Health Sector Response to COVID-19 Pandemic in Nepal

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Government of Nepal
Ministry of Health and Population
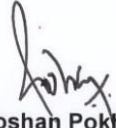
Message from the Secretary

"Health Sector Response to COVID-19 Pandemic in Nepal" provides an overview of the epidemiology of COVID-19 and the health sector response to the COVID-19 pandemic that posed an unprecedented challenge to the health system in Nepal. The Ministry of Health and Population (MoHP) had published a report outlining key challenges faced and lessons learnt during the COVID-19 pandemic in May 2021. Shortly after the report was published, a very large second wave of cases struck the country, with a final receding of cases occurring in October, therefore this report was developed to capture the overall responses until December 2021 which marks 2 years since the onset of pandemic.

The purpose of this report is to take holistic stock of the response and to identify lessons learnt that could help inform both near-term policy options and the longer-term recovery plan from such pandemic. This report is expected to be a useful resource for improving pandemic responses in both the short and long-run and contributes to better preparedness and planning for future epidemics.

The report is organized thematically. The opening chapter considers the epidemiology of the disease in Nepal. This is followed by a cross-cutting chapter addressing issues relating to governance, coordination, and financing of the response. Subsequent chapters address specific domains under the response including risk communication and community engagement, surveillance, case finding and case management, laboratories and diagnostics, software development and data management, research and development, and the progress of the vaccination programme in Nepal. The final chapter brings together key threads from the report and summarises future directions identified across each of the domains.

The data for this report is drawn from document analysis, analysis of epidemiological data and review of meetings and discussion records. The document analysis is done from a wide-ranging desk review that included peer reviewed journal publications, grey literature sources including official reports; strategy and implementation documents; and documents produced by MoHP and different divisions and centers under MoHP and the Department of Health Services (DoHS), donors and other partner organisations. Population-level epidemiological data as of December 2021 were obtained from Information Management Unit (IMU) and analysis of data on caseload, test results, mortality, and vaccination uptake is done. Information on decisions and actions taken in response to COVID-19 was extracted from meeting minutes of the CCMC Directive Committee and COVID-19 Prevention and Control High Level Coordination Committee, and publicly released notices from MoHP through website and social media pages. Audio/video records of virtual meetings and meeting notes with policymakers (Technical Working Group for this report) and health workers engaged in COVID response were also analysed.

MoHP would like to acknowledge the efforts of technical working group, individuals and agencies who provided information for producing this report. Special thanks to UKaid-NHSSP for technical assistance for commissioning this task.

Dr. Roshan Pokhrel
Secretary

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Abbreviations

ACE2	Angiotensin-converting enzyme 2
AEFI	Adverse event following immunization
ANC	Antenatal care
ARV	Anti-Retroviral
BEONC	Basic Emergency Obstetric and Neonatal Care
BSL	Biosafety Level
CAMH	Child and Adolescent Mental Health
CCMC	COVID-19 Crisis Management Center
CDO	Chief District Officer
CDC	Centre for Disease Control
CEONC	Comprehensive Emergency Obstetric and Neonatal Care
CFR	Case Fatality Rate
CICT	Case investigation and contact tracing
CICTT	Case investigation and contact tracing team
CMO	Crisis Management Ordinance
COPD	Chronic Obstructive Pulmonary Disease
COVAC	National COVID-19 Vaccine Advisory Committee
COVAX	COVID-19 Vaccines Global Access initiative
COVID-19	Corona Virus Disease -19
CPT	convalescent plasma therapy
DAO	District Administration Office
DCCMC	District COVID-19 Crisis Management Committee
DDA	Department of Drug Administration
DFID	Department for International Development
DHIS	District Health Information Software

DM	Diabetes Mellitus
DoHS	Department of Health Services
DOTS	Directly observed Therapy, Short Course
EDCD	Epidemiology and Disease Control Division
EDP	External Development Partners
EPI	Expanded Programme on Immunization
eLMIS	electronic Logistics Management Information System
EQAS	External Quality Assurance Service
ERB	Ethical Review Board
EWARS	Early Warning and Reporting System
FAO	Food and Agriculture Organisation of the United Nations
FAQ	Frequently Asked Questions
FCDO	Foreign, Commonwealth & Development Center
FCHV	Female Community Health Volunteer
FDA	Food and Drug Administration
FNJ	Federation of National Journalists
FWD	Family Welfare Division
GHSC-PSM	Global Health Supply Chain Program-Procurement and Supply Management
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GOARN	Global Outbreak Alert and Response Network
GoN	Government of Nepal
GCP	Ground Crossing Point
GPS	Global Positioning System
HAA	Health Accreditation Authority
HCD	Health Coordination Division

HDC	Hospital
HDU	High-dependency Unit
HEDMU	Health Emergency and Disaster Management Unit
HEOC	Health Emergency Operation Center (MoHP)
HIV	Human Immunodeficiency Virus
HLCC	High-Level Coordination Committee for the Prevention and Control of COVID-19
HMIS	Health Management Information System
HR	Human Resource
ICS	Incident Command Structure
ICTV	International Committee on Taxonomy of Viruses
ICU	Intensive Care Unit
ICT	Information and Communication Technology
IEC	Information, Education and Communication
IgG	Immunoglobulin G
IHMIS	Integrated Health Management Information Section
IHR	International Health Regulations
ILI	Influenza Like Illness
IMU	Information Management Unit
INGO	International non-governmental organization
IOM	International Organisation on Migration
IPC	Infection Prevention and Control
IT	Information Technology
LMIC	Least Middle-Income Countries
LMS	Logistic Management System
MD	Management Division

MERS	Middle East Respiratory Syndrome
MoFAGA	Minister of Federal Affairs and General Administration
MoHA	Ministry of Home Affairs (Nepal)
MoHP	Ministry of Health and Population (Nepal)
MoSD	Ministry of Social Development (Nepal)
MoU	Memorandum of Understanding
MR	Measles-Rubella
mRNA	messenger Ribonucleic Acid
NAAT	Nucleic Acid Amplification Test
NCD	Non-communicable disease(s)
NDRRMA	National Disaster Risk Reduction and Management Authority
NDVP	National Deployment and Vaccination Plan
NEOC	National Emergency Operations Center
NGOs	Non-governmental Organization/s
NHEICC	National Health Education Information and Communication Centre
NHLCC	National High Level Coordination Committee
NHRC	Nepal Health Research Council
NHSSP	Nepal Health Sector Support Programme
NHTC	National Health Training Center
NIAC	National Immunization Advisory Committee
NIHR	National Institute for Health Research
NMA	Nepal Medical Association
NMC	Nepal Medical Council
NPHL	Nepal Public Health Laboratory
NPR	Nepalese Rupee
NQAP	National Quality Assurance Programme

NRCS	Nepal Red Cross Society
NRN	Non-residential Nepalese
NTC	Nepal Telecom
OIE	World Organization for Animal Health
ORI	Outbreak Response Immunization
PCR	Polymerase Chain Reaction
PHCC	Primary Health Care Centre
PHD	Provincial Health Directorate
PHEIC	Public Health Emergency of International Concern
PHLMC	Provincial Health Logistics Management Centre
PM	Prime Minister
POE	Point of Entry
PNC	Post-natal care
PLHIV	People living with HIV
PPE	Personal Protective Equipment
PPMD	Policy Planning and Monitoring Division
QR	Quick Response
RCCE	Risk Communication and Community Engagement
RDT	Rapid Diagnostic Test
RMNCAH	Reproductive, maternal, newborn child and adolescent health
RT-PCR	Real time polymerase chain reaction (testing modality)
SAARC	South Asian Association for Regional Cooperation
SARI	Severe Acute Respiratory Illness
SAGE	Scientific Advisory Group for Emergencies
SARS	Severe Acute Respiratory Syndrome
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2

SEAR	South East Asian Region
SEARO	South East Asian Regional Office
SMS	Short Message Service
SOP	Standard Operating Procedure
SP	Service Delivery Point
SRMNCAH	Sexual, reproductive, maternal, newborn child and adolescent health
STIDH	Sukraraj Infectious and Tropical Disease Hospital
TIA	Tribhuvan International Airport
TV	Television
UK	United Kingdom
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
USAID	The United States Agency for International Development
USD	United States Dollar
VOC	Variant of Concern
VTM	Viral Transport Media
WASH	Water Sanitation and Hygiene
WFP	World Food Program (United Nations)
WHO	World Health Organization

Executive summary

This report was commissioned by the Ministry of Health and Population (MoHP) to provide an overview of the epidemiology of COVID-19 and the health sector response to the COVID-19 pandemic which posed an unprecedented challenge to the health system in Nepal, as in many other countries worldwide. This report is expected to be a useful resource for improving pandemic responses in both the short- and long-run, and contribute to better preparedness and planning for future epidemics.

As of 31 December 2021, epidemiological trend data show two large case waves in Nepal, the first wave from 23 January 2020-14 March 2021 and the second wave from 15 March 2021 onwards. Similarly on that date, the cumulative number of RT-PCR/Antigen positive cases had reached 922, 942 with the recovery rate of 98% and Fatality Rate of 1.26%. The highest numbers of RT-PCR positive cases were reported on 22 October 2020 (5,713 cases) during the first wave and 11 May 2021 (9,317 cases) during the second wave. Nepal had its highest test positivity rates on 26 October 2020 during the first wave (34.8%) and 10 May 2021 during the second wave (51.8%). There have been important variations in the distribution of disease across populations and geographies in Nepal. In particular, Bagmati Province has seen the largest number of cases, with a majority of cases concentrated in the three districts of the Kathmandu valley.

The Health Emergency Operation Center (HEOC) under the Health Emergency and Disaster Management Unit (HEDMU) of the MoHP steered the response during the early pandemic phase, and remained as a core body for the COVID-19 response within the MoHP. The Incident Command System accelerated the evidence-informed decision-making process within the MoHP and helped to improve the overall effectiveness of the COVID-19 response. As a technology intervention a software was developed by the Information Management Unit (IMU) under the MoHP secretary. The IMU had six sub-groups: data/information collection team, data quality assurance team, data analysis team, IT management team, report preparation team, and COVID-19 vaccine related support team (after vaccination start) aiming to capture and provide the right data to the right persons on the right time through a one-door policy as per a Secretary-level decision. Daily data analysis was continuously done and shared to higher authorities by members of Information, Statistics and Monitoring under the ICS for decision making in the planning process.

The MoHP was able to align the support from partners in priority areas identified in the early phase of the pandemic which were regularly updated, reviewed, and shared in cluster meetings. There were some challenges in engaging the private sector in testing and service delivery during the early phase of the response. However, in later stages, the role of the private sector remained crucial in expanding the health system capacity for testing and delivery of COVID-19 and non-COVID-19 services.

The MoHP, in collaboration with other partners, rolled out a series of communication activities to spread awareness of COVID-19 and help increase adherence to preventive measures. These included

radio and television placements, SMS messaging, and use of web-based tools. More than 500 radio stations and 22 television channels throughout the country disseminated COVID-19 related information in multiple languages.

Delivery of laboratory testing was a success story for the response in Nepal, given resource constraints. At the beginning of the pandemic, the National Public Health Laboratory (NPHL) was the only COVID-19 RT-PCR capable laboratory, but over the course of pandemic the capacity was rapidly expanded in all seven provinces with a total 101 laboratories performing COVID-19 RT-PCR testing as of December 2021. Although antibody-based rapid testing was introduced as case numbers rose, exceeding the RT-PCR testing capacity particularly during the first wave, the MoHP shifted its focus on expansion of RT-PCR testing capacity due to the limited sensitivity of antibody-based testing. In the second wave, the introduction of antigen-based rapid testing helped to expand the testing capacity throughout the country. These efforts in expansion of testing capacity were supported by a series of guidance documents to help ensure adherence to proper laboratory and testing procedures. As the testing capacity rapidly expanded during the pandemic, there is an opportunity to ensure the sustainability of laboratory capacity by diversifying the activities of these laboratories to include testing for other common pathogens which could be useful for future outbreak response.

The MoHP placed high emphasis on contact tracing and community isolation systems in Nepal over the course of the pandemic. However, the performance was constrained by some operational challenges such as the lack of human resources at local level.

Remarkable improvements in the clinical management of COVID-19 patients were made over the course of the first and second waves as familiarity with the disease improved, evidence on effectiveness of therapeutics became clearer, and pathways for care became more established. Particular improvements were noted in triage and referral especially in the second wave, and the availability and use of ambulance services. There is now an important opportunity to take stock of best practices from clinical teams working across the country, documenting the best practices, and disseminating them widely ahead of potential future waves.

Shortages of oxygen became more pronounced during the second wave and prevented hospitals from operating to their full capacity. The recent period with receding numbers of cases could be used as an opportunity for the country to prepare and bolster the supply of essential equipment and commodities including oxygen supply so as to be better positioned for future waves (if any).

Essential health services (especially reproductive, maternal, newborn child and adolescent health and routine immunization delivery) in Nepal, for the most part, have shown signs of resilience and weathered the COVID-19 storm reasonably well, with attendance rates showing rapid recoveries even during the lockdown period. However, evidence is lacking on how NCDs (including mental health) and other essential services were impacted by COVID-19 pandemic and if they have recovered to normal levels now that second wave case numbers have declined.

Despite initial challenges, Nepal has been able to roll out vaccines quite efficiently with more than half of the population ≥18 years of age being fully vaccinated as of 31 December 2021. As health workers were vaccinated as the first priority, restoring service delivery became relatively easy in the second

phase. However, with high demand and acceptance of COVID-19 vaccines from public, maintaining preventive measures like social distancing in vaccination sites emerged as an issue in some facilities.

Strengthening situational awareness systems that provides better understanding of the disease situation and bolstering modelling/forecasting capabilities within the country based on real time collected IMU data could be priority areas for action. This could be achieved through capacity development of the researchers in country and close collaboration of the MoHP, NHRC, academia, and other partners. Strengthening and sustaining the Knowledge Café initiatives under Policy, Planning and Monitoring Division of MoHP could help further in evidence-informed decision making in the future.

1. Background

Summary
- COVID-19 is a respiratory infection with systemic manifestations caused by the SARS-CoV-2 virus. The first cases emerged in China in late 2019, and the infection spread rapidly worldwide, with first arrivals in Nepal from late January 2020.

- SARS-CoV-2 acts by binding to receptors in the respiratory tract, and although most cases are mild (up to a third may be asymptomatic), in severe disease this binding can trigger a cascade of effects including problems with blood pressure control and inappropriate blood clotting.

- While the global epidemiology of disease has varied by region and by country, there are commonalities in the patterns that we see across populations. Severe COVID-19 outcomes (including intensive care admission and death) have predominantly been reported in older people and in those with comorbidities.

- The South East Asian region (SEAR) was hit hard during the pandemic, although in terms of reported cases and deaths has performed better than many counterparts in Europe and North America. While, overall, the case and fatality rates from COVID-19 in Nepal over the course of the pandemic have been below some regional neighbours, the country endured an exceptionally large second wave that started after March 2021, with the highest number of active cases reported in May 2021 along with relatively high-test positivity rates.

- The purpose of this report is to present the epidemiology of disease and the processes of the COVID-19 response in Nepal so that it can be useful reference for planning and preparing the health system for responses to future pandemics and outbreaks of a similar nature.

