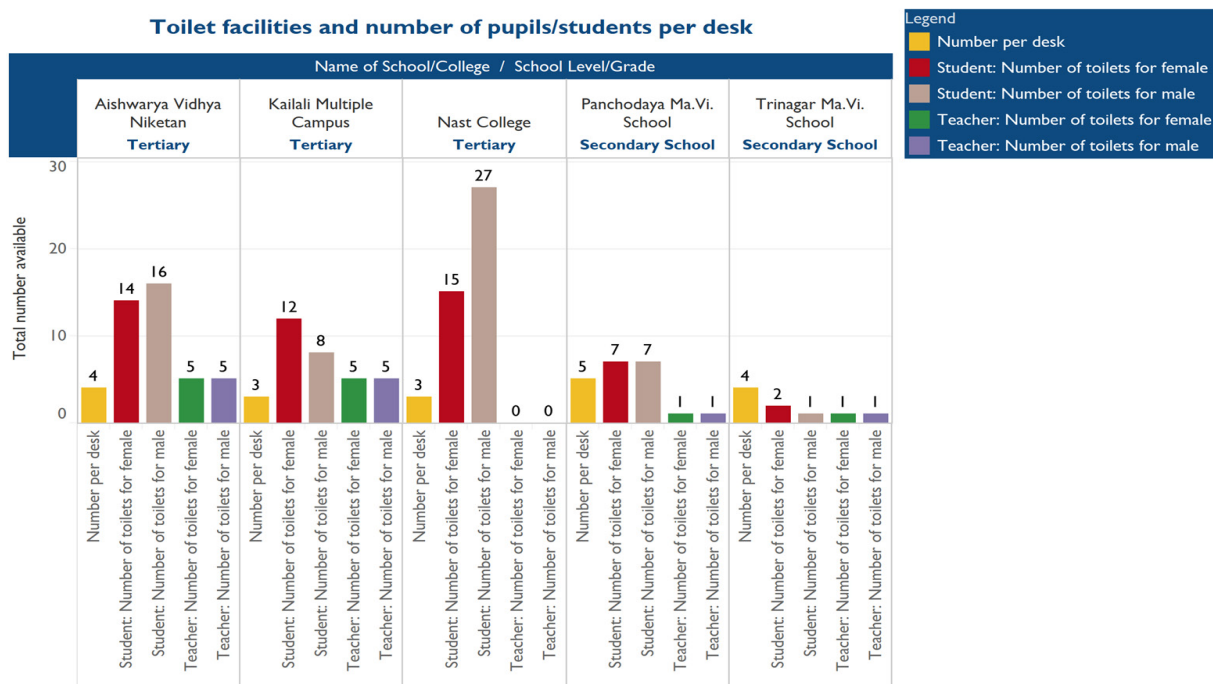
Fig. 4.2: Toilet facilities and students/pupils' seating accommodation

Kailali Multiple Campus is the most populated with 12,000 enrolments in 2019, 4,000 males and 8,000 females. As shown in Fig 4.3 and 4.4, *Kailali Multiple Campus* is also the most crowded in the terms of people per classroom, considering the number of classrooms is 120, compared to, for example, *Aishwarya Vidhya Niketan School*, which has around one-third of enrolments (4,500) but more classrooms (125). Female students are in higher numbers compared to boys in all the educational facilities, except for *Nast College*, which is also the least populated in terms of students but with the highest number of teachers per student (1 teacher for 8 students), compared to other schools/colleges (1 teacher for 36 students).

Total number of school population before COVID-19 Pandemic (2019)
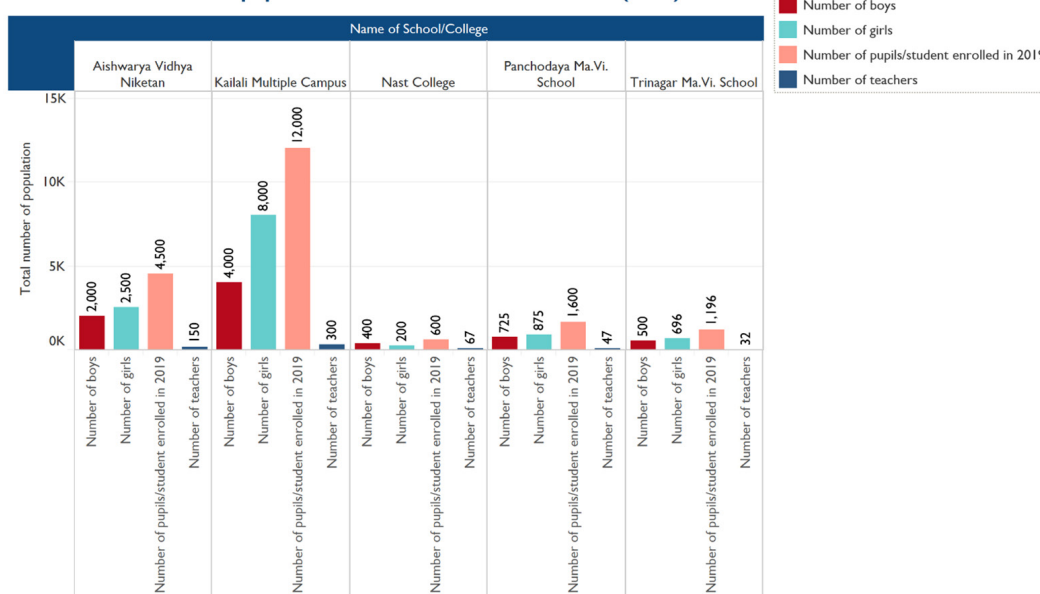
Fig. 4.3: Population distribution at the schools/colleges

Fig. 4.4 indicates the number of pupils/students' accommodation per desk. The colour in red shows the number of classrooms, orange the number of desks, green the number of pupils/students per desk, brown the number of desks per classroom, and blue the number of pupils/students per classroom. *Kailali Multiple Campus* has an average of 42 desks per classroom, in stark contrast with *Aishwarya Vidhya Niketan*, with only 9. The remaining schools/colleges have more desks per classrooms and less students/pupils per desk. The school with the highest number of students/pupils per desk is *Trinagar Ma.Vi. School* with 5 students per desk, followed by *Aishwarya Vidhya Niketan* and *Panchodaya Ma. Vi. School* (4 per desk each). *Nast College* instead only has one (1) pupil sitting per desk. The number of pupils/students per classroom accounts for the highest in *Kailali Multiple Campus* (100), followed by *Trinagar Ma.Vi. School* with 80 pupils/student per class (see Fig. 4.4).

Number of classrooms, desks, and pupils/students classroom/desk ratio
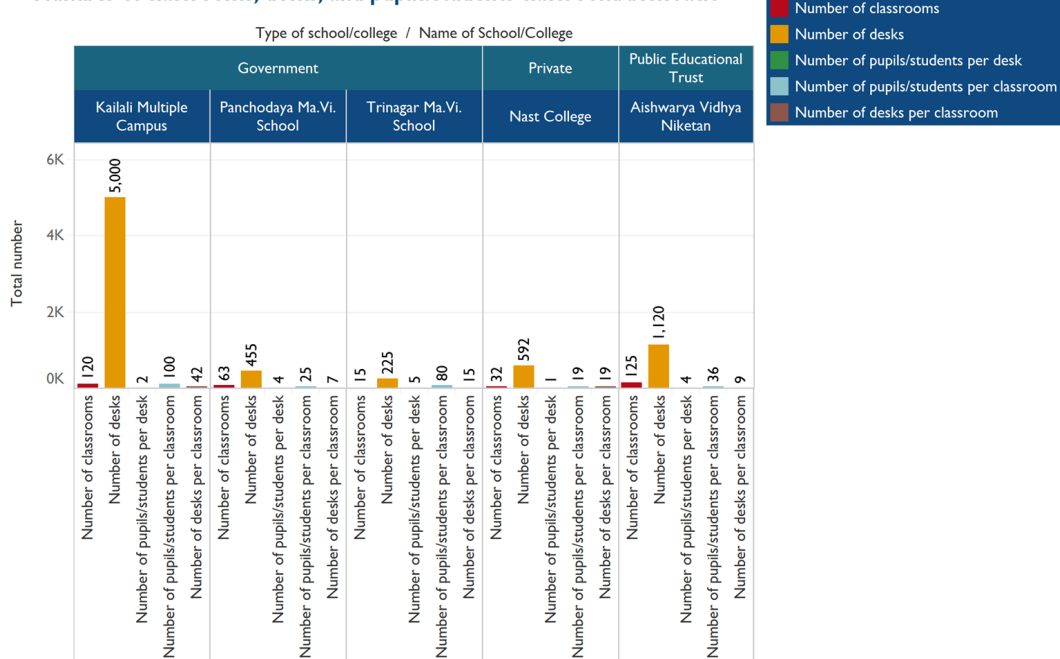
Fig. 4.4: School seating accommodation per desk and available classrooms

All the assessed educational facilities have water and toilet facilities available and refer sick pupils/students to clinics or hospital (see Fig. 4.5). Only one (1) out of five (5) schools – *Trinagar Ma.Vi. School* – has a health agent present on site. Approximately 80 per cent of respondents (4/5) have stated that more than half of the population in the municipality wears masks. *Nast College* is the school with the largest number of toilet stalls (42) but also the furthest away from the water source (1 Km), followed by *Kailali Multiple Campus School* (500 m). All other schools have a source of water on site. The overall average number of toilet stalls for the other sites is 17.

Basic Facilities in the Schools/Colleges

| Name of School/College	Estimated Percentage Wearing Mask in the Municipality	Where Pupils/Students go when they get sick	Presence of Health Agent	Availability of Water	Availability of Toilet Facility	Presence of Cafeteria/ FoodService	Number of stalls (drop holes)	Distance to the nearest water source
Aishwarya Vidhya Niketan	>50%	Clinic or Hospital	No	Yes	Yes	Yes	30	0.0
Kailali Multiple Campus	10%-30%	Clinic or Hospital	No	Yes	Yes	Yes	20	0.5
Nast College	>50%	Clinic or Hospital	No	Yes	Yes	Yes	42	1.0
Panchodaya Ma.Vi. School	>50%	Clinic or Hospital	No	Yes	Yes	Yes	14	0.0
Trinagar Ma.Vi. School	>50%	Clinic or Hospital	Yes	Yes	Yes	No	5	0.1

Fig. 4.5: Health infrastructure at the schools/colleges

All assessed schools/colleges are open throughout the seasons, except for *Trinagar Ma.Vi. School* which is operative in summer only. Waste management is available in all the educational facilities. Two (2) out of five (5) schools/colleges have trash visible on the floor and in three (3) out five (5) unwanted animals/insects are present. In *Kailali Multiple Campus* one COVID-19 case was detected during the pandemic.

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

Name of School/College	Availability of Waste Management	Visibility of Trash on the Floor	Visibility of Unwanted Animals/Insects	Suspected COVID-19 Case During the Pandemic	School Seasonality
Aishwarya Vidhya Niketan	Available	No	No	No	All seasons
Kailali Multiple Campus	Available	Yes, limited	Yes, limited	Yes	All seasons
Nast College	Available	No	No	No	All seasons
Panchodaya Ma.Vi. School	Available	Yes, limited	Yes, limited	No	All seasons
Trinagar Ma.Vi. School	Available	No	Yes, limited	No	Summer only

According to the school assessment survey, in terms of the communication system, 50 per cent agreed that the communication mainly happens through phone/text message, followed by internet/email/social media and UHF/VHF Radio with 40 and 10 per cent, respectively (see Fig. 4.6, left). The main reasons pupils/students sometimes do not attend school lie on events related to market, farming and cultural festivals, with a percentage of 30 and 20, respectively. Other reasons carry an equal distribution of 10 per cent (see Fig. 4.6, right).