It has now been more than two years since the first cases of a novel coronavirus disease (COVID-19) were reported in mainland China, and around 23 months since Nepal reported its first case (in January 2020). This report sets out the epidemiology of COVID-19 in Nepal since that first case was confirmed and presents an overall description of the response to the virus since January 2020. The report describes and assesses the COVID-19 response under different thematic areas including coordination and planning, risk communication and community engagement, surveillance, point-of-entry measures, laboratory and diagnostic support, infection prevention and control, case management, operational support and logistics, vaccination, software development and data management, research, development, and monitoring. It also provides a brief overview of challenges and ways forward under each of these thematic areas. It considers the effects of COVID-19 on routine and emergency health service delivery more generally, and the extent to which regular services have been maintained during the pandemic.

Throughout the report, the focus of analysis is on considering both the extent to which the health system in Nepal was prepared for an emergent pathogen with pandemic potential, and the strategies the country adopted in response to the pandemic. In producing this assessment, we are mindful both

of the extraordinary nature of the pandemic – the first, on this scale, since the influenza pandemic of 1918-19 – and of large variations in the extent of preparedness and the comprehensiveness of national responses in many countries worldwide. Account must also be taken of the resource constraints under which the response in Nepal has been delivered, relative to both regional neighbors and international comparators.

The report has been produced by the Nepalese Ministry of Health and Population (MoHP), and the findings documented here are likely to be relevant for those working at federal, provincial, and local levels within the Nepalese health system; for donors and other external partners in the response; and for those in the private and voluntary sectors. Findings may also be of wider interest to Nepalese citizens and others in Nepal and elsewhere.

1.1. Emergence of the COVID-19 pandemic

A cluster of patients in Wuhan city of Hubei province, Central China, presented with fever, cough, myalgia, fatigue, shortness of breath, and pneumonia of unknown aetiology with majority of these cases being linked to Huanan Seafood Wholesale Market.[1, 2] The linkage of patients with the wet market in Huanan hinted towards infection of zoonotic origin. On 31 December 2019, authorities informed the World Health Organization (WHO) local office and closed the market on the following day.[2, 3] In the earliest stages of the outbreak, human-to-human transmission was speculated but was not confirmed until two family clusters including one in which the husband transmitted the disease to his differently-abled wife were identified in mid-January 2020.[2]

Chinese health and medical professionals quickly ruled out the other common respiratory pathogens and Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) coronaviruses, which were responsible for outbreaks in 2002 and 2012.[2] Broncho-alveolar lavage fluid from seven patients with severe pneumonia was tested in Wuhan Institute of Virology for diagnosis of the pathogen. On 7 January 2020, it was confirmed that a novel coronavirus with 80% nucleotide sequence similarity to the SARS coronavirus and 96% similarity with bat coronavirus had been isolated from these samples. In the second week of January, 2020 the full genome was globally shared, which facilitated the rapid development of diagnostic tests and ultimately the vaccines.[2] The WHO announced coronavirus disease (COVID-19) as the name of this new disease on 11 February 2020, following guidelines previously developed with the World Organization for Animal Health (OIE) and the Food and Agriculture Organization of the United Nations (FAO). The International Committee on Taxonomy of Viruses (ICTV) officially named the virus as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). [4]

The outbreak coincided with the Chinese Lunar New Year, considered one of the important holidays in China, which could have important implications on the spread of disease.[2] Chinese authorities took aggressive containment measures, blocking most travel into and out of Wuhan, establishing a cordon sanitaire on 23 January 2020, which was later expanded to other cities too. Soon after China, Thailand

(13 January 2020), Japan (15 January 2020) and the Republic of Korea (20 January 2020) reported the first cases of COVID-19. [2, 5]

The disease that started in a small cluster in Wuhan showed exponential growth affecting multiple countries from that point onwards. By 11 March 2020, there were 118,000 cases reported in 114 countries with over 4,000 deaths. In light of the alarming levels of spread internationally and the severity of disease being reported from health facilities across a range of countries, the WHO declared COVID-19 a Public Health Emergency of International Concern (PHEIC) on 30 January 2020[6] and as a global pandemic on 11 March 2020. [7]

1.2. Basic biological, clinical and epidemiological characteristics of COVID-19

Biological and immunological features of COVID-19

COVID-19 is caused by SARS-CoV-2, a virus with significant genetic similarities to other recognised coronaviruses including SARS-CoV-1 (which caused the SARS outbreak of 2003) and MERS (for which cases have emerged intermittently but with no evidence, to date, of human-to-human transmission).[8] The biological origins of SARS-CoV-2 are contested and although an animal to human spillover event (or possibly multiple such events) remain the most likely explanation for the first reported cases in China, investigations led by the WHO and other actors continue.

As for other viruses, SARS-CoV-2 triggers infection in human hosts initially by binding to target receptors on cells. Where exactly this occurs varies from person to person, but a common location is in the surface cells of the upper airway. SARS-CoV-2 targets a receptor called angiotensin-converting enzyme 2 (ACE2), and by binding to this receptor, the virus is able to disrupt a series of biological processes that ultimately control blood pressure, the permeability of blood vessel walls, and cellular inflammation. This combination of effects is what typically produces the most severe clinical manifestations of COVID-19.[9] The critical binding unit on SARS-CoV-2 itself is the spike (S) protein, and so far all of the most significant variants of COVID-19 to emerge have involved mutations of varying extent to the structure of this protein. This protein is also the principal target for the COVID-19 vaccines currently in use in Nepal and elsewhere.[10]

The immunological response to SARS-CoV-2 is multi-faceted and scientific understanding in this area continues to develop. We know that in the near-term, most people produce marked antibody responses within a matter of days, plateauing at around 2-6 weeks after primary infection depending on the antibody type, before gradually declining over time.[11] The duration of the effective primary antibody response to infection remains unclear, although current evidence indicates it can last at least 8-9 months.[12] Of course, this covers only one aspect of the protective immune response to infection. We know that cellular immune memory (T cell) responses are generated following both infection and vaccination against SARS-CoV-2.[13] Once again, the duration and effectiveness of these responses in protecting against future infection is uncertain although protective effects appear to be strong and long-lasting.[14] Quite how long these effective responses can be sustained following vaccination and/or natural infection will be one of the key determinants of the later course of the pandemic.

Fundamentals of COVID-19 epidemiology

As later sections in this chapter will show, the precise epidemiological picture for COVID-19 varies both regionally and from country to country but some global patterns were discernible from an early stage in the pandemic. First, although the distribution of cases globally has varied in important ways over time, dominant variants have shifted over time (as would be expected). The currently dominant variant in most countries – including Nepal – is the Delta variant which has transmission dynamics that differ somewhat from earlier forms, and a wider symptom set.

Second, COVID-19 is a disease for which the worst effects are overwhelmingly seen in older adults, those with pre-existing comorbidities and among men. Current evidence suggests a doubling in risk of the most severe outcomes (hospitalisation and particularly mortality) for every additional ten years of age, and in general both susceptibility to infection and clinical manifestations of COVID-19 in children have been mild.[15, 16] There is a marked association between gender and disease severity, with the worst outcomes predominantly seen in older men; the association with gender is less marked in younger adults.[17] Although current evidence suggests that risk in pregnant women is generally low, proportionately higher caseloads have been noted in this group in high income settings especially after the first wave, and particularly among women with relevant comorbidities.[18] This may, however, be linked to lower vaccination uptake among pregnant women. Evidence also suggest the associations between ethnicity and severe COVID-19 outcomes, although to date the overwhelming majority of these data have come from the United States and United Kingdom.[19, 20] Data from serological studies conducted in LMICs indicates that many have seen extensive population spread but without translation into mortality and morbidity at the levels that these caseloads might suggest.[21] This picture of high population spread but lower than expected mortality and morbidity has been seen in Nepal.[5]

Finally, evidence from a number of countries has revealed stark inequalities in the geographical distribution of disease. The precise patterning of these variations differs in important ways from country to country, and are linked to access to diagnostic testing, clinical care and of course vaccination. However, they are underpinned in many cases by long-standing variations in socio-economic status, as well as by discrimination in its various forms. We review the picture in Nepal in detail in chapter 3.

Clinical aspects of COVID-19

From a clinical case management perspective, the presentation of COVID-19 is now well characterized. In those with no comorbid conditions, the vast majority who contract COVID-19 experience either no, or mild symptoms (including, among others, cough, shortness of breath, fever and variably loss of smell or taste).[22] Although figures vary from study to study and according to the virus variant, current estimates are that perhaps around a third of those who contract COVID-19 will display no symptoms at all.[23, 24] Moderate to severe symptoms (usually signified by a decline in oxygen saturation) may require supportive treatment in hospital at ward-level, high-dependency unit (HDU) level or even intensive care, although there have been important innovations in service delivery in resource-constrained settings to account for limited intensive care capacity. At the extreme end, patients may present in acute respiratory failure requiring intensive care and frequently invasive ventilator. In these patients, effects of COVID-19 are often multi-systemic and can include strokes or

other vascular (clotting) events and multi-organ failure. For this patient group, mortality rates even in high income intensive care settings can be in excess of 50%.

The COVID-19 pandemic is impacting health services round the world; and a great many attempts to understand this impact, and adjust for it, are being made.[25-29] In many places, it is recognised that this impact will go far beyond the direct immediate demand for hospital care for COVID-19 patients; as more general services are getting disrupted and delayed – with serious deleterious consequences for general population health.[30-33] While past disease outbreaks such as SARS and Ebola affected limited numbers of countries and remained within geographical boundaries, the COVID-19 has rapidly spread across the world in short period. It has not only threatened the lives of those infected but has led to huge economic loss and has also impacted mental health of people.[34] Given the scale and intensity of the pandemic and its impact in health system, it is essential to have deeper understanding of the impact on health services so that the appropriate policies and programmes can be designed to recover the loss sustained due to pandemic and restore the health system to normal functioning.

1.3. Overview of the epidemiology

Global scenario

The global epidemiological picture for COVID-19 continues to evolve rapidly. At the time of writing, there had been around 240 million confirmed cases of COVID-19 worldwide, and a little under 5 million deaths (however the number of deaths could have been underestimated considering the operational challenges in mortality surveillance). Current trends suggest a plateauing in reported case numbers, with reported deaths at the lowest levels since June 2021, but there have been at least 3 global waves since the first cases were identified in China in late 2019. The future course of the pandemic remains highly uncertain.

There have, in addition, been large variations in the caseload and in COVID-19 related mortality over time, reflecting not just differences in the severity of the epidemic in different parts of the world but differences in population structure, health service delivery capacity, and quality of diagnosis and testing regimes (see Figure 1). Reported caseloads have consistently been highest in the Americas, with the exception of a period in March-April 2021 when case numbers in South East Asia exceeded those anywhere else in the world, largely because of the size of the early spring wave in India. Overall figures for mortality are similarly highest in the Americas and the WHO European region, as they have been throughout the pandemic. The WHO African region has consistently reported by far the lowest number of cases and deaths since the beginning of the pandemic, likely reflecting much lower-case ascertainment due to lack of timely access to diagnostics, poor mortality reporting and younger populations.

Figure 1: Time series for confirmed cases by WHO region and reported deaths
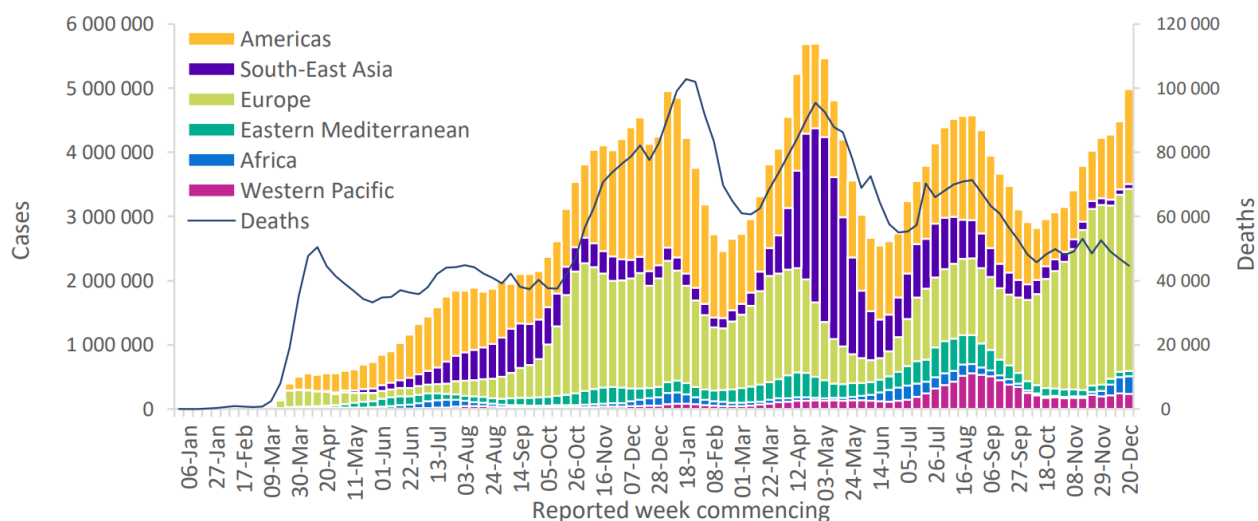
Globally, policy responses to this evolving picture have been highly variable. Many countries have, at various junctures, implemented "lockdown" measures of varying severity with stay-at-home orders, restriction on mobility and gathering, closure of venues and limitations of contacts among individuals with some limited exceptions (for example, essential health care). These have been accompanied by public communications emphasizing the importance of social distancing, mask-wearing in some cases, and exclusion of confirmed COVID-19 cases and their contacts, but the extent to which these measures have been enforced has varied

Regional scenario

Countries in the WHO Southeast Asian Region (SEAR) were considered likely to be vulnerable to COVID-19 spread given their geographic proximity to China, and given the extent of cross-border communications in terms of supply chains, business travel, tourism and in other domains. [35] On 13th of January 2020, a 61-year-old woman from Wuhan tested positive in Thailand, making it the first country besides China to report a case, and marking the initial spread of COVID-19 in this geographical region.[36] Nepal Reported the second case of COVID-19 in SEARO region on 23 January 2020[37] followed by Sri Lanka (27 January 2020)[38], India (27 January 2020)[39], Indonesia (2 March 2020)[40], Bhutan (6 March 2020)[37], Maldives (7 March 2020)[41], Bangladesh (8 March 2020)[42], Timor Leste (21 March 2020)[30], and Myanmar (23 March 2020)[40]. In the early phase of the pandemic, growing numbers of patients, a shortage of protective equipment for health workers, and limited facilities to provide intensive care added to the fears of an outbreak in the region that would be hard to control[18].

However, the current picture puts the SEAR third globally in terms of confirmed caseload over the duration of the pandemic. Most countries saw a moderately sized initial wave of cases in Spring 2020, followed by much larger waves in Spring/Summer 2021. The magnitude of the case peak in 2021 was in some cases catastrophic; India reported in excess of 400,000 new cases per day in late April. Overall,

available data show that Nepal has been the second worst hit country in the region (measured in terms of cases per million population), although the aggregate case fatality rate (CFR) across the whole pandemic to date is, at 1.4%, well below those of regional neighbours including Myanmar (3.7%) and Indonesia (3.4%).[43]

Nepal's experience in facing COVID-19 has been influenced by vulnerabilities that pre-dated the pandemic. Although the number of cases per million population in Nepal was somewhat similar to that of India, the number of deaths during the second wave was notably higher in Nepal (Appendix 2, Figures 1 and 2). Later chapters in this report will address the national picture in Nepal in detail, including epidemiological trends over the course of the pandemic (see Chapter 3).