Communication system

- UHF/VHF Radio 10.0%
- Internet / E-mail / Social Media 40.0%
- Phone/Text Message 50.0%
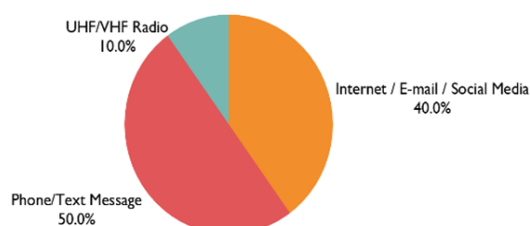
Reasons for less attendance of students/pupils

Main Reason	
Market day	30.0%
Farming	20.0%
Cultural Festival	20.0%
Religious Festival	10.0%
Market (set up in the locality - temporal or permanent)	10.0%
Crusade	10.0%

Legend: 10.0% — 30.0%

Fig. 4.6: Communication system and reasons for less attendance of students/pupils

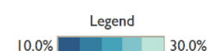In terms of accessibility to the respective schools/colleges, the analysis shows that the most common means of transport are motor bikes and walking by foot (25% each). Buses are the second most used (20%), followed by cars and minivans which carry an equal weight of 15 per cent, each (see Fig. 4.7).
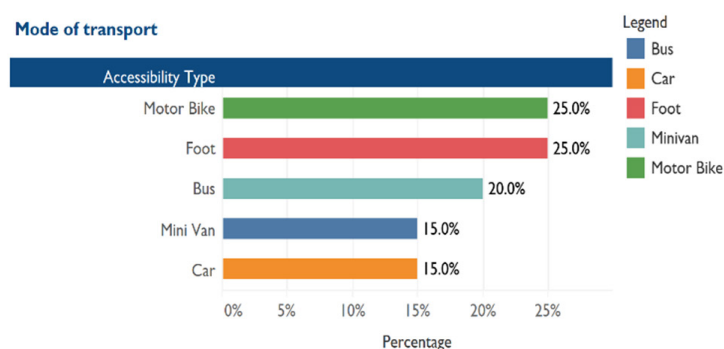

Fig. 4.7: Modes of transport to access the schools/colleges

3.2.f ENTERTAINMENT CENTRES

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

Population mobility at the entertainment centres in Dhangadhi Sub-Metropolitan City takes an account for every day, however, Saturday is the busiest day and January, February and June are the busiest months. According to the analysis, most of the places of entertainment attract people from India, as well as other districts and municipalities. People visiting these sites mainly originate from *Kailali, Kanchanpur, Dadeldhura, Baitadi, Doti, Achham,* and *Bajura* districts. At the municipality level, people mostly come from *Godawari Municipality, Ghodaghodi Municipality, Bhajani Municipality, Kailari Rural Municipality, Tikapur Municipality,* and *Bhimdatta Municipality.*

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

Among the entertainment centres investigated in Dhangadhi Sub-Metropolitan City, *Casino (Hotel Sathi)* lies at the *Main Road* which is connected to *Bhimdatta Highway* and *Trinagar Chauki POE* (formal). This site is easily accessible by vehicle; however, people use tricycles and bicycles to reach. Likewise, *Aircraft Museum* lies at one of the largest localities – *Hasanpur* – connected to the *Uttar Mukhi Marg* and *Bhimdatta Highway*. Furthermore, *Dhangadhi Fun Park* is located near *Trinagar Chauki POE* (formal) and linked through *Bhimdatta Highway* to the nearest localities, *Adarsha Tole, Chauraha* and *Milan Chowk.*

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

Six (6) entertainment centres were investigated in Dhangadhi Sub-Metropolitan City during the PMM activities. The bar in orange colour shows the average entry flow per day, the one in blue indicates the average entry flow on the busiest day, and in green is the percentage of people coming from India. *Covered Hall* has the highest mobility of people with an average of 10,000 and 12,000 per day and on the busiest day, respectively. The average flow for the other entertainment centres is between 100 and 400. In *Fun Park, Covered Hall* and *Casino (Hotel Sathi)* the percentage of people coming from India reaches 50 per cent, compared to 10 and 7 per cent in *Deja Vu Dance Bar* and *Aircraft Museum*, respectively.
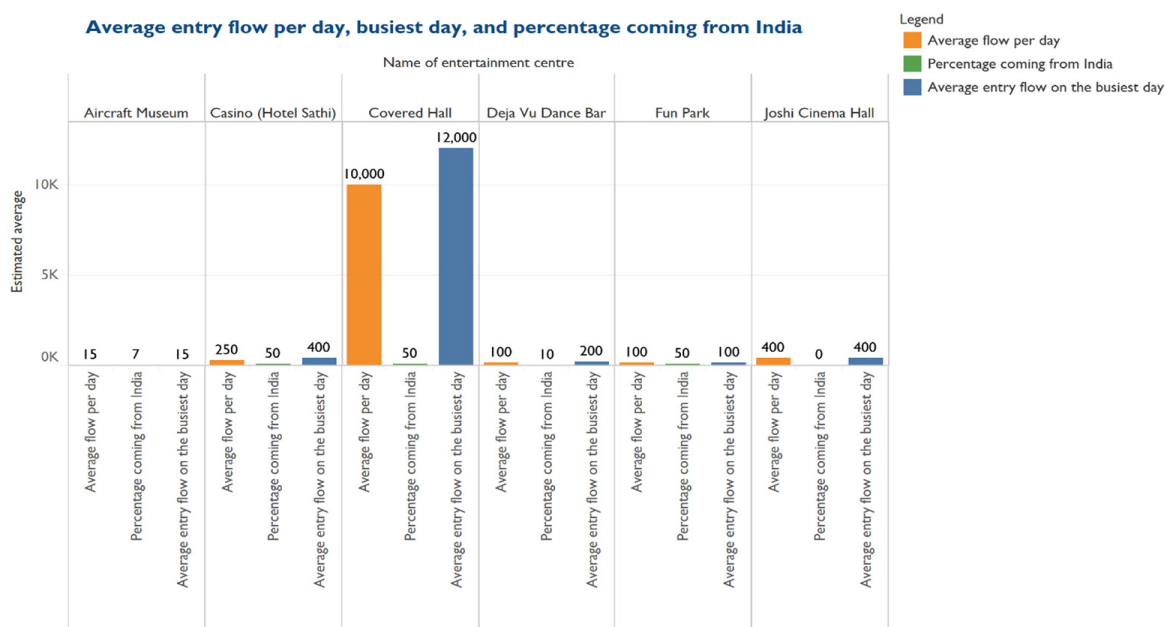
Fig. 5.1: Population mobility at the entertainment centres

As shown in Table 5.1, four (4) out of six (6) places of entertainment have stagnant water visible on the floor and have no isolation place dedicated for sick people. For all the assessed entertainment centres, the data revealed that unwanted animals/insects are present, and half of them (3/6) have trash visible on the floor. Except for *Joshi Cinema Hall* and *Aircraft Museum*, respondents from all other sites have stated that more than 50 per cent of people wear masks. Overall, places of entertainment are busier during the weekend (Friday to Sunday). People's dual flow during the year varies according to the corresponding site, the majority (4/6) are busier in specific months, and others equally frequented throughout the year (2/6).

Table 5.1: Hygiene status at the entertainment centres

Name of entertainment centre	Visibility of stagnant water on the floor	Visibility of trash on the floor	Visibility of unwanted animals/insects	Estimated percentage wearing mask	Isolated places dedicated for sick people	Busiest day of the week	Busiest month of the year
Aircraft Museum	Not visible	Yes, visible	Yes, visible	31%-50%	Not available	Saturday, Sunday	January, December, June, July, February, March
Casino (Hotel Sathi)	Not visible	Yes, visible	Yes, visible	>50%	Not available	Sunday	June, July
Covered Hall	Yes, visible	Yes, visible	Yes, visible	>50%	Available	Every day	Every month
Deja Vu Dance Bar	Yes, visible	Not visible	Yes, visible	>50%	Available	Every day	Every month
Fun Park	Yes, visible	Not visible	Yes, visible	>50%	Not available	Friday, Saturday	January, February, May
Joshi Cinema Hall	Yes, visible	Not visible	Yes, visible	<10%	Not available	Saturday	April, May, June

Table 5.2 depicts the health screening status and other mechanisms that are essential to track people's health for COVID-19. The results show that, except for *Joshi Cinema Hall*, respondents from all the entertainment centres are aware of procedures to follow in case of a COVID-19 positive case. These include; 1) calling emergency hotline, 2) calling/notifying on-site authorities, and 3) counselling and calming the patient. None of the sites have a health agent present at their premise. Furthermore, five (5) out of six (6) entertainment centres have no body temperature checking, nor a screening station, which demonstrate the inadequacy of health screening mechanisms.

Table 5.2: Health screening mechanism at the entertainment centres

Name of entertainment centre	Procedure to follow if someone affected by COVID-19	List of procedures to follow if someone is affected by COVID-19	Temperature checking status	Presence of screening station	Presence of health agent
Aircraft Museum	Yes	Isolation, call emergency hot line, call / notify on-site authorities, counsel and calm the patient	Not available	Not available	Not available
Casino (Hotel Sathi)	Yes	Call / notify on-site authorities, call emergency hot line	Not available	Not available	Not available
Covered Hall	Yes	Counsel and calm the patient, call emergency hot line	Available	Not available	Not available
Deja Vu Dance Bar	Yes	Call emergency hot line, call / notify on-site authorities, isolation	Not available	Not available	Not available
Fun Park	Yes	Call emergency hot line, call / notify on-site authorities, isolation, counsel and calm the patient	Not available	Available	Not available
Joshi Cinema Hall	No	Don't Know	Not available	Not available	Not available

The most used communication method is phone/text message (54.5%), followed by internet/email/social media (36.4%) and UHF/VHF radio (9.1%). The availability of water sources is distributed by percentage as follows; the most common are pumps and the public water system which carry an equal weight of 40 per cent, whereas only a minority relies on river/lakes or deliveries by truck/vehicle (10% each).
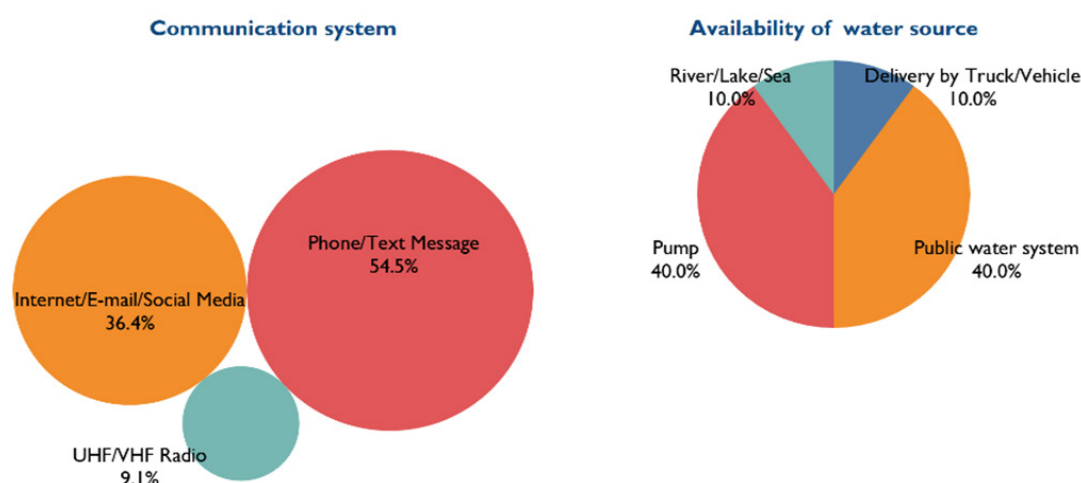
Fig. 5.2: Communication system and availability of water source at the entertainment centres

Fig. 5.3 shows the percentage distribution of the modes of transport to access the entertainment centres (red bar) and the main reasons for the busiest days/months (green bar). The reasons for the busiest days, in order of relevance, are; crusade, market/trade, visit of relatives and religious festivals (20% each), whereas weddings and cultural festivals carry an equal weight of 10 per cent. In terms of accessibility, cars and motor bikes carry the highest percentage of 13.6, closely followed by walking with 9.1 per cent.

Mode of transport and reasons for the busiest days and months of the year

Reason for the busiest day and month / Mode of transport
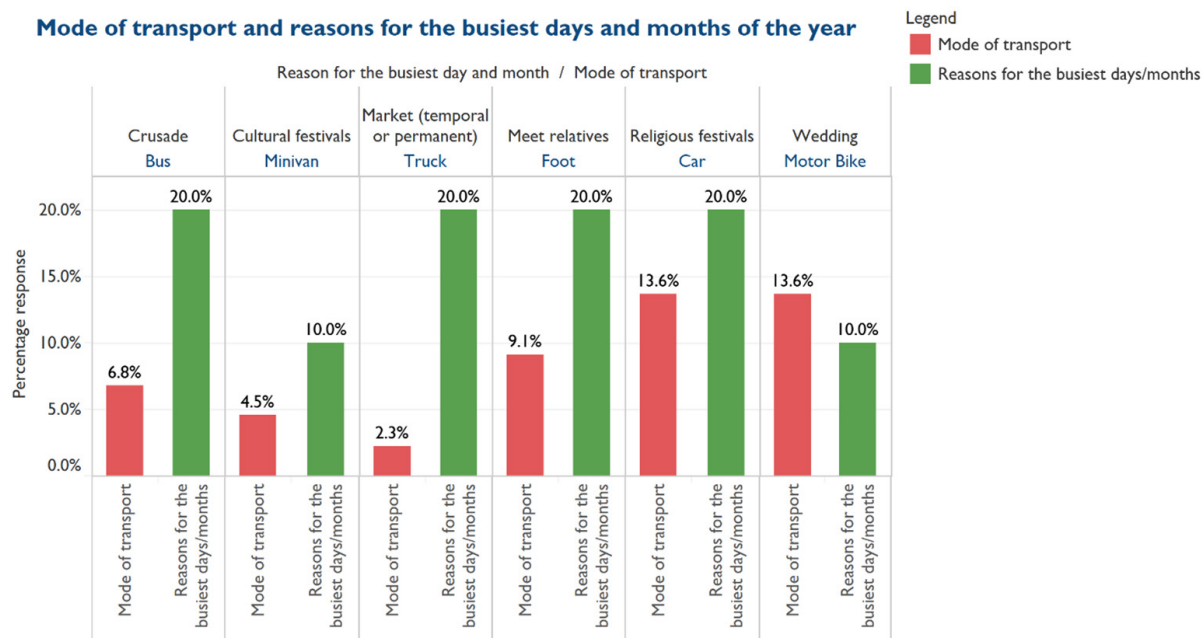
Fig. 5.3: Modes of transport and reasons for the busiest days/months

In case of someone being affected by COVID-19, at the entertainment centres, the most common procedure involves calling an emergency hotline (33.3%). The second preferred action is to call/notify on-site authorities (26.7%), followed by isolating, counselling and calming the patient (20% each). This information is important since it helps health authorities understand the level of citizens' awareness of procedures and related adopted daily practices (see Fig. 5.4).

Procedure to follow if someone affected by COVID-19 by percentage

List of Procedure	
Call emergency hotline	33.3%
Call / notify on-site authorities	26.7%
Isolation	20.0%
Counsel and calm the patient	20.0%
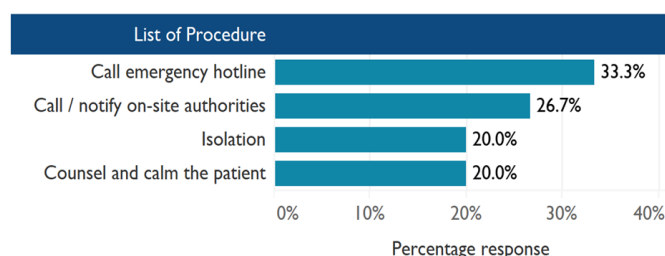
Fig. 5.4: Percentage distribution of procedures to follow for suspected COVID-19 cases

3.2.g MARKET CENTRES

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

Among the investigated market centres in Dhangadhi Sub-Metropolitan City, the highest population mobility is found at *L.N. Chowk* and *Dhangadhi Bajar markets*. The markets are open every day, however the busiest months of the year are between June and December. The study shows that the people visiting the markets are mainly from *Kailali, Kanchanpur, Doti, Achham, Dadeldhura*, and *Bajura* districts. Furthermore, visitors come from other municipalities, such as *Godawari Municipality, Lamki Chuha Municipality, Ghodaghodi Municipality, Tikapur Municipality,* and *Bhajani Municipality*.

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

L.N. Chowk Market and *Dhangadhi Bajar Market* are situated at the main junction of Dhangadhi Sub-Metropolitan City, connected through the *Trinagar Chauki POE* and *Bhimdatta Highway*, which can be accessed by bus, truck, car, minivan and motorcycle. Other markets, such as *Buspark Market* and *Dhangadhi Crossroad Market* are also connected through *Bhimdatta Highway*. These markets are close to a number of localities, namely *Bishalnagar, Uttarbehandi, Taranagar, Baiyabehandi* and *Adarsha Tole*.

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

The markets which attract the largest number of people on the busiest days are *Buspark Market* and *Dhangadhi Crossroad Market*, with a mobility of 3,000 and 2,500 per day, respectively. However, the markets with the highest entry flow per day are *Dhangadhi Super Market* and *L.N. Chowk Market* (200 each). The percentage of people coming from India is higher in *Dhangadhi Crossroad Market* (50%) and *Chauraha Market* (40%). The remaining market centres have an average of 10 per cent (see Fig. 6.1).
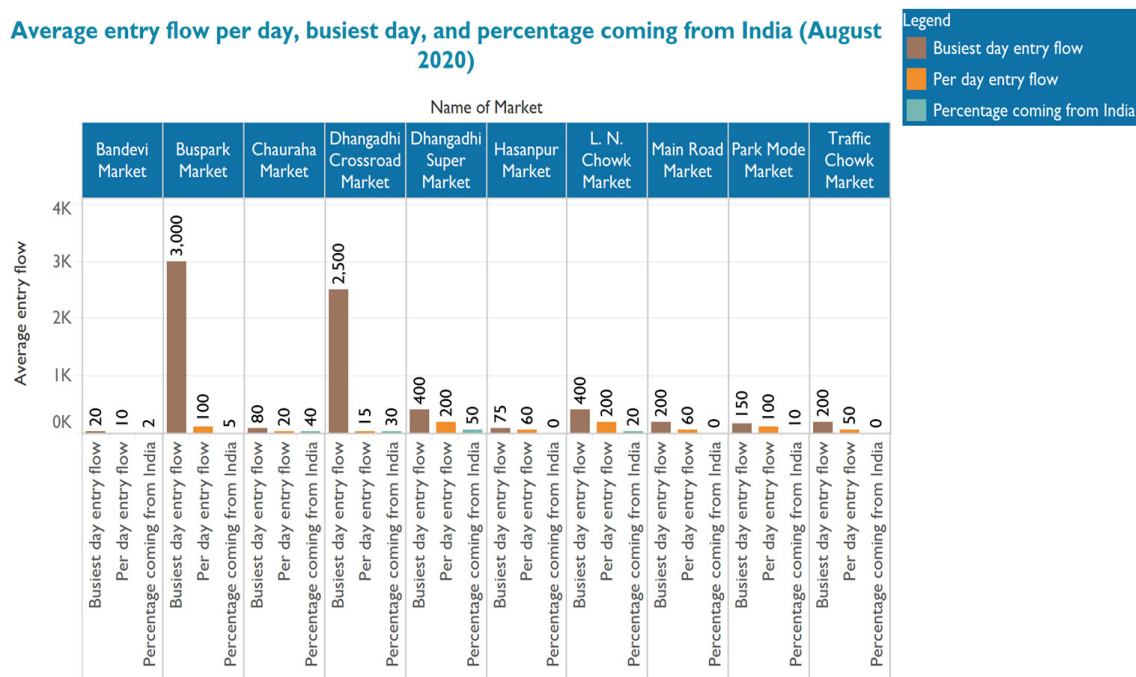
Fig. 6.1: Population mobility at the markets centres

In order to understand the nature and extent of health challenges at the market centres, it is necessary to categorise the level and availability of resources. Except for *Chauraha Market* and *Dhangadhi Crossroad Market,* all the assessed sites have a waste management system in place. However, no markets have an isolation place for sick people. Health authorities for emergency cases are only present in three (3) out of ten (10) markets, namely *Bandevi Market, L.N. Chowk Market,* and *Park Mode Market.* Made exception for *Dhangadhi Super Market,* all the markets have both trash and stagnant water visible on the floor, either limited or in large quantity. Respondents from six (6) markets stated that more than half of the visitors wear masks; the remaining informants located the percentage between 31 and 50 (see Table 6.1).

Table 6.1: Hygiene status at the market centres

Name of Market	Availability of waste management	Availability of isolated place for sick people	Name of the nearest health centre	Presence of health authority for emergency case	Visiblity of trash on the floor	Visibility of stagnant water on the floor	Estimated percentage wearing mask
Bandevi Market	Available	Not available	Seti Provincial Hospital	Available	Yes, limited	Yes, limited	31%-50%
Buspark Market	Available	Not available	Nawajiwan Hospital	Not available	Yes, limited	Yes, in large quantity	31%-50%
Chauraha Market	Not available	Not available	Seti Provincial Hospital	Do not know	Yes, in large quantity	Yes, in large quantity	31%-50%
Dhangadhi Crossroad Market	Not available	Not available	Seti Provincial Hospital	Not available	Yes, limited	Yes, in large quantity	>50%
Dhangadhi Super Market	Available	Not available	Nawajiwan Hospital	Not available	Not visible	Not visible	>50%
Hasanpur Market	Available	Not available	Nisarga Hospital & Research Center Pvt. Ltd	Not available	Yes, limited	Yes, in large quantity	>50%
L. N. Chowk Market	Available	Not available	Seti Provincial Hospital	Available	Yes, limited	Yes, limited	>50%
Main Road Market	Available	Not available	Nova Hospital	Not available	Yes, limited	Yes, in large quantity	>50%
Park Mode Market	Available	Not available	Joshi Medical Hospital	Available	Yes, limited	Yes, in large quantity	>50%
Traffic Chowk Market	Available	Not available	Seti Provincial Hospital	Do not know	Yes, in large quantity	Yes, in large quantity	31%-50%

Table 6.2 presents a set of information on water availability, electricity at the marketplaces, busiest day and month. In seven (7) out of ten (10) markets where the research was conducted, water is available, and people's flow is similar throughout the week. Eighty (80) per cent of the assessed sites have no electricity available, despite being open all year long. The busiest period varies according to the specific market; however, most sites have identified 3 to 6 months.