1.4.   Socio-economic Impact of COVID-19

In addition to health effects, COVID-19 had a significant impact on people's socioeconomic status around the world. Following the COVID-19 outbreak in Nepal, the Nepalese government imposed restrictive measures like lockdown that impacted business sector and livelihood of people. [44] Restrictive measures imposed in the bid to break the transmission chain of COVID-19, transportation, shops, marketplaces, cinema halls, retail malls, and other institutions were closed, affecting people's life, particularly the impoverished, who have become more vulnerable.[45] The disruption of transportation and movement had a negative impact on socioeconomic activity in Nepal, resulting in a health and social crisis.[46] Detail socio-economic impact of the COVID-19 pandemic and policy measures adopted to contain the disease is beyond the scope of this report and is not discussed here.

1.5.   Rationale and organization of report

In May 2021, the MoHP published a report outlining key challenges faced during the pandemic up to that point, and identifying lessons learnt.[47] The context in Nepal has changed in many ways since this time. Shortly after the report was published, a very large second wave of cases struck the country, with a final receding of cases occurring in October. The function of this report is to take stock of the response as a whole now that the worst of the second wave has passed, and to identify lessons that could help inform both near-term policy options for the coming months, but also the longer-term recovery from the pandemic.

While there is some early evidence of the impact of COVID-19 on the health sector in Nepal, existing studies are predominantly focused on specific diseases or services, measuring effects including maternal health service utilization, mental health of frontline health workers, and so on. Comprehensive assessments of the impact of COVID-19 on the health system have yet to be published. In collating this report, it should be acknowledged that future trajectories for COVID-19 in Nepal and globally remain uncertain, and circumstances could change significantly in the future. However, there is a critical opportunity to learn from the experiences of the first and second waves, to better inform the design and implementation of disease mitigation strategies over the coming months and in the post-pandemic recovery phase, and to reduce both direct and indirect health impacts linked to COVID-19.

The report is organized thematically. The opening chapter considers the epidemiology of the disease in Nepal. This is followed by a cross-cutting chapter addressing matters relating to governance, coordination, and financing of the response. Subsequent chapters address specific domains under the response including risk communication and community engagement, surveillance, case finding and case management, laboratories and diagnostics, software development and data management, research and development, and the progress of the vaccination programme in Nepal to date. The final chapter brings together key threads from the report and summarises future directions identified across each of the domains.

2. Methodology

2.1. Approach

The COVID-19 response in Nepal has been multi-faceted, encompassing functions ranging from risk communication and community engagement through to preparing the health system for providing diagnostics and treatment services. The scope of this report is therefore broad, incorporating analysis of epidemiological data relating to COVID-19 in Nepal, but also information on preparedness and response strategy and implementation. In addition, because the epidemiology and population-level impacts of COVID-19 in Nepal and elsewhere continue to evolve at pace, there was a need to triangulate data from multiple sources to build up a comprehensive picture of what has occurred. Further details of methods in each category are given in the following sections.

2.2. Data collection and analysis

Document analysis

The data for this report was drawn from a wide-ranging desk review that included peer reviewed journal publications, grey literature sources (including official reports; strategy and implementation documents; and documents produced by MoHP and different divisions and centers under MoHP and the Department of Health Services [DoHS], donors and other partner organisations, especially situation updates produced by the MoHP and the WHO), daily analyzed time series data, the IMU and HMIS data in DHIS2 platform, media monitoring reports produced by WHO Nepal and Health Emergencies Programme and websites of key international organisations, principally the WHO, UNICEF, the World Food Program, and leading donor organizations such as USAID, the FCDO and GIZ. Ministry also received information from partner organization relating to their support in COVID-19 response in written form during preparation of this report. Relevant data from these sources were identified using the themes around which the report is structured (i.e., the chapter headings) and narratively synthesized.

Analysis of epidemiological data

Population-level epidemiological data for Nepal were obtained from the IMU and DHIS 2 system, and included aggregated data on caseload, testing results (both PCR and antigen testing), mortality, and vaccination uptake figures nationally, by province, by sex, and by age group. Publicly available sources for epidemiological data were also consulted, including the situation reports produced by MoHP, WHO's global COVID-19 dashboard, situation updates released by the WHO South East Asian Regional Office (SEARO), and situation update reports for Nepal issued by the WHO country office. Given the longitudinal focus of this report, trends for key indicators are included in most instances. In some sections, however, rates are given instead; where present, these were calculated using projected population denominators from the 2011 Census in Nepal [48].

Analysis of meeting /discussion records

Information on decisions and actions taken in response to COVID-19 was extracted from meeting minutes of the CCMC Directive Committee and COVID-19 Prevention and Control High Level Coordination Committee, and publicly released notices from MoHP through website and social media pages. Similarly, information from video records of the First National Health Summit held on 25 September 2021, and organized by the Nepal Medical Association, was extracted. Audio/video records of virtual meetings and meeting notes with policymakers (involved in the Technical Working Group for this report) and health workers were also analysed, particularly for the content quoted verbatim (in text boxes) throughout the report. These quotes have also been integrated into the text of the report without attribution to specific individuals. However, to preserve the confidentiality, names and positions of individuals have not been quoted in the report.

3. Epidemiology of COVID-19 in Nepal

Summary

- Nepal witnessed the first case of COVID-19 on 23 January 2020 in a 32-year-old male coming from Wuhan, China. The second case was seen almost a month later on 23 March 2020, and was followed by a nationwide lockdown on 24 March 2020. Two months after the first imported case, the first case of local transmission was seen in a 34-year-old female. This shows that Nepal was largely able to control the spread and buy time during first few months of the pandemic.

- As of 31 December 2021, a total of 922,842 (cumulative) cases had been reported with 11,594 deaths. The number of cases, deaths differed notably across seven provinces and different age groups.

- Epidemiological data show a substantially larger second wave in 2021 by comparison with the initial wave in 2020. This second wave was also more geographically dispersed. High positivity rates at the peak of each wave also suggest substantial under-reporting of both cases and deaths through routine systems. Highest test positivity rate stood at 34.8% during the first wave and 51.8% during the second wave.

- Genomic studies indicate that the dominant SARS-CoV-2 strain in Nepal from the middle of 2021 was the delta variant.

- Reported case fatality rates (CFRs) in Nepal were higher for the second wave than the first wave but in either case fell well below those reported in other countries. At the peak of second wave, the CFR stood at 1.6% in the second wave while it was 1.09% in the first wave. Care should be taken while interpreting these findings as it is likely that the number of deaths were under-reported.

- There have been important variations in the distribution of disease and mortality by population and by geography. As seen elsewhere, the majority of cases and deaths in Nepal occurred in men, and especially among older men. Some 26% of deaths reported as of 31 December 2021 have occurred in those with at least one co-morbid condition. In both the first and second waves, Kathmandu valley was the most affected area.

Chapter 1 provided an overview of the epidemiology of COVID-19 on a global and regional basis. The focus of this chapter is on taking a deeper look at the epidemiology of the infection within Nepal, and the ways in which observed patterns and trends have changed over time and by population. As of 31 December 2021, the cumulative number of RT-PCR positive cases had reached 828,431 with an additional 96,202 cases testing positive on antigen tests. As of 31 December 2021, the recovery rate stood at 98% with CFR of 1.26%.

3.1.   SARS-CoV-2 and its variants

In Chapter 1 we outlined the essential features of SARS-CoV-2, the causative pathogen for COVID-19, and set out some of the main clinical manifestations of disease. While general clinical manifestations of infection have remained broadly stable over the course of the epidemic, transmission behaviour has changed over time linked to behaviour change, the imposition of prevention measures, but also because of the emergence of new variants. Table 1 below outlines current variants of concern (VOCs) as defined by the WHO, as of late November 2021. Genomic studies in Nepal have shown that, as in many other parts of the world, the delta variant had become the dominant VOC by the middle of 2021, outcompeting the alpha and kappa variants more commonly seen in the early stages of the pandemic. [49] In the late November 2021 another VOC Omicron was seen in different parts of the world which is spreading rapidly across countries while this report is being prepared (January 2022).[50]

Table 1: VOCs identified by the WHO, as of 31 December 2021

WHO label	Pango lineage	Earliest documented samples	Date of designation
Alpha	B.1.1.7	United Kingdom, Sep-2020	18-Dec-2020
Beta	B.1.351	South Africa, May-2020	18-Dec-2020
Gamma	P.1	Brazil, Nov-2020	11-Jan-2021
Delta	B.1.617.2	India, Oct-2020	VOI: 4-Apr-2021, VOC: 11-May-2021
Omicron	B.1.1.529	Multiple countries, Nov-2021	VUM: 24-Nov-2021, VOC: 26-Nov-2021

Source: WHO

3.2.   Transmission dynamics

Table 2 describes early incident cases of COVID-19 in Nepal following the first reported case in late January 2020. This timeline is consistent with multiple importations during the early stages of the first wave, with the first instance of human-to-human transmission within Nepal not reported until early April. However, within-country transmission dynamics for COVID-19 have varied in important ways over time which can be linked to relaxation of restrictive measures, and the extent of cross-border movement into and out of India.

Modelling work after the first wave, for example, has shown substantial variations in the effective reproduction number for the virus by province, linked partly to the extent of cross-border movement but also to within-population contact patterns[51]. These findings are also in concordance with the other study published in April 2021 indicating a large increase in the reproduction number linked to the relaxation of measures including quarantining and border controls[52]. The reproduction number that remained around 0.21 during the controlled phase increased to 1.8 during the outgrown phase, which authors have linked to alteration of border screening and quarantine, lockdown, and detection and isolation strategies[52].

However, these theoretical studies are based on modelling assumptions, particularly on the nature and type of contacts between citizens that are drawn from the international literature rather than from Nepal specifically. It is therefore difficult to determine the extent to which they effectively represent drivers of transmission within Nepal,[53]and the extent to which drivers of community transmission were effectively captured.

Table 2: Early epidemiology of COVID-19 until the first local transmission was reported

Case	Date	Age	Sex	Transmission
1st case	23 January	32 years	Male	Imported, Wuhan China
2nd case*	23 March	19 years	Female	Imported, France
3rd case	25 March	32 years	Male	Imported, UAE
4th case	26 March	34 years	Male	Imported, UAE
5th case	28 March	19 years	Female	Imported, Belgium
6th case	2 April	65 years	Female	Imported, Belgium
7th case	4 April	21 Years	Male	Imported, India
8th case	4 April	42 years	Male	Imported, India
9th case	**4 April**	**34 years**	**Female**	**Local transmission**

*Second case on 23 March 2020 precipitated lockdown on 24 March 2020

3.3. Disease epidemiology

This section provides an overview of disease epidemiology. **Error! Reference source not found.** presents a summary of key statistics describing the epidemiology of COVID-19 in Nepal over the duration of waves 1 and 2. The highest PCR positivity rate (among test performed within last 24 hours) was 34.8% during the first wave and 51.8% during the second wave while the cumulative PCR positivity rate stood at 12.42% and 20.9%.

Table 3: Summary epidemiological indicators across first and second wave

Indicators	First wave		Second wave	
	2021 January 23 – 2021 March 14		**2021 March 15 onwards**	
Total RT-PCR tests	22,15,411	Till March 14	2,643,944	31 December
Total RT-PCR positive cases	2,75,178	Till March 14	553,253	31 December
RT-PCR Positivity rate (Cumulative) (%)	12.42	Till March 14	20.9	31 December
Highest number of RT-PCR tests/Day	20,118	October 21	22,353	May 22
Highest number of RT-PCR positive cases/Day	5,743	October 22	9,317	May 11
Lowest number of RT-PCR positive cases/Day	53	March 14	79	March 15
Highest positivity rate (%)/Day	34.8	October 26	51.8	May 10
Weekly highest RT-PCR positive cases	25,929	3rd week of October	61,814	2nd week, May

Highest number of active cases/Day	38,461	November 12	110,263	May 16
Total deaths	3,014	Till March 14	8580	31 December
Highest number of deaths/Day	45	November 10	246	May 19
Case fatality rate (%)	1.09	Till March 14	1.6	31 December
Highest number of districts reporting new cases/Day	71	November 15	75	May 4

Higher CFR during the second wave (1.6% compared to 1.09% in the first wave) have also been demonstrated from the statistical modeling work using MoHP data although the rates differ notably[54]. These figures are notably lower than reported CFRs[i] worldwide. Important insights can also be drawn from the source of mortality data. For example, cumulative mortality data to 31 December 2021 show that some 93.8% of deaths occurred in a hospital while just 6% of deaths appear to have occurred in community settings.

The summary picture presented in Table 3 masks important variations in epidemiological trends and patterns over the course of the pandemic, which the sections below address in more detail.

Variations over time

Epidemiological trend data show two large case waves, 23 January 2020-14 March 2021 and the second from 15 March 2021 onwards. In the first wave, the highest number of active cases was noted on 12 November 2020 while in the second wave it was on 11 May 2021. After a decline in the number of cases from the peak in May 2021, a small peak was noted in first week of August 2021, followed by a steady decline in the number of cases thereafter (Figure 2).

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[i] Care should be taken while interpreting these data as there are differences on how the CFR is calculated. For example, while in some studies, total cases have been used as denominator, other studies have used total cases with 14 days' time lag as denominator. Theoretically, CFR is to be calculated using number of closed cases as denominator. Similarly, as a number of deaths occurring in community setting may not have been reported completely, CFR could be underestimated to some extent.