Table 6.2: Water availability, electricity, seasonality, and busiest days/months at the market centres

Name of Market	Availability of water	Busiest day of the week	Busiest month of the year	Market Seasonality	Availabilityof Electricity
Bandevi Market	Available	Every day	May, June, August, July, September	Rainy season only	Not availble
Buspark Market	Available	Every day	December, January, February, July, June	All seasons	Not availble
Chauraha Market	Not available	Every day	September, October, June, July	All seasons	Not available
Dhangadhi Crossroad Market	Not available	Every day	August, September	All seasons	Available
Dhangadhi Super Market	Available	Saturday	September, October	All seasons	Not availble
Hasanpur Market	Available	Every day	November	All seasons	Not availble
L. N. Chowk Market	Not available	Sunday, Saturday	January, June, August, November	Rainy season only	Not availble
Main Road Market	Available	Every day	Every month	All seasons	Not availble
Park Mode Market	Available	Sunday	June, May, January	All seasons	Not availble
Traffic Chowk Market	Available	Every day	January, February, April, May, June, July	All seasons	Available

Individuals mostly reach the market centres by foot and motorbike, with an equal percentage distribution of 26.5 per cent (see Fig. 6.2), closely followed by cars (20.6%). The remaining modes of transport are used less frequently, especially trucks, with an average of 8.8 per cent.

Mode of transport
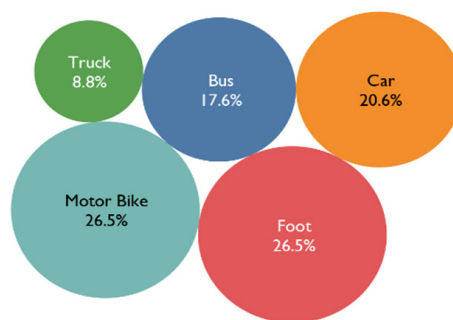
Fig. 6.2: Accessibility to the market centres

In Fig. 6.3, the bar in blue colour shows the main functions of health authorities on site, and the bar in grey shows the procedure to follow if someone is affected by COVID-19. According to the conducted market assessment, the health authority at the markets mainly deals with health promotion and immunization, with 37.5 and 25 per cent, respectively. The preferred procedure in the event of a COVID-19 positive case is isolation (28%), closely followed by calling the emergency hotline or notifying on-site authorities (24% each).
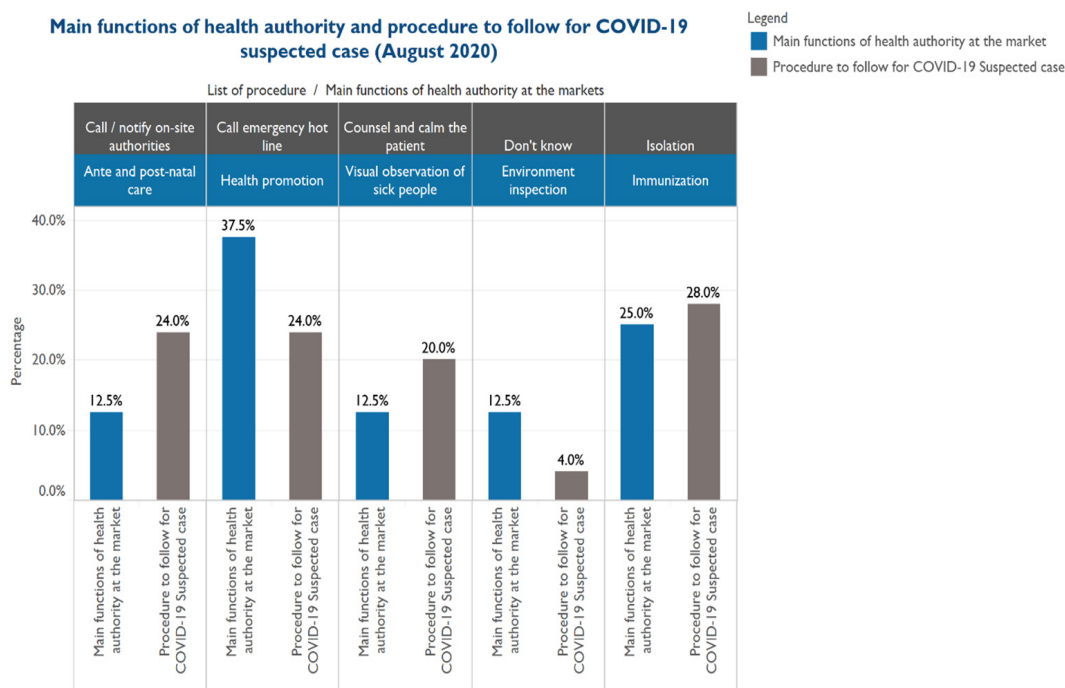
Fig. 6.3: Functions of health authorities and procedures to follow for suspected COVID-19 cases

The communication system at the market centres mostly relies on phone/text messages and internet/email/social media, with a percentage of 45 and 40, respectively. UHF/VHF radio carries 10 per cent, whereas in 5 per cent of the cases communication is completely absent (see Fig. 6.4, left). The market centres are usually busier in the occurrence of cultural festivals, weddings, crusades, market days (sporadic or nomadic) and religious festivals, in ascending order of percentage (see Fig. 6.4, right).

Communication system

Means of Communication	
Phone/Text Message	45.0%
Internet / E-mail / Social Media	40.0%
UHF/VHF Radio	10.0%
No Communicion	5.0%

Legend
5.0%   45.0%

Main reasons for busiest days/months

Reasons for the busiest days/months

Cultural festivals	20.0%
Wedding	16.0%
Crusade	16.0%
Market day (sporadic or nomadic)	12.0%
Farming	12.0%
Religious festivals	8.0%
Market (temporal or permanent)	8.0%
Worship services / Temple / Church / Mosque	4.0%
Other places	4.0%

Percentage

Fig. 6.4: Communication system and reasons for the busiest days/months

3.2.h MIGRANT WORKSITES

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

According to the results obtained, more than half of the migrant worksites (5/9) employ workers who come from India. The population mobility at the migrant worksites mainly originates from *Kanchanpur, Dadeldhura, Bajura* and *Achham* districts. Migrant workers also come from close-by municipalities, namely *Godawari Municipality, Ghodagho-di Municipality, Tikapur Municipality, Lamki Chuha Municipality* and *Kailari Rural Municipality*. The investigated migrant worksites are open every day; however, the busiest months are between January and June.

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

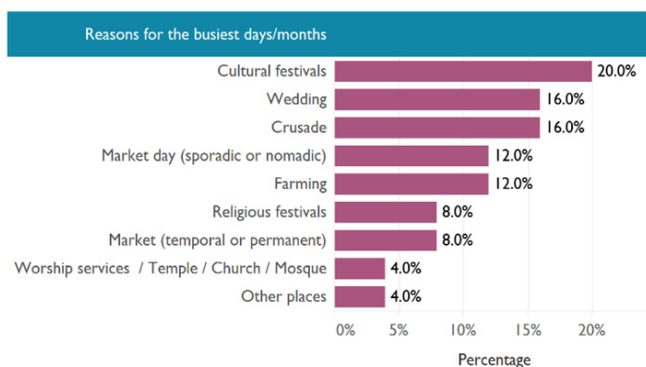The study shows that most of the investigated migrant worksites, which attract a large number of migrant workers, are located at *Dhangadhi Bajar* junction. These migrant worksites are accessible by bus, truck, car, minivan and motorcycle from the POEs and close-by localities, namely *Milan Chowk, Bishalnagar, L.N. Chowk, Baiya Behandi* and *Adarsha Tole*. Subsequently, *Ghuiyaghat* and *KGN* migrant worksites lie on the main road *Bhimdatta Highway* and are connected to the nearest localities through alternative roads. Similarly, migrant workers coming from India use *Bhimdatta Highway* to reach the respective sites in Dhandaghi Sub-Metropolitan City.

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

Three (3) out of the nine (9) assessed migrant worksites, namely *Dhangadhi Buspark, Main Road Buspark,* and *Tribehandi Embroidery*, have a screening station, and they are the only ones to also have body temperature checking, together with *Sabjimandi*. Accommodation for staff is present in five (5) migrant worksites. Except for *Akash Auto Service Centre*, all the sites have toilets available, whereas water is also not available at *KGN Bike Workshop* and *Sabjimandi*. The majority of the migrant worksites (7/9) are equally busy throughout the week, whereas people's flow varies throughout the year. According to respondents, *Seti Provincial Hospital* is the most used health centre by migrants, followed by *Maya Metro Hospital*.

Table 7.1: Hygiene status at the migrant worksites

Name of Migrant Worksites	Availability of screening station	Status of body temperature checking	Availability of accommodation for staff	Name of the most used health centre	Availability of water	Availability of Toilet	Busiest day of the week	Busiest month of the year
Akash Auto Service Center	Not available	Not availble	Not available	Maya metro hospital	Not available	Not available	Every day	April, May, September
Chauraha	Not available	Not availble	Not available	Seti hospital	Available	Available	Every day	January, December, June, July
Dhangadhi Buspark	Available	Available	Available	Seti provincial hospital	Available	Available	Every day	Every month
Ghuiyaghat	Not available	Not availble	Available	Bibek clinic	Available	Available	Every day	Every month
KGN Bike Workshop	Not available	Not availble	Available	Maya metro hospital	Not available	Available	Every day	Every month
KGN Metal Workshop	Not available	Not availble	Available	CP hospital	Available	Available	Every day	March, April, May, June
Main Road Buspark	Available	Available	Available	Seti provincial hospital	Available	Available	Monday, Tuesday, Saturday	January, March, June, July, August, November
Sabjimandi	Not available	Available	Not available	Seti provincial hospital	Not available	Available	Sunday, Friday, Tuesday	April, March
Tribehandi Embroidery	Available	Available	Not available	Seti provincial hospital	Available	Available	Every day	Every month

The migrant worksites with the largest number of workers are *Sabjimandi* and *Main Road Buspark*, both in terms of daily entry flow (200 and 500, respectively) and attendance on the busiest days (1,000 and 800, respectively). However, the entry flow indicates migrant workers (staffs) and people who visits these places on a daily basis. Other sites have an average of people's flow per day between 50 and 5. Four (4) out of nine (9) migrant worksites have no workers from India, the remaining employ an average of 10-30 per cent of people of Indian nationality.
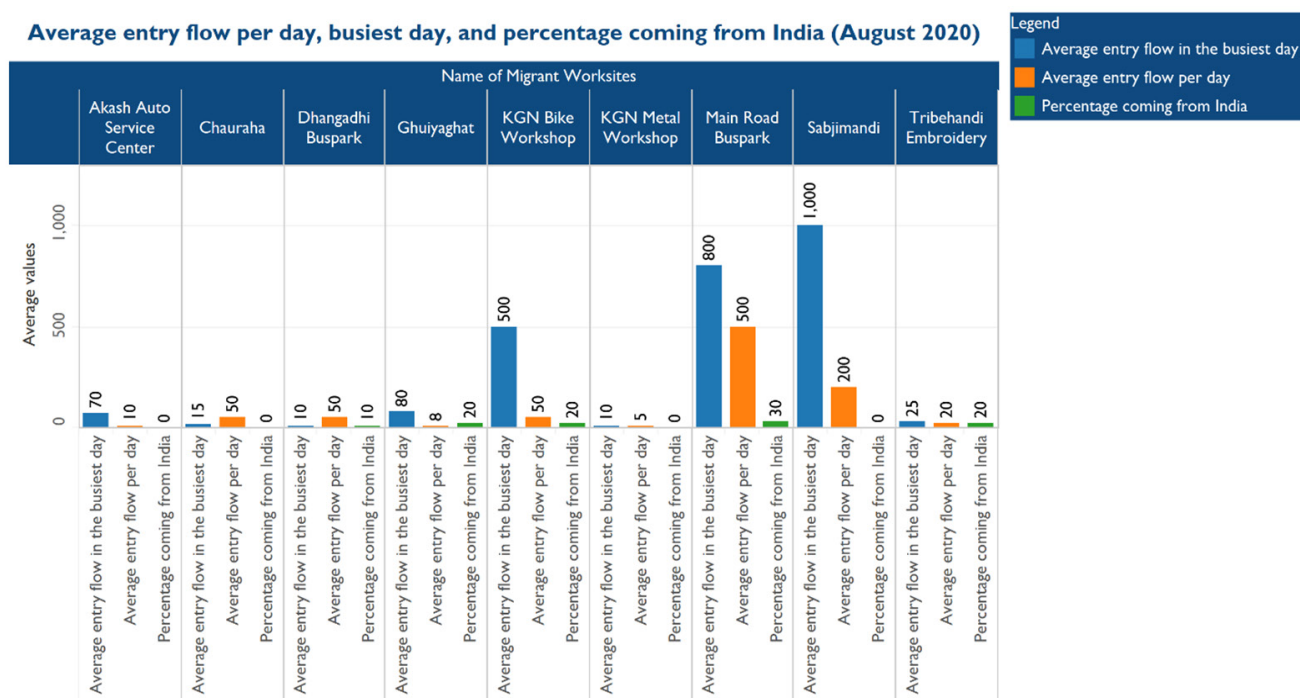
Fig. 7.1 Population mobility at the migrant worksites

Among the unwanted animals/insects at the migrant worksites, mosquitoes are the most widespread (45%), together with ants/beetles (25%), flies/moths (20%), and less frequently cockroaches (10%). According to the respondents from the migrant worksites (see Fig. 7.2), when people fall ill, they go to a clinic or hospital (43.8%), seek treatment at home (18.8%), at the pharmacy (25%) or from a traditional healer (6.3%).

Unwanted animals/insects and places of treatment when people get sick

Legend
- % by treatment centres when people get sick
- % of unwanted animals/insects

	Ants/beetles		Cockroaches		Flies/moths		Mosquitoes	
	Traditional Healer		Pharmacy		Home Treatment		Clinic or Hospital	

Name of unwanted animals/insects / Treatment centres for sick people

Bar chart values (Percentage by category):
- Ants/beetles — Traditional Healer: % by treatment centres when people get sick = 6.3%; % of unwanted animals/insects = 25.0%
- Cockroaches — Pharmacy: % by treatment centres when people get sick = 25.0%; % of unwanted animals/insects = 10.0%
- Flies/moths — Home Treatment: % by treatment centres when people get sick = 18.8%; % of unwanted animals/insects = 20.0%
- Mosquitoes — Clinic or Hospital: % by treatment centres when people get sick = 43.8%; % of unwanted animals/insects = 45.0%

Fig. 7.2: Percentage distribution of unwanted animals/insects and places where ill people go to seek help

Waste management is available in seven (7) out of nine (9) migrant worksites. Stagnant water is visible on the floor at all the sites, except for *Main Road Buspark* and *Tribehanddi Embroidery,* which are also the only ones with no unwanted animals/insects, together with *Dhan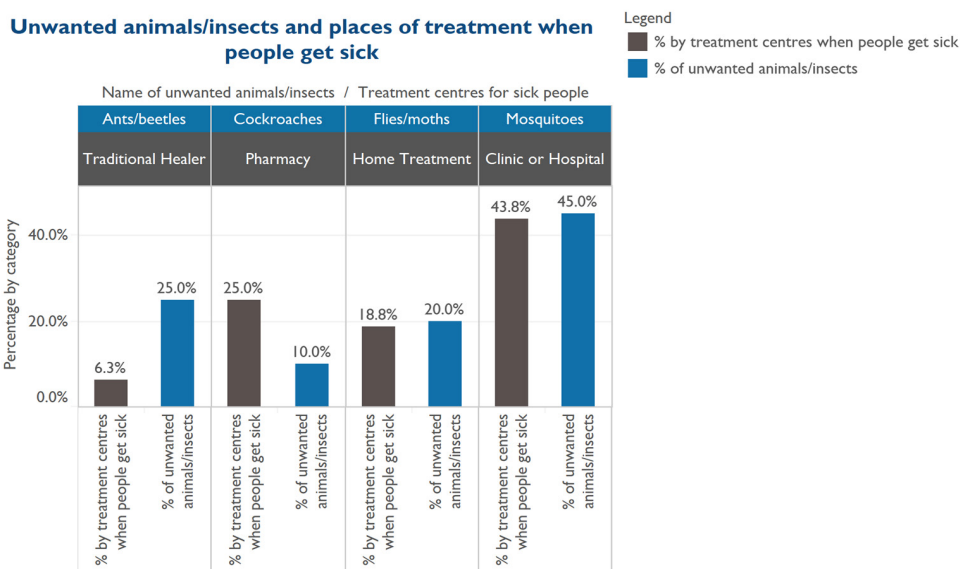gadhi Buspark*. Around 55 per cent of the assessed sites have visible trash on the floor. The respondents from six (6) migrant worksites stated that more than 50 per cent of people wear masks. A health agent is only present at one site, *Main Road Buspark* (see Table 7.2).

Table 7.2: Waste management and health screening status at the migrant worksites

Name of Migrant Worksites	Availability of waste management	Visiblity of trash in the open	Visibility of stagnant water on the floor	Where people go when they are sick	Visibility of unwanted animals/insects	Estimated Percentage wearing mask	Presence of health agent on site
Akash Auto Service Center	Yes, visible	Yes, visible	Yes, visible	Pharmacy	Yes, visible	31%-50%	Not available
Chauraha	Yes, visible	Yes, visible	Yes, visible	Clinic or Hospital	Yes, visible	>50%	Not available
Dhangadhi Buspark	Yes, visible	Not visible	Yes, visible	Clinic or Hospital	Not visible	>50%	Not available
Ghuiyaghat	Yes, visible	Not visible	Yes, visible	Clinic or Hospital, Home Treatment	Yes, visible	10%-30%	Not available
KGN Bike Workshop	Not visible	Yes, visible	Yes, visible	Pharmacy Clinic or Hospital, Home Treatment	Yes, visible	>50%	Not available
KGN Metal Workshop	Not visible	Yes, visible	Yes, visible	Clinic or Hospital	Yes, visible	>50%	Do not know
Main Road Buspark	Yes, visible	Not visible	Not visible	Pharmacy	Not visible	>50%	Yes, available
Sabjimandi	Yes, visible	Not visible	Yes, visible	Clinic or Hospital	Yes, visible	>50%	Not available
Tribehandi Embroidery	Yes, visible	Yes, visible	Not visible	Traditional Healer, Pharmacy, Religious Leader, Clinic or Hospital, Home Treatment	Not visible	31%-50%	Not available

Migrant worksites are usually busier when there are weddings (19%) and markets, be they sporadic/nomadic or temporal/permanent (19% each). Crusades, cultural festivals and worship services are the second major activity attracting large numbers of people (9.5% each), followed by farming and religious festivals (4.8% each). This shows that, apart from weddings, the major reason for these sites to be busier than usual lies in trade and commerce (see Fig. 7.3).

Main reasons for the busiest days/months of the year
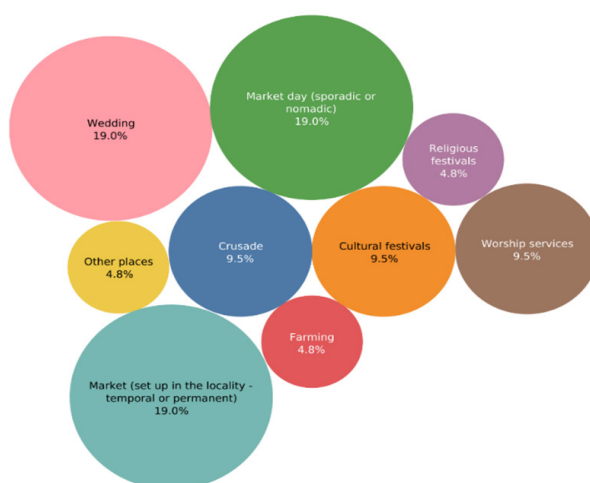
Fig. 7.3: Main reasons for the busiest days/months

As shown in Fig. 7.4, the most used modes of transport to reach migrant worksite are motor bikes (42.9%) and cars (33.3%). In terms of procedures to follow in case of someone affected by COVID-19, the main actions taken involve isolation, calling/notifying on-site authorities and calling emergency hotline (28.6% each).

Fig. 7.4: Procedures to follow for suspected COVID-19 cases and accessibility to the migrant worksites

The most common and equally used water sources are pumps and the public water system (44.4% each), whereas wells only stand at 11.1 per cent (see Fig. 7.5). In regard to voice/network communication, phone and text messages are preferred to internet/email/social media (41.2%) and UHF/VHF radio (5.9%).

Fig. 7.5: Water source and communication system at the migrant worksites

3.2.i TRANSPORT STATIONS

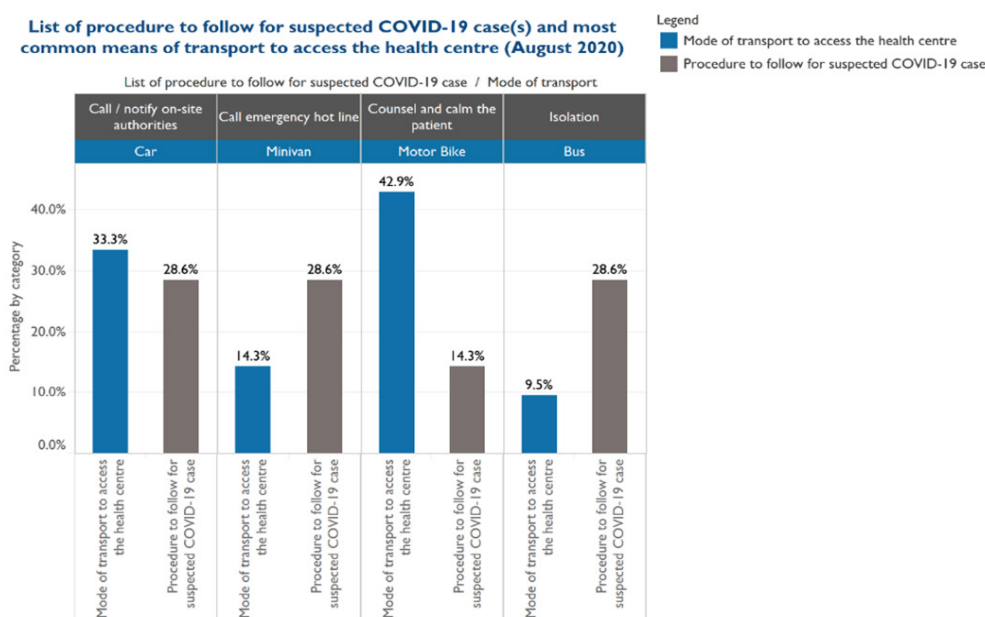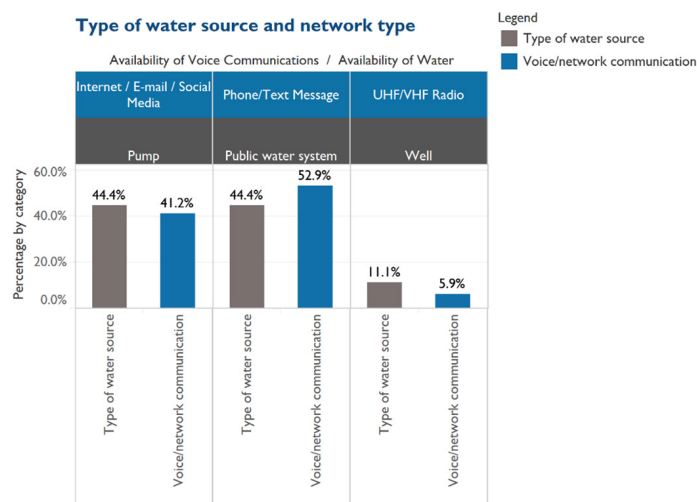*Population Mobility Pattern (who, where they come from, where they go)*

The investigation has revealed that, among all the sites, the transport stations in Dhangadhi Sub-Metropolitan City have the largest population mobility. The study shows that people from both India and Nepal access these transport stations to commute to their respective destinations. However, the population mobility mainly originates from *Doti, Achham, Darchula, Bajhang, Bajura, Kanchanpur, Dadeldhura*, and *Baitadi* districts. The transport stations are open throughout the year, although the busiest days are Friday and Saturday. Furthermore, travellers accessing these sites also come from *Godawari Municipality, Ghodaghodi Municipality, Bhajani Municipality, Lamki Chuha Municipality, Tikapur Municipality* and *Bhimdatta Municipality*.