Figure 2: Trend of positive cases (daily positive, 3-day average, and 7-day average
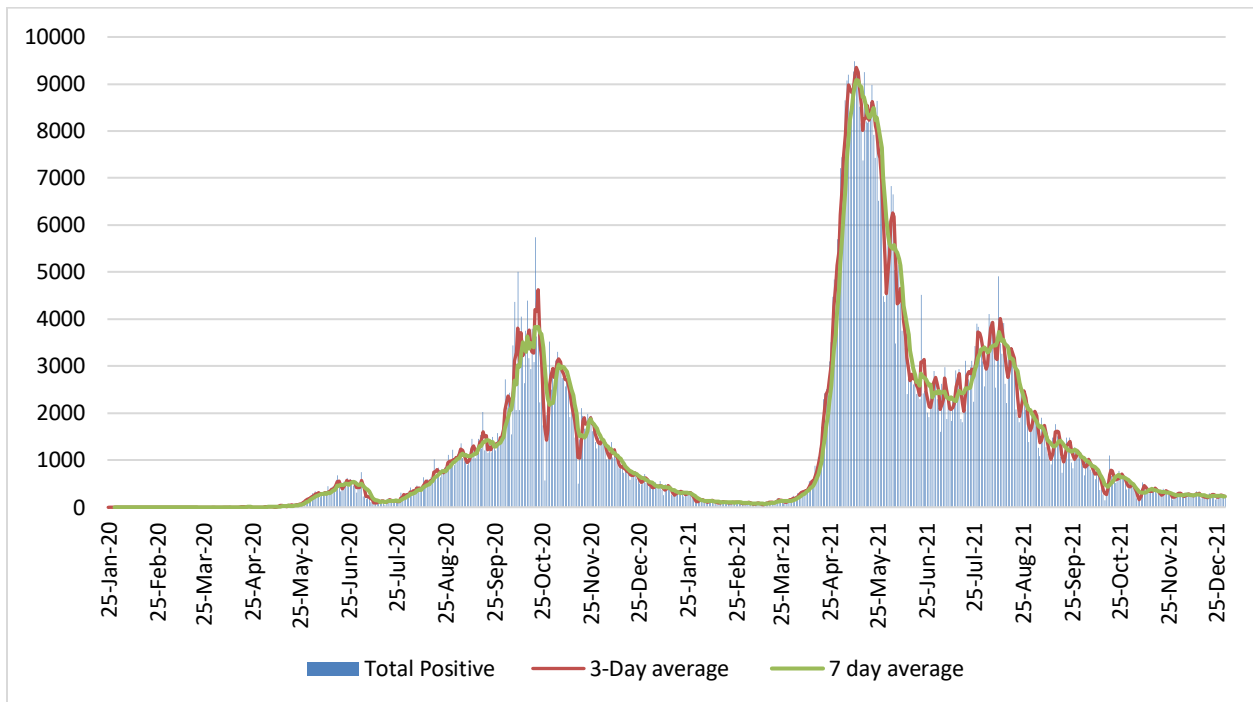
Positivity rates during the peaks were very high indicating the linkage of documented magnitude of these cases with testing capacity or test strategy in the country. The test positivity rate peaked in the period when the number of cases was also approaching a peak. The number of positive antigen tests increased sharply in the third week of May 2021, displaying a fluctuating trend thereafter which resembles the epidemiological curve of disease. While the antigen test increased sharply, the number of RT-PCR tests seems to have decreased in similar fashion indicating that, rather than expanding the testing capacity, antigen test may have replaced the conditions where RT-PCR tests were performed (Figure 3).

Figure 3: Daily number of tests and test positivity rates
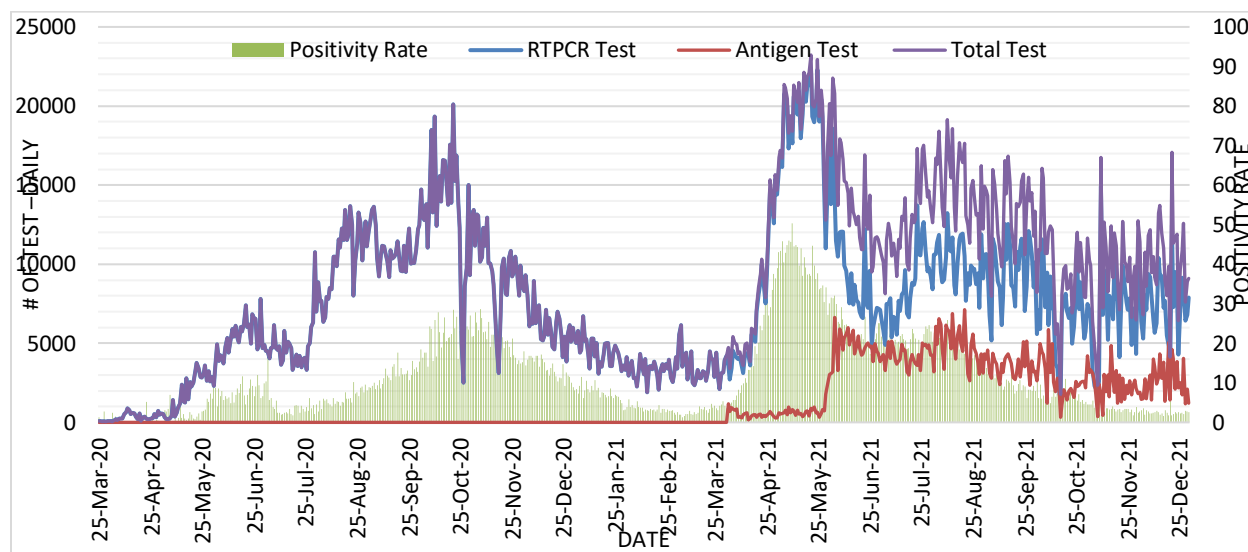
Although the number of cases can be seen in two distinct waves, deaths were largely concentrated in the second COVID-19 wave when health facilities became overwhelmed by the volume of acutely unwell patients. The exceptional peak in the reported number of deaths on 24 February 2021 (see **Error! Reference source not found.**), is an artefact: on this day a large number of additional COVID-19 deaths that had occurred over the preceding year. A second similar spike in the number of deaths, on 3 March 2021, was also due to the addition of deaths that had previously been missed, from the running total. These additional deaths were those occurring in the community not reported through the regular reporting system. The number increased substantially on these dates as Nepal Army which was engaged in dead body management (including the deaths occurring in community) reported to MoHP. The actual number of deaths in the preceding 24 hours on both 24 February and 3 March 2021 was 1. The number of daily deaths peaked on 19 May 2021, with the total of 246 on that day.

Figure 4: COVID-19 deaths daily or 7-day rolling average basis
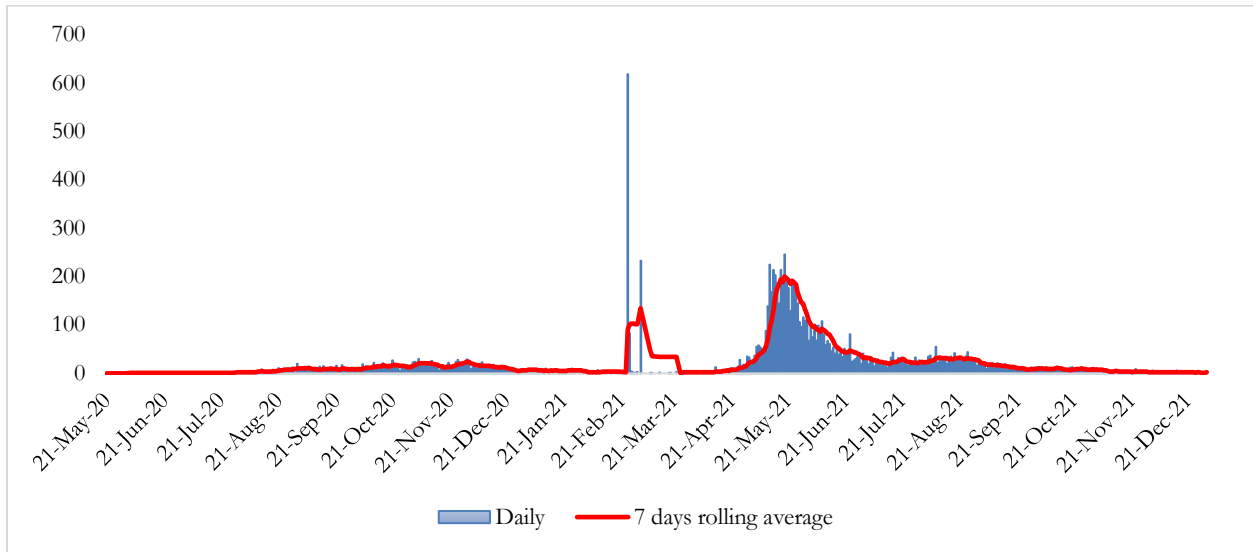
Variations by population group

Globally, there have been marked variations in caseload and particularly incidence of severe disease and death by population. The worst outcomes have been reported more commonly in those of older age and those with clinical comorbidities.

There is a clear variation in both case numbers and deaths by gender (see **Error! Reference source not found.** and **Error! Reference source not found.**), with higher case numbers and deaths reported in men compared to women across all age groups over the duration of the pandemic (the pattern for mortality among children by gender is more equivocal but numbers here are too small to draw clear conclusions).

Figure 5: Pyramid chart showing the distribution of confirmed COVID-19 cases since the beginning of the pandemic in Nepal, by 10-year age band
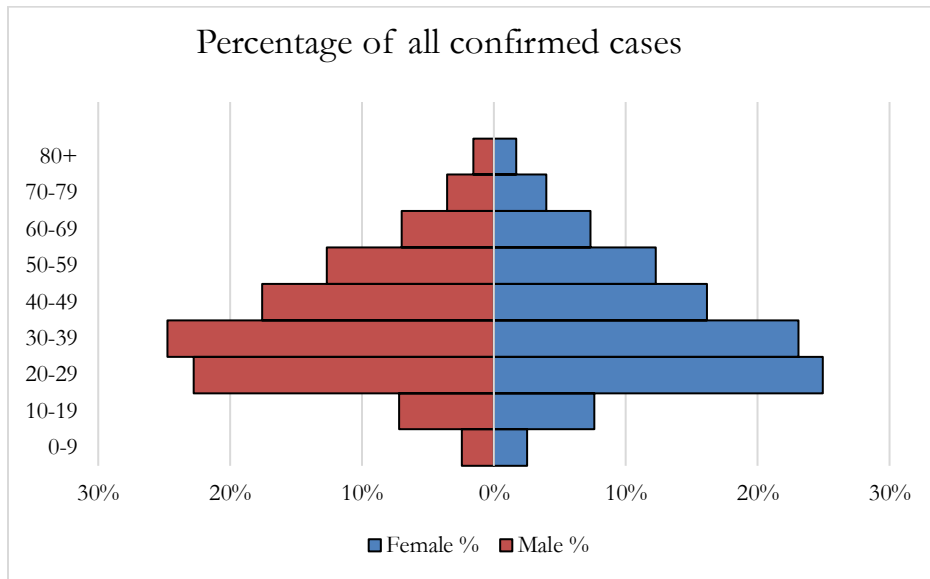
Note: Age is missing for 1673 females and 2890 males

Figure 6: Pyramid chart showing the distribution of registered deaths from COVID-19 in Nepal since the beginning of the pandemic, by 10-year age band
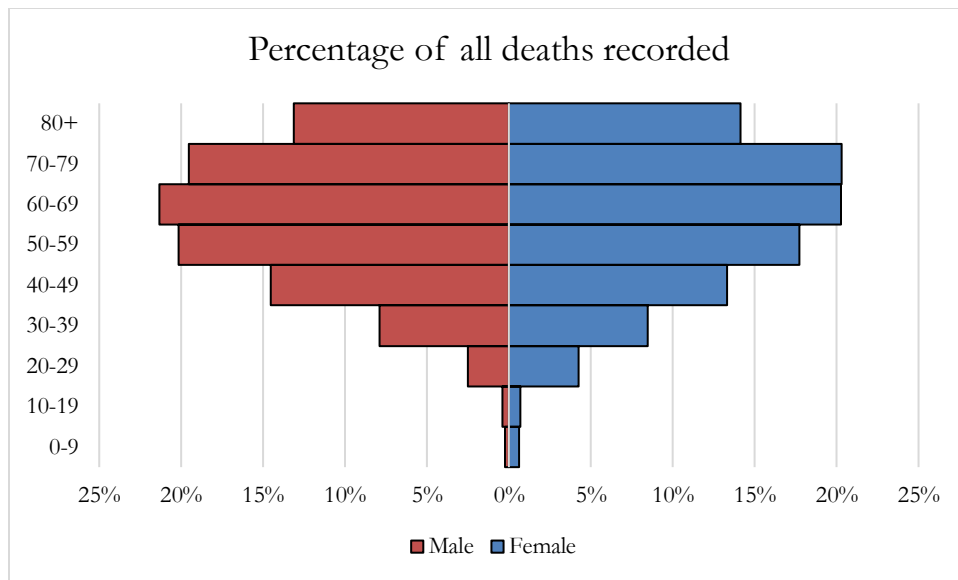
Note: Age is missing for 8 females and 20 males

There are also good data to suggest that increased vulnerability to severe disease and death among those with clinical comorbidities, noted in global observations, have also emerged in Nepal. Of all COVID-19-related deaths reported in Nepal to 31 December 2021, for example, 25.47% presented with at least one co-morbid condition. The most commonly reported co-morbid conditions were

circulatory diseases, metabolic and endocrine diseases (including type 2 diabetes), and respiratory diseases (refer to Appendix 2, Table 3b).

Variations by geography

Among the provinces, the first case was reported in Bagmati Province on 23 January 2020 followed by Sudurpaschim Province on 27 March 2020 and Gandaki Province on 28 March 2020. Bagmati Province accounts nearly half of the total cases and deaths as of 31 December 2021. The Karnali Province has reported the lowest number of cases (cumulative cases = 26,368) and deaths (cumulative deaths = 480) as of 31 December 2021 (See Figure 7).

Figure 7: Variation on population, test performed, number of cases and deaths by provinces

Karnali Province
Total population: 1694889
First case: 19 May 2020
First death 31 May 2020
Total tests: 128362
Total cases: 26368
Total deaths: 480

Gandaki Province
Total population: 2479745
First case: 28 March 2020
First death 8 June 2020
Total tests: 292911
Total cases: 100927
Total deaths: 1370

Bagmati Province
Total population: 6084042
First case: 23 January 2020
First death 16 May 2020
Total tests: 3109563
Total cases: 448600
Total deaths: 4929

Province 1
Total population: 4972021
First case: 17 April 2020
First death 30 July 2020
Total tests: 531240
Total cases: 139646
Total deaths: 1666

Sudurpaschim Province
Total Population: 2711270
First case: 27 March 2020
First death: 31 May 2020
Total tests: 195227
Total cases: 42967
Total deaths: 500

Lumbini Province
Total population: 5124225
First case: 1 May 2020
First death 17 May 2020
Total tests: 425625
Total cases: 116316
Total deaths: 1830

Madhesh Province
Total population: 6126288
First case: 12 April 2020
First death 25 May 2020
Total tests: 186427
Total cases: 48096

A deeper look into the data reveals that the higher attribution of Bagmati Province in total cases and deaths is due to the higher rates in Kathmandu valley. In first wave, reported caseloads in Kathmandu Valley tracked the trajectory of the national wave fairly closely. This was also true in the early peak in second wave, after which the cases seemed slightly scattered in different provinces, with Kathmandu valley accounting major share in the number of cases. See Figure 8.