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

Dhangadhi Bus Park, Chauraha Bus Station and *Dhangadhi Crossroad Station* are located at the main road *Bhimdatta Highway*, which is connected to *Trinagar Chauki POE* (formal). These transport stations are found at the largest localities, namely *Basanta Tole, Hasanpur, L.N. Chowk*, and *Behandi*. Furthermore, *Hospital Line* transport station is located near *Seti Provincial Hospital* and other hospitals where the population movement is high.

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

Among the ten (10) transport stations assessed in Dhangadhi Sub-Metropolitan City, *Chauraha Bus Station, Magic Transport Station*, and *Dhangadhi Crossroad Buspark* have the highest entry flow with 6,000 people per day and on the busiest days. These are closely followed by *Hospital Line* and *Auto Station* with 4,000 people travelling dually, and 2,000 per day and 3,000 on the busiest days, respectively. The remaining transport stations have an average entry flow of 700 and 800 people per day and on the busiest days. In the cases of *Dhangadhi Crossroad* and *Tanker Station*, 50 per cent of people are coming from India, followed by *Ratopul Bus Station* with 20 per cent (see Fig. 8.1).
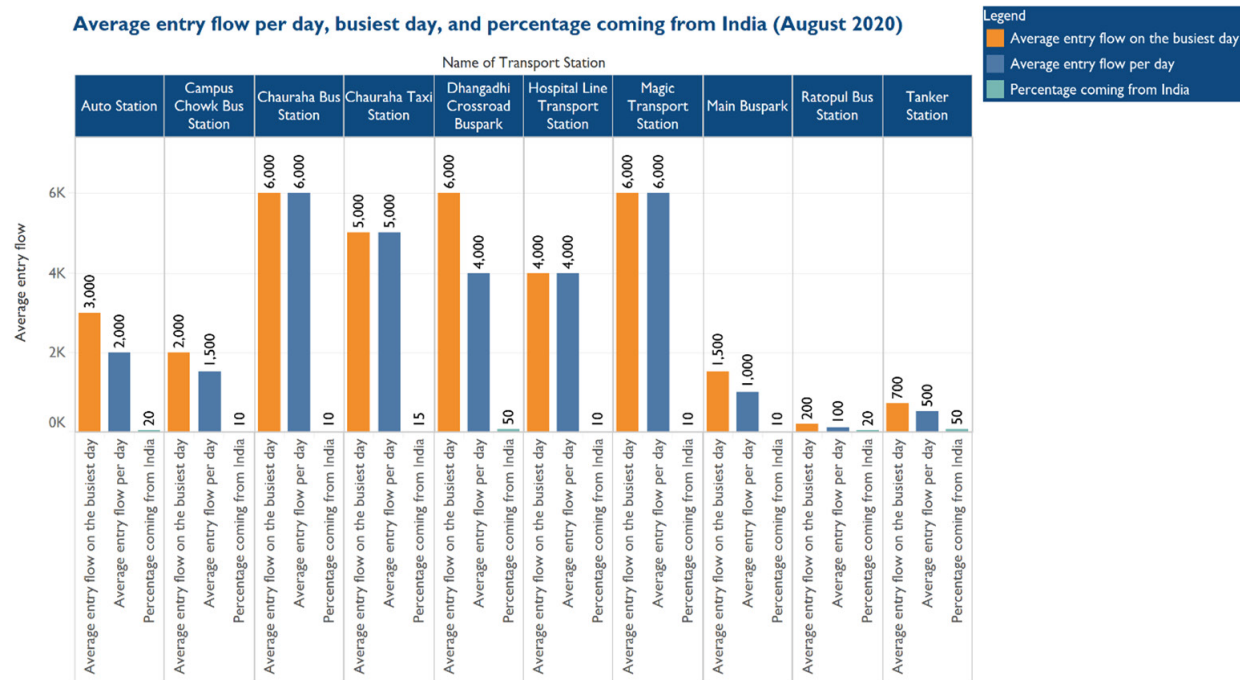
Fig. 8.1: Population mobility at the transport stations

The blue dots indicate the distance to the nearest water source, whereas the red dots show the distance to the nearest health centre. The average distance to the water source is 500 m from the respective sites. However, *Tanker Station, Magic Transport Station* and *Campus Chowk Bus Station* are about 1 Km distant from their water source. The distance to the nearest health centre is, on average, 300 m. *Campus Chowk Station* is around 1 Km distant from the nearest health facility, whereas in the cases of *Chauraha Bus Station, Chauraha Taxi Station,* and *Magic Transport Station* the distance is 700 m. Water is available in seven (7) out of ten (10) transport stations, and half of these sites are equally busy throughout the week. The busiest months of the year fall in June and July. There are no tracking records of traveller's movement across all the assessed transport stations (see Fig. 8.2).

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

Name of Transport Station	Availability of water	Busiest day of the week	Busiest month of the year	Availability of record book/device	Distance to the nearest water source [in Km]	Distance to the nearest health centre [in Km]
Auto Station	Available	Sunday	December, January, February	Not available	0.5	0.2
Campus Chowk Bus Station	Available	Every day	July, February, March	Not available	1.0	1.0
Chauraha Bus Station	Available	Friday, Thursday, Wednesday	June, May, July, August	Not available	0.1	0.7
Chauraha Taxi Station	Not available	Every day	August, July, June	Not available		0.7
Dhangadhi Crossroad Buspark	Available	Every day	May, June, July	Not available	0.2	0.5
Hospital Line Transport Station	Available	Every day	June, July, May	Not available	0.2	0.2
Magic Transport Station	Available	Saturday	June, July, May	Not available	1.0	0.7
Main Buspark	Not available	Saturday, Wednesday, Friday	June, July	Not available		0.5
Ratopul Bus Station	Not available	Friday, Saturday	June, July	Not available		0.2
Tanker Station	Available	Every day	Every month	Not available	1.0	0.1

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

As shown in Table 8.1, there was only one suspected COVID-19 case that was found in *Chauraha Bus Station.* Most respondents (8/10) have stated that more than 50 per cent of people wear masks. Among all the assessed transport stations, none have isolated places dedicated for sick people, and only at *Tanker Station*, travellers are checked for body temperature. In about 80 per cent of the total transport stations, trash, stagnant water and unwanted animals/insects are visible, which pose serious health concerns.

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

Name of Transport Station	Suspected COVID-19 during travelling	Estimated Percentage of People Wearing Mask	Availability of Health Agent	Body Temperature Checking Status	Isolated Places Dedicated for Sick People	Availability of Waste Management	Visibility of Trash on the Floor	Visibility of Unwanted Animals/Insects	Visibility of Stagnant Water on the Floor
Auto Station	No	>50%	Not available	Not available	Not available	Available	Yes, visible	Yes, visible	Yes, visible
Campus Chowk Bus Station	Yes	10%-30%	Not available	Not available	Not available	Not available	Yes, visible	Yes, visible	Yes, visible
Chauraha Bus Station	No	>50%	Not available	Not available	Not available	Not available	Yes, visible	Yes, visible	Yes, visible
Chauraha Taxi Station	No	>50%	Not available	Not available	Not available	Not available	Yes, visible	Yes, visible	Yes, visible
Dhangadhi Crossroad Buspark	No	>50%	Not available	Not available	Not available	Not available	Yes, visible	Yes, visible	Yes, visible
Hospital Line Transport Station	No	>50%	Not available	Not available	Not available	Not available	Yes, visible	Yes, visible	Yes, visible
Magic Transport Station	No	>50%	Not available	Not available	Not available	Available	Yes, visible	Not visible	Yes, visible
Main Buspark	No	>50%	Not available	Not available	Not available	Available	Not visible	Yes, visible	Not visible
Ratopul Bus Station	No	>50%	Not available	Not available	Not available	Available	Not visible	Yes, visible	Yes, visible
Tanker Station	No	31%-50%	Not available	Available	Not available	Available	Yes, visible	Yes, visible	Yes, visible

At the transport stations, people mostly use phone/text messages (62.5%) and internet/email/social media (25%) for communication purposes. The most common means to access water at these sites is by the public water system (62.5%) and by well (25%). Essentially, the water system in Dhangadhi Sub-Metropolitan City mainly relies on public supplies, and the communication system is mostly efficient through voice communication and text messages provided by the Internet Service Providers (ISP).
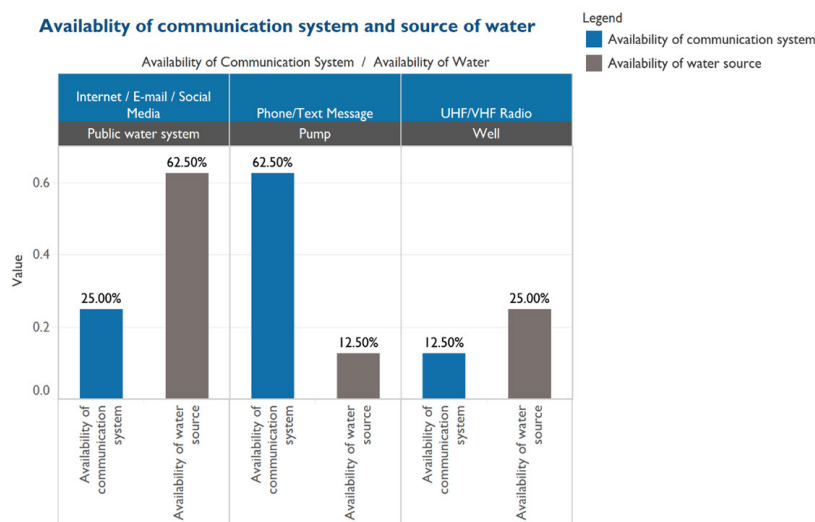
Fig. 8.3: Water source and communication system at the transport stations

The bar in pink colour shows the list of procedures to follow if someone is COVID-19 positive, and the bar in blue shows the most common means of transport to access the health centres by percentage. The most common means to travel to transport stations is by motor bike (28.6%), car, and foot (25.7% each). If someone is infected by COVID-19, the most common procedures to follow involve calling or notifying on-site authorities (37.5%), calling emergency hotline (33.3%), and isolating the patient (16.7%) before the arrival of a health officer (see Fig. 8.4).

Fig. 8.4: Procedures to follow for suspected COVID-19 cases and accessibility of the transport stations

The transport stations are busier during markets (temporal or permanent) and religious festivals (21.9% each). Among other reasons, weddings and crusades carry an equal percenta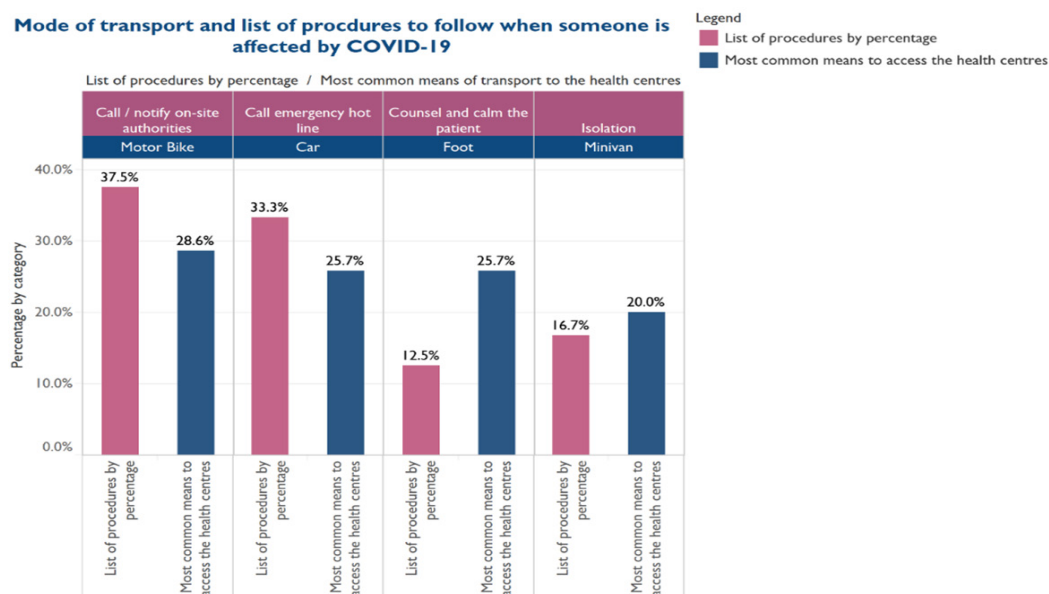ge of 12.5 per cent, followed by market days (sporadic or nomadic), visit of relatives, farming, cultural festivals (6.3% each) and worship purposes, with an average of around 3 per cent (see Fig. 8.5).
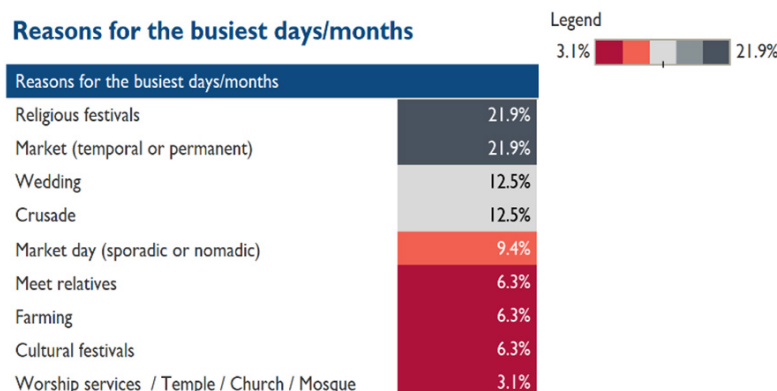
Fig. 8.5: Main reasons for the busiest days/months

3.2.j PLACES OF WORSHIP

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

In terms of population mobility at the places of worship, *Shivapuri Dham, Laxmi Narayan Temple*, and *Baheda Baba Temple* have the highest entry flow of people from Dhangadhi Sub-Metropolitan City, as well as India. The study shows that these sites are open every day throughout the year, however the busiest days are Monday and Saturday. These sites attract believers from *Kailali, Doti, Achham, Bajura, Kanchanpur, Dadeldhura, Baitadi*, and *Darchula* districts. At the municipality level, people visit these sites from *Godawari Municipality, Ghodaghodi Municipality, Shuklaphanta Municipality, Dhangadhi Sub-Metropolitan City, Mahakali Municipality*, and *Bhimdatta Municipality*.

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

In terms of connectivity, *Laxmi Narayan Temple* is located at the *Main Road* and one of the largest junctions, *L.N. Chowk,* which is easily accessible by vehicle. Likewise, *Shivapuri Dham* is located near *New Road* and *Bhimdatta Highway.* The temple is found at the proximity of *Uttar Behandi* and *Chatakpur* localities. The study shows that the places of worship in Dhangadhi Sub-Metropolitan City are accessible by vehicle, and people use tricycle, bicycle, bus, minivan and car to reach these sites from POEs and the respective junctions.

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

The bar in orange colour shows the average entry flow per day, whereas the blue bar indicates the average entry flow on the busiest days; teal colour refers to the percentage of people coming from India, and in green is the distance (in Km) to the nearest health centre. At *Laxmi Narayan Mandir* and *Shivapuri Dham,* the average entry flow per day is 100 and 250, respectively, whereas 300 and 260 people visit these sites on the busiest days. The average entry flow per day and on the busiest days at the remaining sites is around 10 and 25, respectively. The distance to the nearest health centre from *Baheda Baba Temple* is 4 Km, and 1 Km from *Shivapuri Dham,* compared to the overall average of 300 m from the other places of worship.
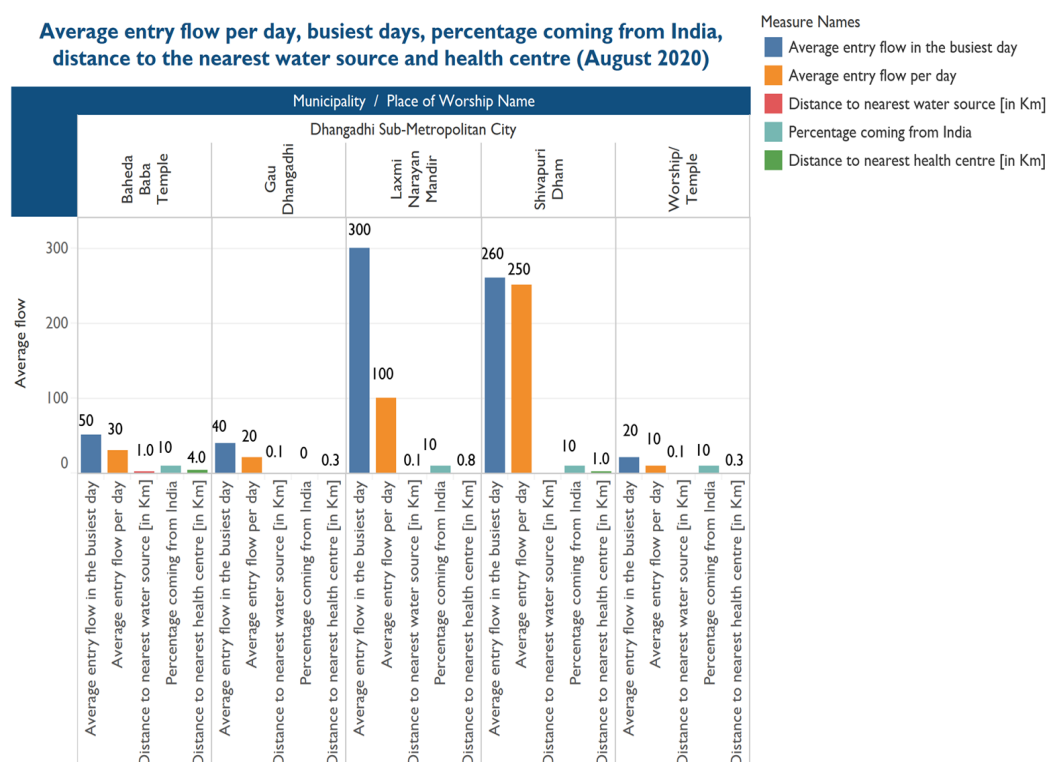
Fig. 9.1: Population mobility at the places of worship

The nearest health centre from the assessed places of worship is *Seti Provincial Hospital* (3/5). According to the majority of the respondents (3/5), greater than 50 per cent of people wear masks; the remaining two (2) have stated that the percentage is between 10 and 30 (see Table 9.1). At all the assessed places of worship, a waste management system is in place and no trash is visible on the floor. None of the sites have a screening station, despite being open throughout the year.

Table 9.1: Hygiene status at the places of worship

Name of Place of Worship	Name of the nearest health centre	Estimated percentage wearing mask	Availability of waste management	Visibility of trash on the floor	Visibility of uwanted animals/insects	Availability of screening station	Seasonality
Bandevi Bhagawati Temple	Seti Provincial Hospital	>50%	Available	Not visible	Yes, visible	Not available	All seasons
Behenda Baba Temple	Ghasita Health Post	10%-30%	Available	Not visible	Yes, visible	Not available	All seasons
Laxmi Narayan Mandir	Seti Provincial Hospital	>50%	Available	Not visible	Yes, visible	Not available	All seasons
Nava Durga Anusthan	Seti Ayurvedic Hospital	10%-30%	Available	Not visible	Yes, visible	Not available	All seasons
Shivapuri Dham	C.P. Hospital	>50%	Available	Not visible	Yes, visible	Not available	All seasons

Fig. 9.2 (top) shows the communication system in use and the presence of health authorities, together with the environmental status (bottom) at the places of worship. The respondents agreed that phone/text message (50%) are the most common means of communication, followed by internet/email/social media (25%) and UHF/VHF Radio (12.5%). Eighty (80) per cent of the sites have isolated places dedicated for sick people. The presence of health workers at the places of worship stands at 60 per cent. The majority of the places of worship have stagnant water visible on the floor (60%).

Communication system

Communication system	
Phone/Text Message	50.0%
Internet / E-mail / Social Media	25.0%
UHF/VHF Radio	12.5%
No Communication	12.5%

Legend
12.5% 50.0%

Presence of health authority and environmental Status

Isolated places dedicated for sick people	Presence of health worker	Visiblity of stagnant water on the floor	Percentage dedicated for sick people	Presence of health worker by percentage	Visibility of stagnant water on the floor
Available	Available	Not visible	80.0%	60.0%	60.0%
Not available	Not available	Visible	20.0%	40.0%	40.0%

Fig. 9.2: Communication system and presence of health authority at the places of worship

The places of worship (temples, churches or mosques) are busier during worship services and religious festivals (20.8% each). Among other reasons, market days (sporadic or nomadic) and cultural festivals carry an equal percentage of 16.7, followed by crusades, weddings, meeting relatives with an average of 5 per cent (see Fig. 9.3).