Figure 8: Trend of COVID-19 cases in Kathmandu valley and outside valley
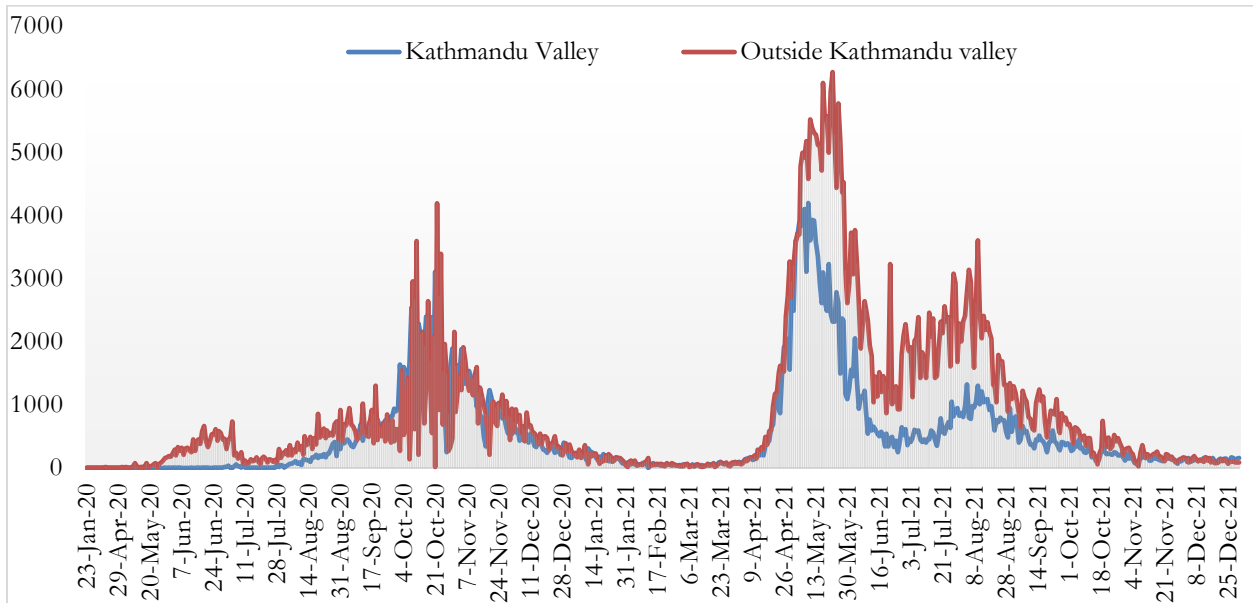
Figure 8 and 9 reveals the COVID-19 cases and deaths inside and outside Kathmandu valley. In both the waves, Kathmandu valley reported the greatest number of COVID-19 cases and deaths due to COVID-19 than other places of Nepal.

Figure 9: COVID-19 deaths in Kathmandu valley and outside valley
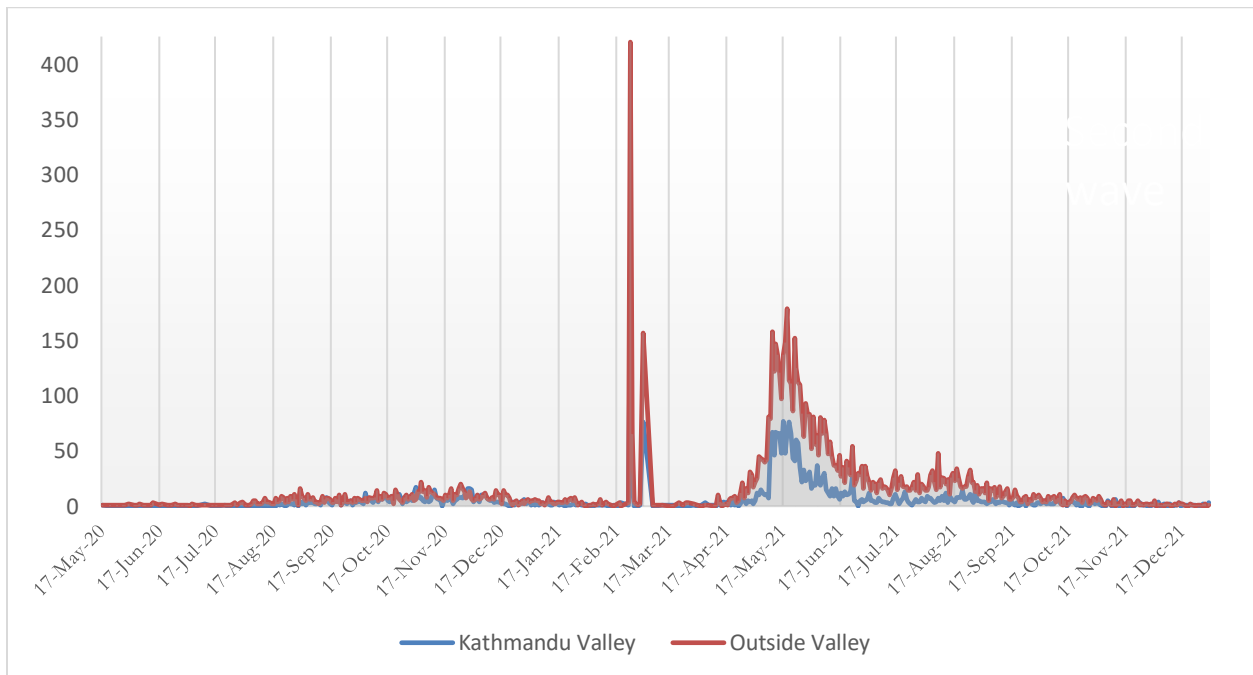
Disaggregated by sex, the number of cases show almost similar pattern in all seven provinces, as seen in Figure 10. All seven provinces have reported higher number of cases among males compared to females.

Figure 10: Cumulative number of COVID-19 cases by province and disaggregated by sex
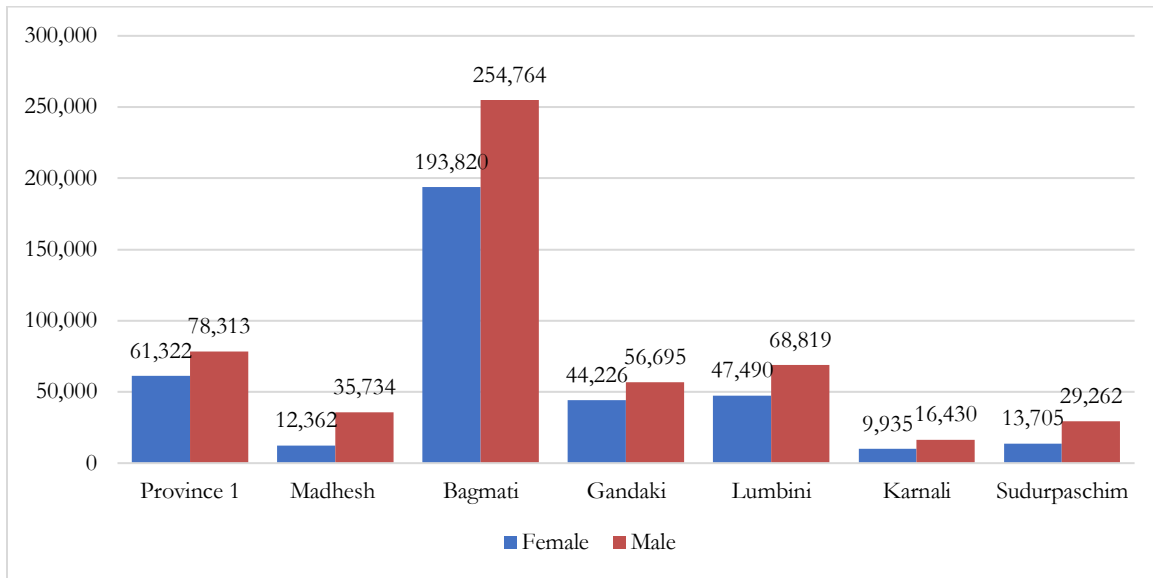
Similar to the number of cases, all seven provinces reported notably higher deaths among male compared to that of females within the province (see Figure 11). Bagmati Province had higher number of deaths in both the sexes.

Figure 11: Cumulative number of deaths by province and sex (as of 31 December 2021)
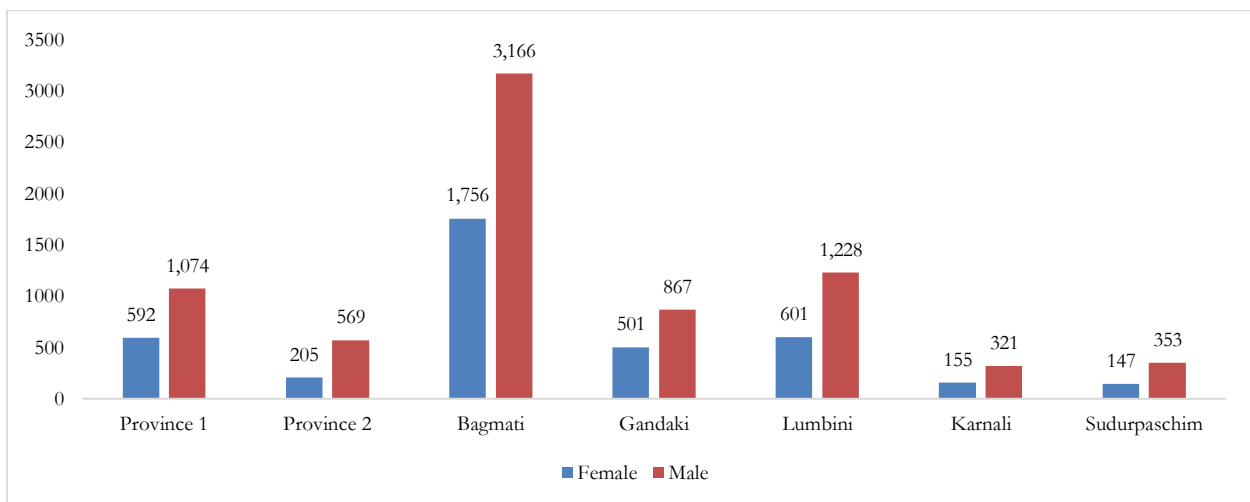
Note: 14 death cases are Indian/American and 31 cases are not mentioned the district/province name and Sex is missing for 14 cases

As of 31 December 2021, total cumulative number of COVID-19 positive cases reported was 922,942 with a total of 11,594 and CFR of 1.26 %. The highest number of cases were seen in the age group

25-29 years while the highest deaths occurred in the 60-64 years age group (see Table 4). Data also show large variations in the age-specific CFR for COVID-19, from a low of 0.05% in those aged 10-14 years, up to a maximum of 12.06% in those aged 85 and over. This trend in increasing mortality from COVID-19 with age mirrors patterns seen globally.

Table 4: Age-specific case fatality rate due to COVID-19

Age group	RTPCR+Antigen Positive cases	Deaths	Age, specific case fatality rate (%)
0-4	8,713	37	0.42
5-9	13,921	9	0.06
10-14	22,651	11	0.05
15-19	45,263	47	0.10
20-24	96,112	130	0.14
25-29	122,347	230	0.19
30-34	119,494	395	0.33
35-39	102,726	546	0.53
40-44	86,903	760	0.87
45-49	69,911	876	1.25
50-54	66,504	1,103	1.66
55-59	48,897	1,136	2.32
60-64	38,847	1,276	3.28
65-69	26,908	1,155	4.29
70-74	20,514	1,280	6.24
75-79	13,801	1,016	7.36
80-84	8,484	792	9.34
85+	6,368	768	12.06
NA	4,578	27	0.59
Total	922,942	11594	1.26

Figure 12 illustrates the place of COVID-19 deaths during first and second waves. During both the waves, more deaths occurred in private hospitals followed by federal hospitals. Few COVID-19 patients died in home isolation.

Figure 12: Place of deaths due to COVID-19
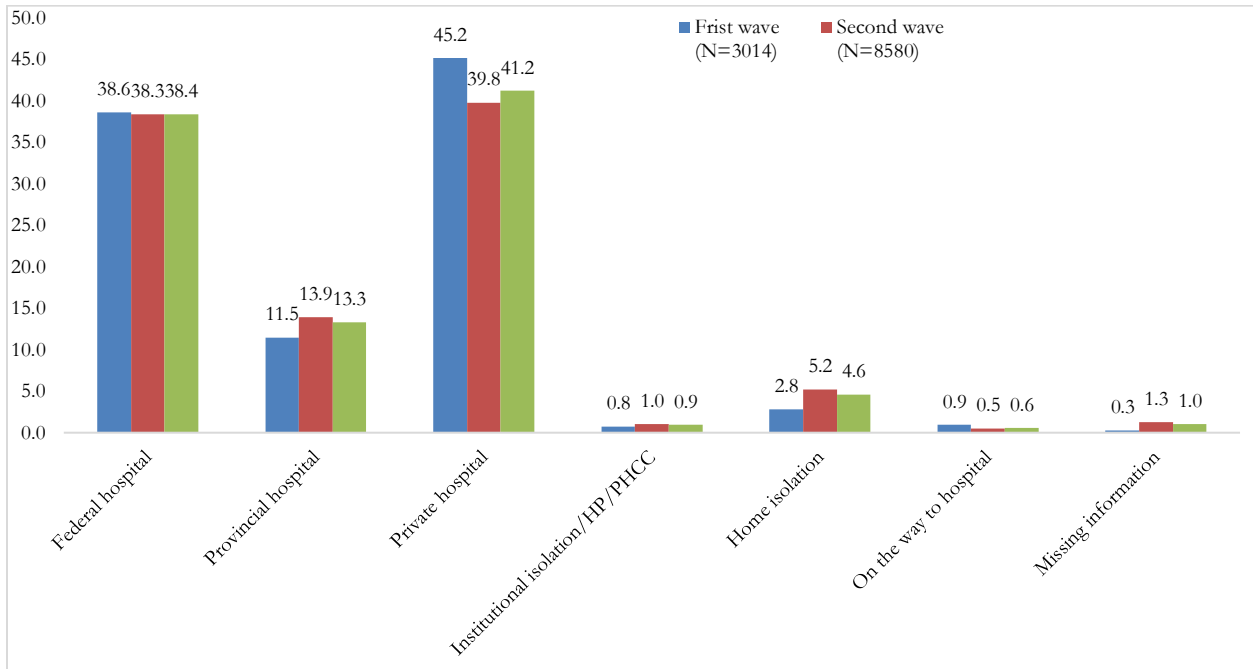
Map in Figure 13 displays the COVID-19 cases per 1000 population in all 77 districts. Three districts in Kathmandu valley (Kathmandu, Bhaktapur and Lalitpur) in Bagmati province and Kaski district of Gandaki province reported the highest cases per 1000 population. Similarly, compared to other provinces, most of the districts in Bagmati province and Gandaki province have reported higher proportion of COVID-19 cases compared to their population.

Figure 13: Spatial distribution of COVID-19 cases as of 31 December 2021
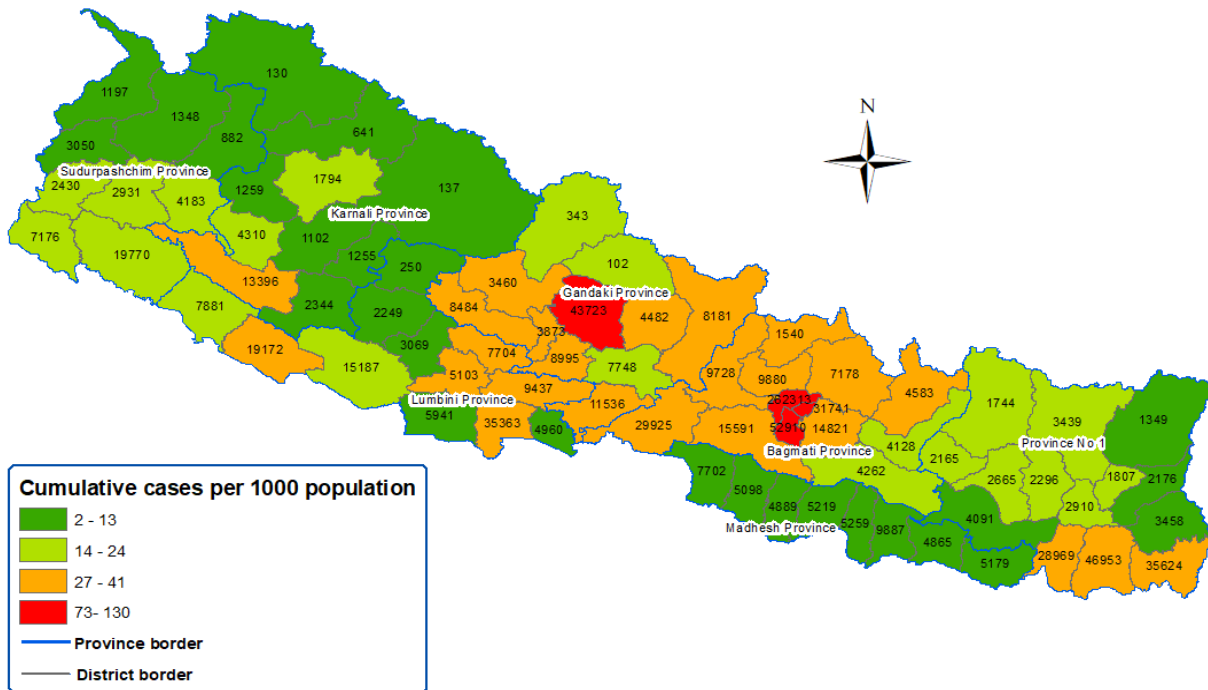
Note: The color codes in legend represent the case per 1000 population whereas the number inside district boundry in map represent the total cases as of 31 December 2021

The Kathmandu district of Bagmati province, which has the highest number of COVID-19 cases also reported the highest number of deaths in the country. Similarly, Bhaktapur, Lalitpur and Chitwan district of Bagmati Province, Kaski district of Gandaki Province, Rupandehi district of Lumbini Province and Jhapa, Morang and Sunsari district of Province 1 that have reported a higher number of cases and also had a higher number of deaths (See Figure 14).

Cumulative number of COVID-19 cases
- 102 - 5939
- 5941 - 197769
- 19770 - 52909
- 52910 - 262313

Dot density
- 1 Dot = 10
- Deaths
- Province border
- District border
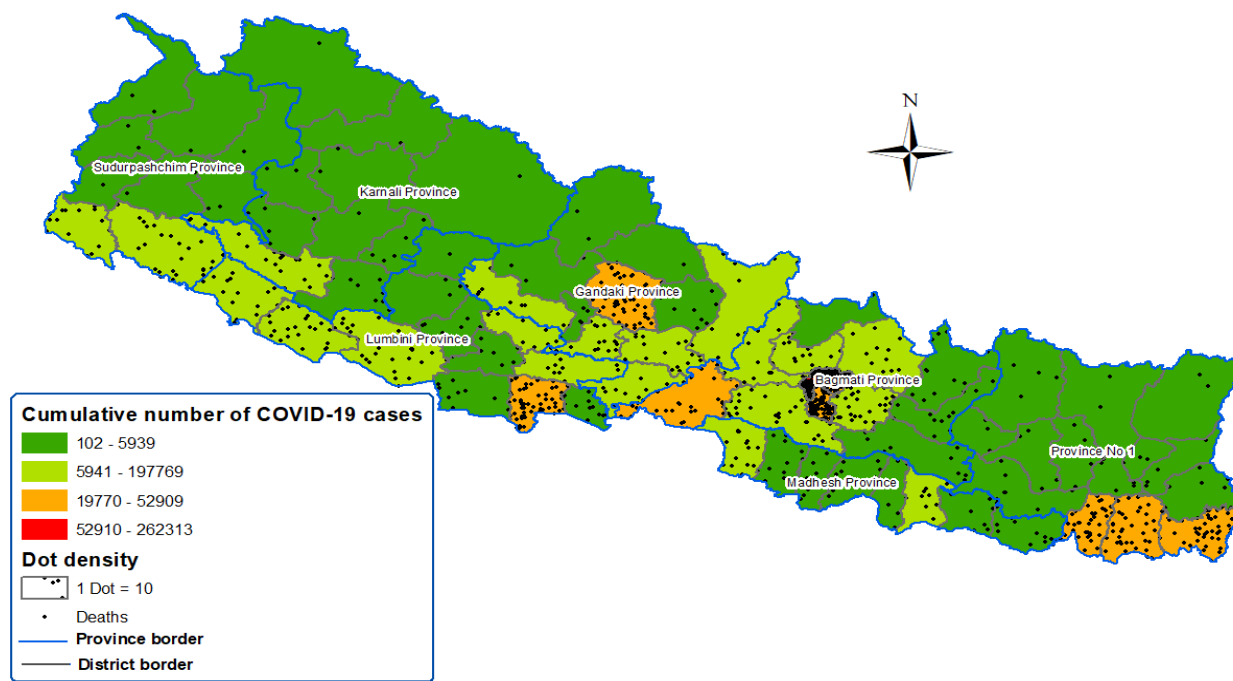
Note: The color codes in legend represent the case per 1000 population whereas the number inside district boundry in map represent the total cases as of 31 December 2021

Despite having similar patterns of COVID-19 cases and deaths among districts, some differences were seen in CFR among provinces. For example, the CFR varied by province ranging from 1.2% in Bagmati and Sudurpaschim to well over 2% in Karnali Province. These differences could be partly because of the differences in access to clinical care (of all levels) by province, principally the wider availability of higher quality care in Kathmandu and its surrounding areas. We will discuss briefly about how laboratory and diagnostic capacity and the capacity to provide curative services (taking ICU and ventilator capacity as proxy) evolved during the course of pandemic in Chapters 8 and 11, respectively.

3.4. Lessons and future directions

Currently, the COVID-19 deaths that occur at community level are required to be reported to the administration. However, some of the deaths occurring at community level may have been missed. An area for improvement could be to use the home isolation feature of IMU to capture community death and use IMU software as mandatory to capture overall CoVID-19 related data. The use of IMU could also ensure the timely availability of data through the one-door policy and strengthen mortality surveillance enabling it to capture the deaths occurring in the community.

The basic epidemiological data on COVID-19 are captured through routine information systems and are also shared through the data visualization dashboard mostly in the form of crude numbers. However, having a denominator permits calculation of rates which could facilitate comparison across different segment of population and geography.

4. Coordination, planning, financing, and monitoring

Summary

- The GoN was able to align partners' support in priority areas of the COVID-19 response by identifying priority areas early and seeking support from partners in the prioritized areas. Furthermore, weekly cluster meetings provided an opportunity to update partners about the epidemiological situation and emerging priorities for disease containment. Partners provided direct financial support, logistic support, and technical support throughout the pandemic period in areas identified by GoN.

- Multiple structures in addition to HEOC were created by the government to accelerate the response to COVID-19. These included the High-Level Coordination Committee for the Prevention and Control of COVID-19 (HLCC) and the COVID-19 Crisis Management Center (CCMC) which played an active role in different phases of the pandemic control. While HEOC was an entity under Health Emergency and Disaster Management Unit (HEDMU) of the MoHP, HLCC and CCMC were new structures created to facilitate inter-ministerial responses to COVID-19. Nepal Disaster Risk Reduction and Management Authority (NDRRMA) in different tiers of government also operated and managed activities related to COVID-19 management effectively. The overlapping responsibilities of these structures often resulted in confusion.

- Situational awareness: as in many other countries worldwide, Nepal struggled to project the future scenario and prepare the health system accordingly for the COVID-19 response. The number of cases and cases requiring hospital services often exceeded the scenario planning by the MoHP and the health system was overstretched particularly during the peak of the second wave.

- While the COVID-19 pandemic hit hard the health systems in countries across the world, Nepal was additionally impacted by the recent transition to a federal structure. Responsibilities were divided among three tiers of government. With relatively new structures in place, Federal, Provincial, and Local governments faced some problems in coordination particularly in areas like financing, mobilization of human resources, patient referral, distribution of supplies, data management regarding data capture and reporting in multiple sources (IMU and others), reporting of data, and monitoring of service delivery.

- Owing to urgency in decision making, policy makers and programme implementers at sub-national level could not be engaged to the level they were engaged before the pandemic period. Guidelines and other policy documents were prepared at an unprecedented pace and were released through the official website of MoHP and social media. As the policy documents and rationale behind each of the decisions could not be explained well to implementers, there was confusion relating to implementation of decisions. Federal MoHP tried to overcome these challenges through weekly meetings with provincial Ministries of Social Development (MoSD) and Provincial Health Directorates (PHD) particularly after the first wave.

This chapter considers systems for coordination, planning, financing, and monitoring of the COVID-19 response in Nepal and tracks how these have changed over the course of the pandemic.

4.1. Preparedness prior to the pandemic

The central body in emergency preparedness and response prior to the pandemic was the HEOC, an entity under Health Emergency and Disaster Management Unit (HEDMU) of MoHP. The HEOC was designed along disaster risk management principles and was set up in 2014 to support health sector preparedness for humanitarian events. A series of activities had been undertaken to strengthen systems linked to the HEOC and readiness to respond including through pre-positioning of essential supplies in health facilities.[55] However, as the COVID-19 required whole system approach, new structures like HLCC and CCMC were formed.

4.2. Structure for COVID-19 response

In the early stage of the pandemic, as the epidemiology of the disease itself was evolving and the transmission dynamics largely unknown. Nepal did not have experience of handling outbreaks of this scale before, and a decision was made to establish wholly new structures for oversight of the pandemic response. The HEOC played an active role in coordinating the COVID-19 response among line ministries and other stakeholders in the early stages of the pandemic. The National Emergency Operations Centre (NEOC) under the Ministry of Home Affairs (MoHA) is a coordination and communication point for disaster information across Nepal, including government agencies and other response and recovery stakeholders, which was another important body in the COVID-19 response.

Following the high level multi-sectoral coordination meeting led by Minister of Health and Population on 30 January 2020 and considering the suggestions received in the meeting, the MoHP formed a High Level Monitoring Committee under the chairpersonship of the Minister of MoHP, a Steering Committee under the chairpersonship of Secretary and a Health Technical Committee under the chairpersonship of Chief, Quality, Assurance and Regulation Division, MoHP.[47, 56]

There was a need for a whole system approach in the COVID-19 response, bringing together multiple ministries and developing a shared understanding of the pandemic to address the interconnectedness of interventions to contain the disease. So, the HLCC led by the Deputy Prime Minister and the Minister for Defense was formed at federal level on 1 March 2020. The committee had a very generic responsibility of coordinating the government response and suggesting precaution measures to check the possible threat of COVID-19. At some instances, government also faced criticism that different ministries were acting on their own volition which was gradually improved in later stages. .[57]

On 29 March 2020, the meeting of the Council of Ministers of the GoN took the decision to form the CCMC at federal, provincial, and local levels to make the COVID-19 response more effective. The Deputy Prime Minister, the Minister of Defense, and five Ministers from the Federal Council of Ministers were all represented in the CCMC, which steered the overall response to pandemic. Apart from prevention, control, and treatment of COVID-19, the CCMC also was responsible for the

monitoring of medical equipment, health materials including other essential items, services, and peace and security.[58] From the same meeting, the decision was taken for the formation of a Direction Committee led by the Deputy Prime Minister and Defense Minister, with membership of the Minister of Foreign Affairs, Minister of Federal Affairs and General Administration (MoFAGA), MoHP, Minister of Commerce and Supplies, and the Minister of Finance. A Facilitation Committee to support the CCMC in fulfilling its responsibilities was formed under the leadership of the Chief Secretary. The facilitation committee included the Secretary of the Federal Ministry of Home Affairs (MoHA) and the Chiefs of four security forces (the Army, Police, Armed Police Force, and National Investigation Department). Facilitation committee was further supported by four different operations set up under the committee: health services and treatment (Medical Ops), supply of medicine and equipment (Logistic Ops), maintain law and order (Security Ops), and information and technology support (Media & IT Ops).[58] From June 2020, the CCMC eventually took over key HLCC responsibilities and replaced it.[59] Similar structures like federal CCMC were formed at provincial, district and local levels (Figure 15).

Figure 15: COVID-19 management and response structure
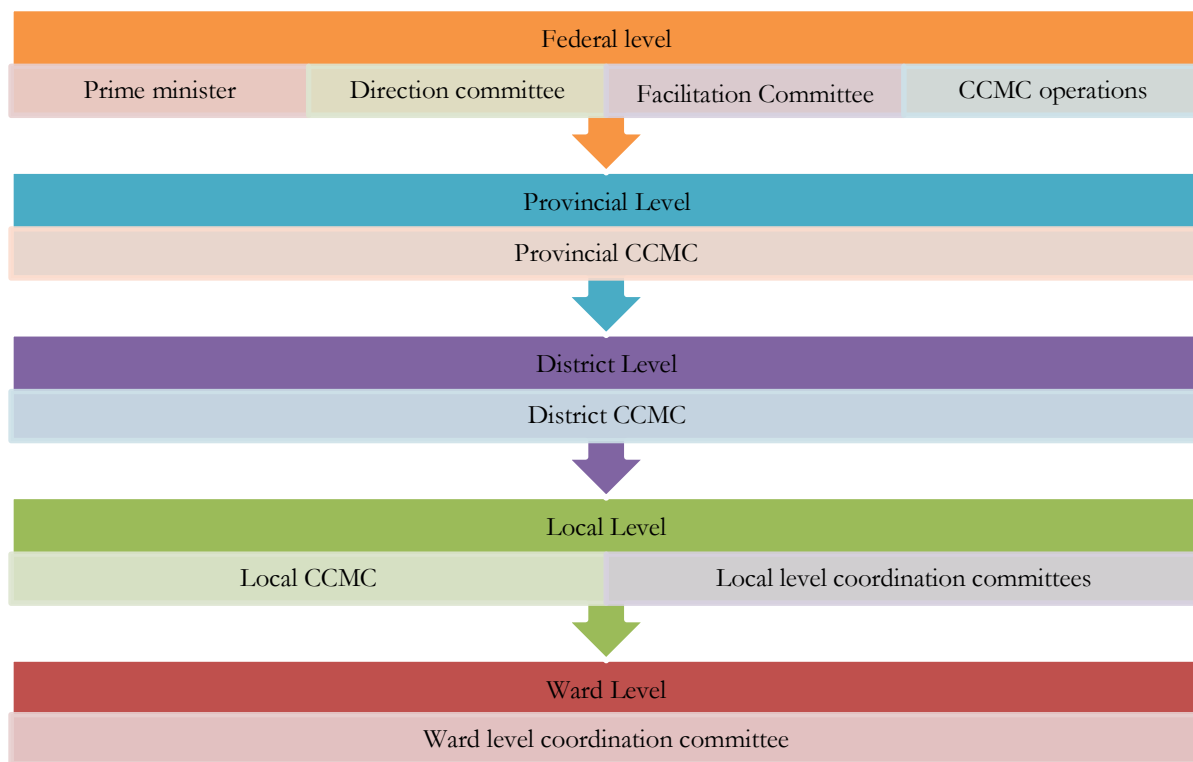
On 1 November 2020, to strengthen different components within the health system and to improve the effectiveness in the COVID-19 response, the MoHP decided to activate Incident Command System (ICS) which was previously formed after the 2015 earthquake to accelerate the response to COVID-19. ICS was assigned the responsibility of making decisions on surveillance, CICT and testing, case management, logistics, information management, and communication.[60] There was also representation from Nepal Health Research Council (NHRC), the apex body for health research in

Nepal in ICS. Although ICS was efficient in decision making backed up with evidence, the overlapping responsibilities with CCMC prevented it from functioning to the optimum level and implementation of the decisions made was often complicated.