Reasons for the busiest days/months

Reasons for the busiest day	
Religious festivals	20.8%
Worship services / Temple / Church / Mosque	20.8%
Market day (sporadic or nomadic)	16.7%
Cultural festivals	16.7%
Crusade	12.5%
Wedding	8.3%
Meet relatives	4.2%
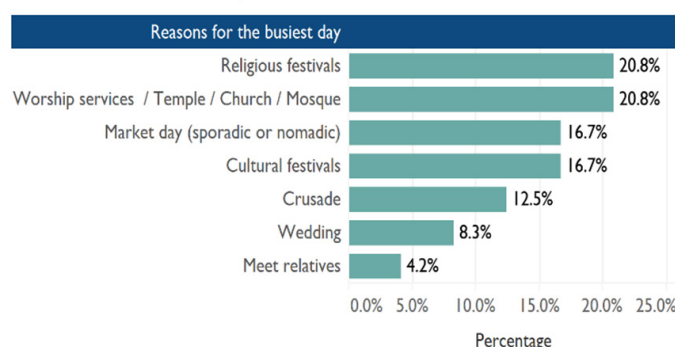
Fig. 9.3: Main reasons for the busiest days/months

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)

In Dhangadhi Sub-Metropolitan City, eight (8) POEs were identified, including one formal crossing point (*Trinagar Chauki POE*). Among the POEs, only three (3) are land border. The distance to the nearest health centre is 5 Km. People mainly travel because of trade, cultural and religious festivals. It has emerged that the implementation of mask wearing practices across the POEs, together with the communication network on site, are inadequate. The main means of accessibility is by motorbike and foot. Findings have also shown the absence of IHR and PHEIC special equipment to address health emergencies both within Nepal and in the corresponding country (India). This is exacerbated by the inadequacy of health infrastructure across the POEs in Nepal.

Health Centres

Seti Provincial Hospital (Government) has the highest inpatient and outpatient wards (1,700 and 10,000), followed by *Eye Hospital* (Private), with a population mobility of 1,586 (inpatient) per day. The most utilised technique of waste management involves waste bins, which are preferred to incineration. Common diseases affecting people in the municipality are diarrhea, dengue, typhoid, and malaria, whereas the main reasons people go to health centres are COVID-19, influenza, ante-natal and post-natal care. Water and electricity are available, and patients take maximum 5 Km to reach the health facilities. Overall, people do seek alternative health care before going to the hospital, such as home care, public health centres, religious leaders, pharmacies, traditional healers, and elsewhere. *Maya Metro Hospital* and *Seti Provincial Hospital* have the highest number of health personnel, with 147 and 64, respectively. However, *Maya Metro Hospital* has inadequate IPC and emergency preparedness plan (never tested). All the hospitals have incoming patients every day, with the busiest day of the week being Sunday (e.g. 2,000 patients visiting *Maya Metro Hospital*).

Traditional Healers

Pashupati Tole locality has the highest population mobility with an average of 200 people per day, 50 per cent coming from India. The results have also revealed that 10-30 per cent wear masks. There is visibility of stagnant water on floor, especially during the rainy season, which in turn causes mosquitoes to bread within the host communities. Practices conducted by the traditional healers are; divination, cure of body diseases and mental illnesses, as well protection. The most common diseases patients seek treatment for at the traditional healers' compounds include; fever, diarrhea, headache, and skin diseases. This shows that, in the event of recurrence of diseases (outbreak) with symptoms similar to COVID-19 and Ebola (i.e. fever and diarrhea), infectious diseases can easily be transmitted due to the nature of health practices performed by traditional healers, as well as the inadequate use of SOPs while visiting patients. According to eye findings, the majority of the traditional healers do not believe in COVID-19, and hence do not wear masks. Unwanted animals visible in the surroundings also contribute to disease transmission. The major reasons for the busiest days/months at the traditional healers' compounds are; religious festivals, meeting

relatives, crusade and cultural festivals and wedding ceremonies.

Schools and Colleges

Kailali Multiple Campus is the most populated college, followed by *Trinagar Ma. Vi. School* with 12,000 and 1,228, respectively. Although *Kailali Multiple Campus* is the most populated in terms of human mobility, it has inadequate toilet facilities. Female students are higher in number compared to males attending educational institutions. *Nast College* has the highest number of teachers per student (1 teacher for 8 students) compared to the average of other schools/colleges (1 teacher for 36 students). *Kailali Multiple Campus* shows the highest average of 3 students per desk, and 9 desks per classroom, together with inadequate toilet facilities. Despite the availability of a waste management system, trash and unwanted animals/insects are still visible at the site. Specifically, one suspected COVID-19 case was reported at *Kailali Multiple Campus* before the implemented closure of schools and colleges during the national lockdown.

Entertainment Centres

Sabjimandi and *Main Road Buspark* have 200 and 500 people accessing the sites per day, respectively, and 1,000 and 800 on the busiest days. The majority of the people choose alternative health care when they fall ill, such as pharmacies, clinic, traditional healers, and home treatment.

Market Centres

Buspark Market and *Dhangadhi Crossroad Market* have the highest population mobility on the busiest days, with 3,000 and 2,500, respectively. However, the highest entry flow per day accounts for *Dhangadhi Super Market* and *L.N. Chowk Market*, with 200 people (each). The percentage of people coming from India is higher at *Chauraha Market* and *Dhangadhi Crossroad Market*, with 40 and 30 per cent, respectively. None of the markets have an isolation place for sick people, and a health authority is available only in three (3) out of the ten (10) assessed markets. This, together with the presence of trash and stagnant water on the floor in 90 per cent of the sites, poses health concerns, especially in terms of prevention and preparedness to outbreaks.

Migrant Worksites

Sabjimandi and *Main Road Buspark* have 200 and 500 people accessing the sites per day, respectively, and 1,000 and 800 on the busiest days. The majority of the people choose alternative health care when they fall ill, such as pharmacies, clinic, traditional healers, and home treatment.

Transport Stations

The highest population mobility at the transport stations was found at *Chauraha Bus Station, Magic Transport Station*, and *Dhangadhi Crossroad Park,* with an average entry flow of 6,000 people per day, followed by *Hospital Line Station* and *Auto Station*, with 4,000 and 2,000 daily travellers, respectively. It is worth mentioning that one suspected COVID-19 case was found in *Chauraha Bus Station*.

Places of Worship

The place of worship *Laxmi Narayan Mandir* has an average entry flow per day of 100 people and 300 on the busiest day. In *Shivapuri Dham*, the daily average of people entering the site is 250, similarly to the flow on the busiest day (260). The farthest distance to a health centre is from *Baheda Baba Temple* (4 Km).

4.1.a ADDITIONAL FINDINGS

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

- The most used and nearest hospitals are *Seti Provincial Hospital* (Government) and *Maya Metro Hospital* (Private). Except for POEs, the distance to the hospital is generally short.
- Inadequate or no presence of health authority/agent dedicated for sick people.
- Visibility of unwanted animals/insects, trash and stagnant water on the floor. This contributes to the proliferation of mosquitoes, which in turn leads to malaria and/or typhoid fever.
- The analysis has revealed that the most common modes of transport to access the sites are motorbikes and travel by foot. In the case of POEs, walking long distances is eminent, and at times, it is the only way to reach the site. People cross the border by swimming/tube, especially for illegal activities (i.e. human trafficking and/or clandestine commerce) conducted at night, and occasionally during daytime.
- For almost all the sites, communication mostly happens through voice/messages. However, interrupted network (bad) is not rare, with higher instances in informal crossing points.
- There are no isolated or adequate places dedicated for sick people, especially at most of the POEs assessed.
- There is availability of water in most of the sites where the study was conducted, such as well, public water system and delivery by truck.
- People understand procedures to follow if someone is affected by COVID-19. However, there are inadequate mask-wearing practices in the municipality, especially in the following sites; traditional healers, some transport stations and migrant worksites.
- Except for hospitals, there is no presence of screening stations and IPC in the sites investigated. This poses serious health threats in case of COVID-19 infection, with a higher grade of vulnerability at POEs, transport stations, migrant worksites, traditional healers, and places of worship (mostly temples).

4.2 RECOMMENDATIONS

PMM has allowed us to better grasp the dynamics and characteristics of human mobility in Dhangadhi Sub-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),

the national supply should be addressed to ensure that everyone has access to basic items, such as surgical masks and hand sanitizer.

4. Invest in capacity building of health infrastructure. This is especially the case for health posts, which are often located in remote areas and are hardly accessible, even by foot. In case of grave ill people, they may not be able to reach the sites and receive the necessary health care. Similarly, medical equipment should be widely available to health workers and volunteers.

5. Focus on risk communication and community engagement. Based on direct field observation and from the respondents, the community seems to lack knowledge of potential risks of infectious diseases, such as COVID-19, and preventive measures for transmission. Citizens should be involved in health-related activities and awareness should be raised on the importance of good sanitary conditions affected by waste management systems, as well as the availability of water and toilet facilities.

6. Develop a health working group for Nepal and corresponding countries at formal POEs for both IHR and PHEIC focal points. This will allow for a better management of travellers' movement, especially for tracking purposes.

7. Conduct an urgent training and capacity development of health staff/immigration/security officials at POEs, including development of SOPs for the POEs and key priority areas.

8. Conduct leadership training for all traditional healers in order to enhance their health practices, adhere to SOPs within their communities, especially in hostile communities where people rely on them for health and other issues.

The findings will be shared with MoHP for further actions.

4.3 LESSONS LEARNT

1. Stakeholders' engagement at all levels (national, district and municipality) is key to ensure effective implementation and ownership of the project. Through such multi-level engagement, the capacity of officers is also enhanced, which in turn contributes to the sustainability of the project. Consequently, this helps to integrate mobility pattern data in epidemiological surveillance for meaningful analysis of public health risks.

2. Community engagement and participation at all levels of implementation ease the process of municipality entry, data collection and municipality/community ownership of the project. This also helps communities understand the possible vulnerabilities, in terms of health risks, that exist in the area, especially during the COVID-19 pandemic.

3. The training and simulations are key for the staff/enumerators to expand their knowledge and improve their skills in interviewing informants and collecting data. This in turn allows to validate and adopt the data collection tools ensuring they are suitable for the local context.

4. Early planning/preparations, logistical arrangements (vehicles, training materials, data collection, maps, plans for field teams, hand sanitizers, masks, etc.) are important for timely and effective implementation of the activities.

5. Field debriefing sessions are necessary to discuss successes, lessons learnt, challenges and recommendations for future improvement of action plans since the project exercise is a learning process in itself.

5. ANNEXES

5.1 ANNEX I

Groups and indicator weights for the vulnerability analysis selection

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

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

5.2 ANNEX II

Vulnerability capacity and sites location generated by the matrix analysis

			Markets	Migrant Worksites	Traditional Healers	Health Facilities	Transport Stations
Group Weight			10	10	20	15	10
Individual Indicator Weight			10	10	20	15	10
Afficher les localités							
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
Chauraha	606		110	310	0	0	180
Hospital Line	585		170	30	0	375	10
Basanta Tole	580		0	0	580	0	0
Chatakpur	445		0	0	0	435	10
Buspark	340		110	0	0	0	230
Uttar Behandi	300		0	0	0	45	0
Main Road	260		30	30	0	75	40
Ghuiyaghat	248		0	160	40	0	0
Campus Chowk	225		0	0	0	0	120
Dhangadi Bazar	208		100	100	0	0	0
Hasanpur	197		10	0	80	0	0
Devotee Chowk	195		0	0	0	195	0
Bhansar Tole	183		0	0	0	0	0
Durga Mandir	180		0	0	180	0	0
Rampur	180		0	0	0	0	0
L.N. Chowk	160		80	0	0	0	20
Purano Bhansar Road	115		0	0	0	0	0
Naina Devi	110		0	0	0	0	0
Rajpur	110		40	70	0	0	0
Jugeda	103		20	30	0	0	0
Katan	100		0	0	100	0	0
Santoshi Tole	97		0	0	0	0	0
Milanchowk	86		0	0	80	0	0
Seto Pool	60		0	0	60	0	0
Behandi	60		0	0	60	0	0
Fulbari	59		30	0	0	0	0
Bangra Katan	47		0	0	0	0	0
Bhansar Road	40		0	0	0	0	40
Traffic Chowk	40		0	0	0	0	40
H. Gaun	37		0	0	0	0	0
Dhangadi Gaun	34		0	0	0	0	0

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