A few months after the formation of the new government, a new High-Level Committee chaired by the state minister (MoHP) and co-chaired jointly by the Health Secretary and Chief Specialist, was formed. The committee had eight major functions, including to: (i) make policy decisions related to COVID-19 prevention and control measures, (ii) develop appropriate policy decisions for continuation of essential health services, (iii) coordinate and facilitate with provinces and local level, (iv) make decisions related to human and financial resources and facilitate its implementation, (v) make policy decisions for effective information management, (vi) mobilize technical and financial support from partners, (vii) seek suggestions from subject experts, (viii) organize bi-weekly meetings and (ix) address any problem or issue related with COVID-19 prevention and control, and continuity of essential health services. [61]

Government formed multiple committees and structures with the aim of accelerating COVID-19 response. The multiple structures in absence of clear demarcation of responsibilities created confusion not only among public but also health professionals engaged in COVID-19 response. The National Disaster Risk Reduction and Management Authority (NDRRMA) under the MoHA and HEOC under MoHP were the permanent structures that could have been useful in COVID-19 response. Rather than making separate committees/structures, strengthening these structures could have institutionalized the learning, saved resources, and capacitated them for future response. Had these structures been capacitated in the first wave, the pandemic response would have been better in the second wave of pandemic response. We would have been in much better positions for future pandemic response.

Policy Maker, Federal MoHP

4.3. Coordination with other countries

Video conferencing through Zoom and Skype with South Asian Association for Regional Cooperation (SAARC) nations, China, and other countries provided an opportunity for sharing experiences, and were useful in designing strategies for COVID-19 response at the national level.[62] In the video conference of the World Health Organization - South East Asia Regional Office (WHO-SEARO) on 2 April 2020, health ministers from 11 countries shared their experience of COVID-19 response in their respective countries and shared commitment for mutual support and collaboration between the member states for better and effective containment of the disease.[63]

Photo1: Virtual meeting among SAARC member countries, 21 March 2020
Source: https://diplomatist.com/2020/03/21/covid-19-diplomacy-social-distancing-virtual-closeness-in-saarc/

The Patan Academy of Health Science was appointed to coordinate with technical teams from the organizations recommended by China through the tele-conference, which provided an opportunity to learn from experience and expertise working in multiple organizations in China.[64]

In subsequent days, there were a series of discussions with high level officials and leaders in other countries like China, India, United States of America, and other countries to enhance lesson learning with potential relevance to Nepal.

Coordination at federal level

In the early phase of the pandemic, the HLCC coordinated the inter-ministerial response on COVID-19. From June 2020, after the CCMC took over the principal responsibilities of the HLCC, the Direction Committee, which was assigned the responsibility of providing direction to CCMC helped in strengthening coordination among different ministries involved in the COVID-19 response. The Direction Committee had Deputy PM and Ministry of Defense, Minister of Home Affairs, Minister of Federal Affairs and General Administration, Minister of Health and Population, Minister of Industry, Commerce and Supplies, and the Minister of Finance as members. Apart from these structures, major decisions were also taken by the Council of Ministers of GoN. Despite this, cross-government coordination continued to be a problem. In the third week of August 2020, for example, the Ministry of Education, Science and Technology directed schools to open ensuring compliance to safety protocols, while the MoHP was requesting guardians not to send their children to school. As 12 % of those infected in the recent surge at that time were children compared to 4% in the previous year, there were concerns that schools could be the breeding ground for the disease.[65]

Coordination with provincial and local governments

In the early stages of the pandemic, engagement of provincial and local governments in consultations and decision making was limited partly because of the urgency in the decision-making process. Federal HLCCs and CCMCs also did not have any representation from provincial governments although they were mainly responsible for execution of the decisions from the HLCC and CCMC.[56] In the later stages, there was good coordination between federal and local government and is continuing till date.

The officials of 12th level were sent by the MoHP to facilitate coordination with the provincial level. Discussion meetings are held among MoHP, provincial and local level regarding combating COVID-19 every Tuesday 2:00 pm.

On 15 March 2020, the Deputy PM and Minister of Defense conducted a meeting with the chief ministers and social development ministers of seven provinces regarding preparation, which covered topics like strengthening health check-up at the borders, setting up more border facilities in coordination of both countries, arrangement of isolation and ICU beds, and diagnosis of COVID-19. The federal MoHP also started providing orientation to health officials from the MoSD and PHD on COVID-19 prevention and care, case investigation, and contact tracing.[66] In the following days, there were more frequent meetings where federal ministers and officials discussed with ministers and officials from the MoSD and directors of the PHDs in all seven provinces.

On 16 April 2020, a province-level committee was formed and was mobilized to facilitate coordination between federal, provincial, and local level governments; management of-human resources and testing; and implementation of COVID-19 related activities in the provinces. The committee had a coordinator as team leader mobilized by the federal MoHP, the Director of the PHD as member secretary, a representative from the MoSD as a member and key experts who could be nominated as invitee members in the committee as per need. On 3 July 2020, the MoHP initiated a weekly virtual meeting between central health cluster and provincial health clusters to discuss issues and challenges at the provincial and local levels. Weekly health cluster virtual meetings including the seven provincial teams were held for better planning, coordination, and support to effectively respond to COVID-19 in the country.[15] On an as needed basis, there were also multiple meetings where ministers and officials from federal MoHP discussed with Ministers for MoSD[67, 68]and focal persons of hospitals[69] about COVID-19 containment measures.

The coordination among federal, provincial, and local governments was not so smooth as it should have been during the pandemic which could be possibly because of the relatively new structure. Some of the local governments are less willing to coordinate with other local governments in pandemic response. Although at the time of pandemic, we should coordinate beyond the boundary of any country, some local governments only considered the area under their jurisdiction and confined themselves to work within a limited geography. As the health workers were divided under three tiers of governments (federal, provincial, and local governments) there were challenges in mobilization of health workers too.

Policy maker, federal MoHP

Private sector coordination

At first, the government attempted to provide diagnostic and treatment services to COVID-19 patients through designated government hospitals. Sukraraj Tropical and Infectious Hospital in Kathmandu was the first hospital to be designated for treatment of COVID-19 patients followed by Patan Hospital and Armed Police Force Hospital[57]. Gradually, the government expanded services to other government hospitals[47].

As the number of cases surged beyond the capacity of government hospitals, the government moved to onboard private hospitals in the COVID-19 response. In the early stage of the pandemic, citing

unavailability of personal protective equipment (PPEs), lack of infrastructure, and fear of contacting COVID-19 by health workers, private hospitals were not readily willing to treat COVID-19 patients. Some of the private facilities were completely closed while others performed thermal screening of the patients and referred all suspected cases to government hospital which further increased the patient load in government hospitals[57, 70].

To attract the private sector in providing treatment services to COVID-19 patients, the government decided to reimburse the cost of treatment to private hospitals. The government decided to reimburse private hospital at the rate of Rs 2,000 per asymptomatic patient or patient with mild symptoms staying in an isolation center, Rs 3,500 for treatment of patient with mild symptoms treated in hospital, Rs. 7,000 per patient with moderate symptoms treated in hospital, and Rs 15,000 per patient for treatment of critical case.[67] However, the government had difficulties in settling claims as hospitals submitted multiple claims for the same patient or were claiming for the patients who had already paid for hospital bills. Such claims were later required to be verified from the Chief District Officer (CDO) office.

On 5 August 2020, the government made the provision that all medical colleges should allocate 33% of the total bed capacity for treatment of COVID-19 patients.[71] Similarly, the government mandated that all satellite hospitals (public, private, and others) should manage 20% of beds for treatment of COVID-19 patients, provided that IPC and isolation standards were met.[72]

Private hospitals were turning away patients refusing to provide treatment. After consistent denial for providing treatment to a patient in suspicion of COVID-19 leading to deaths, there were protests in Birgunj including an instance of vandalism in a private hospital.[73] Considering such events, on 20 August 2020, government warned all health institutions, including private hospitals, against refusing for treatment and stated that healthcare providers not complying with the government's order shall be punished according to the law. Similar warnings were issued from provincial governments stating that the hospitals refusing to treat patients during the COVID-19 crisis may result in the cancellation of registration.[74]

In later stages, the private sector increased its role in delivering services to COVID-19 patients. In the second wave of COVID-19, with the engagement of the private in-service delivery, the government was able to provide services to a large number of patients who required hospitalization because of COVID-19.

Attempts were made to prevent duplication of resources in COVID-19 response as multiple international and national NGOs (I/NGOs) were working in parallel in the COVID-19 response. In a discussion with INGOs, the Minister for Health requested INGOs to provide their support primarily by prioritizing PPE, PCR reagent, VTM, and thermal gun supplies which helped to direct the resources from INGOs in priority areas identified by GoN.[75] Later, government also directed INGOs to divert up to 20% of their program budget to tackle COVID-19.[76]

Apart from private hospitals and service providers, the private sectors and business community worked well with provincial governments in generating resources for COVID-19 response, setting up quarantine services, raising awareness, and providing logistical support like PPE suits, masks, VTM and other resources. In most of the cases, they cooperated well in implementation of stringent

restrictive measures like lockdown in early phase of pandemic although they favored more tailored and customized measures rather than completely shutting down the private sector in the later stages of lockdown as they incurred huge losses linked to this.[70]

The Government also moved to sign a Memorandum of Understanding (MoU) for collaborations with hotels and restaurants for providing quarantine service.[57] There were issues in implementation of the hotel quarantine services as the poor and marginalized, many of whom had lost their jobs and were willing to return from the Gulf countries, were struggling to manage airfares and were reluctant or not able to bear the cost of hotel quarantine. On the other hand, private hotels were reluctant to provide this service at the cost approved by government.[57]

Multi-partner coordination

External Development Partners (EDPs) were engaged in the COVID-19 response from an early phase of the pandemic. Formal activation of the health cluster led by the MoHP and co-led by WHO on 9 April 2020 helped to engage partners in a structured manner. The Health Cluster Coordination Meeting held on 9 April 2020 via teleconference was attended by 94 representatives from 41 organizations. Collaboration and partnerships with EDPs enhanced various aspects of the response, including mobilization of additional resources to support the preparedness and response interventions of the government. The resources from the partners were channeled to key asks from MoHP such as testing, risk communication, procurement and supplies, case engagement support and expansion of critical care facilities, one door information sharing, service continuity, integrated approaches, quarantine facilities and interventions for prevention of community transmission. Health cluster meetings were held on a weekly basis virtually to discuss the key priorities of the MoHP and possible support that partners could provide.

Health partners are providing their support to the government for the continuation of COVID-19 response and non-COVID services throughout the country. This support is provided through the MoHP, especially the HEOC, Health Coordination Division (HCD), Policy, Planning & Monitoring Division (PPMD), Epidemiology and Diseases Control Division (EDCD), National Public Health Laboratory (NPHL), National Health Training Centre (NHTC), National Health Education Information Communication Centre (NHEICC), Family Welfare Division (FWD), Management Division (MD), strengthening IMU, Hub hospital networks; MoSD especially with PHD, District Public/Health Offices, and municipalities. [77,78] As of 24 September 2021, there were 189 implementing agencies working in 9 different areas in 77 districts and had 8,000 non-health related activities. On the same date, there were 57 implementing agencies, in 77 districts working in 9 different areas and 2,000 health related activities.[79]

4.4.   Planning

The planning process

HEOC took the lead role in planning in the very early phase of the pandemic. Later, with the emphasis on whole system approach in pandemic response, the HLCC was made responsible for major

decisions related to COVID-19 which was eventually replaced by the CCMC. For most of the period of pandemic response, the CCMC took the lead role. Apart from the CCMC, the Council of the Ministers of GoN was also involved in taking important decisions for containment of COVID-19.

The Ministry engaged health experts within and outside the Ministry from an early stage in the pandemic. Among three tiers of governments, the decision making was largely concentrated at federal level during the first few months of the pandemic. It appears engagement with provincial and local government officials in the planning process was limited. A previous analysis also suggested that the federal government made policy decisions with limited or no coordination with local governments.[70] Representatives from the provincial and local governments also shared that the resources provided were sometimes disconnected from the actual needs of the local governments as the planning process was not able to adequately consider the fiscal and technical capabilities. This was often cited as one of the reasons for inefficiency and ineffectiveness in some of the activities. Although the promptness with which federal government formulated policies and guidelines was appreciated, there were multiple operational issues during execution and implementation of such policies and guidelines.[70] Throughout the pandemic, government struggled to strike the balance in the tradeoff of urgency in decision making and the need for more rigorous consultative decision making engaging provincial and local governments in decision making process.

The Government tried to engage professional organizations like the Nepal Medical Council[80] and other health professionals seeking suggestions regarding actions needed for containment of COVID-19.[81] In an interaction meeting on 15 April 2020, public health experts stressed the need for increasing the scope of testing, effectively executing contact tracing, and strictly adhering to lockdown measures. In addition, there were discussions on developing short-term (emergency), mid-term and long-term strategies.[82] In May 2020, the GoN formulated the Health Sector Emergency Response Plan for COVID-19 pandemic that served as a guiding document for COVID-19 response. By that time the country had 26,930 hospital beds, 1,595 ICU beds and 840 ventilators in 194 hospitals (public and private). The plan highlighted the strategies to be adopted during four possible scenarios of the pandemic (level I to level IV)[ii] with more stringent measures to be adopted with increasing numbers of cases.[80] The plan was constantly updated, based on the epidemiological situation of the country, emerging evidence from within and outside the country, and the reflection from the previous response period.

Although the COVID-19 case projection figures were close to the real number of cases for most of the time, the number of cases surged beyond the worst-case scenario envisioned in the plan during the peaks. As the cases surged beyond projected numbers, the country struggled to maintain commodities and supplies as the forecasted numbers were not sufficient to meet the increased demand. Planning assumptions under the worst case (scenario 3), for example, assumed a total caseload of at least 10,000 cases over the duration of a complete wave, whereas the daily peak in October 2020 was well in excess of 4,500 and over 9,000 at the height of the second wave in 2021.

[ii] Level I =0-2000 cases, level II =2,000-5,000 cases, level III =5000 -10,000 cases and level IV >10000 cases.

The updated plan in January 2021 extensively revised these planning assumptions, but even with the revisions, the case load during the peak of second wave was well above the projected level.

Similar to the federal level, the CCMC at provincial and local levels took the lead role in planning the COVID-19 response in their respective provincial or local governments. In coordination with the federal government, provincial and local governments were engaged in resource mobilization; setting up quarantine and isolation centers; case investigation and contact tracing; implementation of restrictive measures, such as lockdown; raising awareness about COVID-19; implementing preventive measures; and coordinating treatment services, ambulance, and referral services.[47, 56, 57]

However, there were some operational issues that constrained the COVID-19 response in some provinces. For example, based on hierarchy, elected representatives at local level (i.e., Mayors at local level governments) are at higher level than CDOs. However, the district level coordination committees for COVID-19 response were formed under the leadership of CDO, with municipality being a part of it. Some of the mayors in Karnali Province moved to boycott the meeting headed by CDO. This conflict regarding the authority caused some problems in coordination.[70] Furthermore, some local governments faced difficulties in decision making even though the province had released funds because of the absence of the Chief Administrative Officer. Some employees in local governments felt that they were overburdened with responsibilities and had difficulties in holding daily meetings and preparing plans for the containment of disease.[70] The COVID-19 pandemic was also an opportunity to reflect upon the federalization process Nepal is going through. The roles of federal, provincial and local governments are clearly defined and robust.[83] A previous analysis[70] has highlighted a perception that federal level leaders and officials favored centralized thinking (mindset). Skepticism about the capacities of provincial governments added to this this mindset.[70]

Strategic adaptation and the use of evidence for decision-making

The ICS regularly discussed progress in COVID-19 containment and strategies to be adopted. At the beginning of the pandemic, the meeting of ICS was held every morning at 8:30 am. In later stages, the meetings were made less frequent switching gradually to alternate days, then once a week, then as per need basis on subsequent stages.[84] Epidemiological experts stationed at the federal MoHP at the EDCD had been assigned the responsibility of analyzing epidemiological and surveillance data and presenting in the meeting of ICS with key recommendations for actions.[80] This provided an opportunity to reflect on the effectiveness of interventions and make changes as needed. Apart from these, the regular health cluster meetings were also an opportunity to reflect the actions taken in previous week and identify priorities for the upcoming week. The daily data analysis reports were initially shared by Information, Statistics and Monitoring Committee under ICS and later by IMU to facilitate use of evidence in planning and decision-making process.

The PPMD at the MoHP leads the Knowledge Café secretariat which engages policymakers, programme managers, researchers, and health professionals from the MoHP and the broader health system, in a series of knowledge translation activities. Through semi-formal interactive discussion platforms (virtual and in-person), the Knowledge Café facilitated translation of research evidence into decision-making. Effective measures for controlling transmission of COVID-19, clinical spectrum of

COVID-19, landscape of diagnostic tests, and possible strategies for Nepal considering the available infrastructure and financial capacity, available vaccines, efficacy, and the appropriate candidate vaccines considering Nepalese context were the key issues discussed in Knowledge café sessions that guided decision making. For most of the period during pandemic, Nepal has been able to align the restrictive measures with disease epidemiology (Appendix 2, Figure 3 and 4).

On 13 April 2021, the MoHP moved to establish IMU under ICS through secretary level decision as envisioned in emergency response plan. IMU was assigned the responsibility of coordinating with relevant stakeholder for data generation and analysis (Details in Chapter 15).

The information, statistics, and monitoring committee under ICS lead by statistical officer of IHIMS and supported by the team of Nepal Health Sector Support Programme (NHSSP) also facilitated evidence-informed decision making through regular sharing of the analyzed daily time series situational updated reports and briefing notes with the ICS as per ICS commander's (Health secretary) instruction. These reports were based on the latest epidemiological data in Nepal using IMU as well as HEOC situation reports updated in MoHP website. Additionally, health cluster and sub-cluster meetings also offered an opportunity to discuss regularly the results of assessments carried out by partners in different areas covering service delivery and utilization, including availability of essential commodities, service utilization, quality of laboratories, and other operational issues at provincial and local levels.

4.5. Financing

Domestic sources

The COVID-19 pandemic appeared in Nepal as a major concern in the second half of the fiscal year 2019/20. Budget had to be diverted from other areas to respond to this unprecedented event. To address fiscal issues, the Federal Government established a COVID-19 (Prevention, Control and Treatment) Fund (COVID-19 Fund) at the federal level, which was replicated at the provincial and local levels at its direction. The COVID-19 Fund was to be used to support prevention, control, and treatment of COVID-19 patients, provide relief to the poor and vulnerable, and cover the expenses of infrastructure and human resources directed at COVID-19 responses. A seven-member committee led by the Vice-Chair of the National Planning Commission was formed to operate the Federal COVID-19 Fund, with the Secretaries of relevant ministries as members. The Provincial COVID-19 Funds and Local Level Funds were each operated by a committee led by Chief Minister and Chairs/Mayors, respectively.[56, 70]

The financing of the COVID-19 response was done through budgetary support from provincial level and reallocating development budget at local level. The development budget was diverted to the fund for effective COVID-19 response.[57] Some local governments faced difficulties in mobilizing resources as the amount allocated for natural calamities and disease outbreak was not sufficient and governments had problems in diverting resources from other headings.[57] As the country is in the federalization process and structures are relatively new, provincial governments (for example, Bagmati Province)

also faced challenges in transferring funds to local level as it was already the middle of the fiscal year and clarity was lacking on how the budget should be transferred to meet emergency needs while complying with existing rules. [57]

On 28 May 2020, the federal government presented the budget of NPR 1,474.64 billion for the fiscal year 2020/21. Considering the COVID-19 pandemic and its threat, the budget for the health sector was increased to NPR 90.69 billion (USD 750 million) from NPR 68.78 billion in the previous year, which reflected an increase of 32%. A total of NPR 6 billion was allocated to procure medicines and equipment for treatment and to control the spread of the coronavirus. In the budget, the government also declared free health insurance of up to NPR 500,000 for all health care workers. Government presented its plan of upgrading the existing Covid-19 specialty health centers into full-fledged hospitals with specialty services.[85] Government also announced special healthcare facilities to accommodate infectious diseases, with 250 ICU beds in Kathmandu and with 50 ICU beds each in seven provincial capitals. These infrastructure developments were estimated to cost about 12.46 billion from the health budget.[86] The MoHP received NPR 60.7 billion (67%), provincial governments were allocated NPR 4.5 billion (5%) and local governments were allocated NPR 25.4 billion (28%).[87] The budget was largely concentrated at the federal level with approximately one-third of the total budget reaching provincial and local governments.

On 29 May 2021, the GoN presented a second annual budget of NPR 1647.57 billion for fiscal year 2021/22, which was 11.73 % higher compared to fiscal year 2020/21. NPR 122.77 billion was allocated for Nepal's heath sector which was an increase from NPR 90.69 billion in the previous year. The government allocated NPR 37.53 billion for the control and treatment of COVID-19. GoN placed vaccine procurement in high priority, allocating NPR 26.75 billion for this purpose. NPR 4 billion was allocated for the procurement of medical equipment and testing kits. Following the oxygen crisis earlier in 2021, the government shared its plans for providing a capital grant of 50% to hospitals for the installation of oxygen plants and a 50% waiver on electricity fees for oxygen production throughout the COVID-19 crisis period. Similarly, NPR 1.30 billion was allocated for the construction of infectious disease hospitals in all provinces and NPR 6.15 billion was allocated for the expansion of health services in 396 basic hospitals in rural areas.[88]

Partnership with the private sector, social workers, local community, and citizens residing abroad also helped provincial governments to generate additional resources for the COVID-19 response. For example, Sudurpaschim province was able to manage a huge budget (40 crore) with support from businessmen, social workers, parliaments, and foreign migrants. The fund was provided to local level governments which was used to provide instant relief to people affected by disaster, and included the construction and operation of quarantine and isolation centers.[57]

Foreign sources

There were three types of assistance from partners: financial support, commodity support, and technical support. Some bilateral and multilateral partners provided financial support, in the form of grants and loans to the Nepal government, which could be mobilized as per the priorities of the government. Other organizations supported commodities necessary for COVID-19, which were

mobilized through the Health Coordination Division. Partner organizations also provided technical assistance at federal, provincial, and local levels which ranged from supporting preparation of policy documents to training local health workers in different areas of the COVID-19 response. Government also instructed INGOs to divert 20% of their budget in COVID-19 response which helped to generate additional resources for the COVID-19 response.[76] Decision was also made to accept only the budget of over Rs. 5 lakh as financial support.

There are some reporting requirements for direct financial support provided by different partners and agencies. We understand that, as per the spirit of federalism, more resources have to be mobilized through provincial governments and local governments. However, considering the current capacity for accounting and reporting, the financial assistance was largely handled by federal MoHP. Partners did not provide direct financial support to provincial governments. In the future, when provincial and local governments are fully capacitated, such resources could also be mobilized through provincial and local governments.

Senior Public Health Administrator, MoHP

Photo 2: Glimpse of COVID-19 commodity support received from EDPs
Source: HEOC, Facebook page on different dates

4.6.   Monitoring

Monitoring at federal level

The Monitoring and Evaluation Section under PPMD of the federal MoHP is responsible for monitoring health-related programmes from government and the non-government sectors, evaluating progress in programme implementation and impacts of these programmes. There was also a separate monitoring team led by the Nepal Medical Council (NMC) chair as ministry officials were mostly

occupied with other responsibilities related to pandemic response. The monitoring committee had representation from different professional councils. The committee was considered useful in regularizing hospitals' services, controlling unnecessary use of medicine, and ensuring quality of services. However, as price regulation does not come directly under the jurisdiction of MoHP and councils, the committee faced challenges in regulating prices of the services offered through private hospitals and also the prices of essential commodities. The prices were later monitored by the District Administration Office (DAO). The Ministry of Industry, Commerce and Supplies was also monitoring, particularly the oxygen manufacture and supply particularly during the second wave of the pandemic while Nepal faced acute shortage of oxygen supply and cylinders. The monitoring committee became defunct after responsibility for monitoring was taken over by the CCMC. As the CCMC had many responsibilities, monitoring was not much prioritized.

Monitoring/support to provincial and local level governments

Local governments and provincial governments were responsible for monitoring of health facilities under 25 beds and 25-200 bedded hospitals, respectively. Similar to the federal CCMC, the Provincial CCMCs and Local CCMCs were responsible for monitoring the pandemic response. Although not functional in all, some municipalities had tole (small units within municipalities) development committees which were effective in monitoring compliance to preventive measures. The members of the committee were oriented about the preventive measures, mode of transmission, and the need for compliance to policy provisions. Such committees were also very effective in monitoring and ensuring compliance to policy provisions (preventive measures like social distancing and mask use). Similarly, the 11th level officials from federal level also conducted monitoring for vaccination in the provincial and local level.

Health Offices (HO- a part of the provincial government at district level), also monitored the COVID-19 response activities, particularly the vaccination sites at local level. However, as the local governments were not under the DHO, the DHO could only suggest the vaccination sites highlighting the areas of improvement. Ensuring compliance to policy decisions largely depends on the leadership of local governments.

4.7. Information and communication technology interventions in COVID-19 data reporting

Countries across the world are using technology to organize, manage, prevent and track COVID-19 cases. Nepal faced lots of challenges specially on case recording, reporting, and managing as Nepal did not have a proper public health information system in place. People engaged in case reporting did manual paper-based reporting system which apart from being a time-consuming process caused lots of duplicates.

There were lots of pre-developed applications like DHIS2, tracker, Surveillance, Outbreak Response Management and Analysis System (SORMAS), Go.Data, Open Data Kit (ODK), Epi Info, CommCare, KoboToolbox etc. available in world market that could be used for case recording and reporting during this COVID-19 pandemic. Such as Some of these tools are freely available and some

are patented software. Some countries have used these tools, and some have developed their own as per the requirements they need. China, being the first country to report COVID-19, was naturally first off, the mark to launch a 'health code' app nationwide. The app directed people to stay indoors, report their travel history and share knowledge of any COVID related symptoms they may be experiencing. 80% of Chinese citizens have adopted this app. India followed the idea similar like China in its contact tracing app (CTA) and quickly lunched the "AarogyaSetu" app both Android and iOS app stores. The app crossed 100 million downloads being the fastest growing app ever.

Learning from experience of other countries, MoHP launched the 'Hamro Swasthya' app to disseminate information about the pandemic. Hamro Swasthya also have web portal that includes overall information related to symptoms, causes, and treatment of coronavirus with some videos and pictures attached.

There is lacking authenticated case reports from source of data (i.e., from Labs, Hospitals, and community) to the public health agencies in a fast and easier manner to review and instant perform action to manage the cases in place. This type of information system could empower and strength the community based public health system related with COVID-19 data and instantly reporting cases to the concern government agencies through the authenticated data originated source. To fulfill this gap a maternal and child health program "Amakomaya" have lunched "Hamro Survey" Covid app in April 2020. The goal of this app is to provide COVID-19 suspected and confirmed cases information from the neighboring local area and inform to the Local Level government (LLGs). In June 2020 Hamro Survey App is officially adopted by Nepal government (MoHP) by the recommending from ICS. Later in December 2020 this app is renamed with COVID-19 IMU Nepal. s

IMU Nepal is now used by all COVID-19 Labs, COVID designated hospitals, all local level governments, all health office based in districts, 7 provincial health directorate office and MoHP/MoSD of federal government. IMU Nepal has been a platform to share case reports from the one stakeholder to other stakeholders and share the outcome to the concern public health agencies for review and take instant action. IMU makes COVID reporting from community, labs to public health agencies faster and easier. It moves data securely and seamlessly—from the labs and community at the point of care, to data systems at state, territorial, and local agencies. IMU also allows public health agencies to provide information back to contact investigators (health care professionals) and health institutions. This timely data sharing provides a real time picture of COVID-19 to support outbreak management. So IMU Nepal is sharing

Photo 3 COVID data entry platform

data among and between COVID-19 case management entities. It tracks all the complete life cycle of COVID-19 case management starting from explore of suspected COVID-19 cases to outcome. All the aggregated data with the defined indicators are automatically pushed to DHIS2 platform, from where MoHP can visualize the COVID-19 data. Institutionally IMU software system is administered by IHIMS, which is under the Logistic Management Division (LMD) of DoHS.

4.8. Lessons and future directions

- The GoN formulated several committees and structures to accelerate the pandemic response (often with overlapping responsibilities), in addition to the pre-existing emergency preparedness and response structures including the HEOC, NEOC, and NDRRMA. While the new structures were useful in strengthening inter-ministerial coordination, additional emphasis on strengthening already existing structures and networks like HEOC, NEOC, and NDRRMA could ensure better institutionalized learning from the pandemic which could be useful for future pandemic response. Regarding the routine information management, MoHP has well established IHIMS under DoHS, CoVID-19 IMU as new structure for CoVID-19 related data management was established and made mandatory online reporting as a one-door system. However, multiple reporting practices with manual reporting system based on calls, email, google sheets existed. IMU needs to be better institutionalized in IHIMS for reporting and analyzing data as per the one-door policy in such pandemic situations for timely, evidence-based better management and planning in future.

- At times, the number of cases exceeded the worst-case scenario planning, and the response system was overstretched to deal with the pandemic resulting in shortage of essential commodities. Strengthening situational awareness[iii] and epidemic modelling capacity available to the MoHP, either internally or in collaboration with academia, could further improve the near-term COVID-19 response, and longer-term preparedness for future outbreaks.

- The MoHP was able to prepare a number of policies, guidelines, and protocols in a very short period of time. However, in doing so could not be adopted because of the urgency in developing policies, guidelines, and protocols. The documents were posted on the web portal of the MoHP and also shared through social media so that health facilities and health workers across the country could get access in a very short period of time. However, in the early phase, as health workers were not extensively trained, there were some operational challenges in implementation of the decisions and policy provisions. Regular meeting with the stakeholders explaining the rationale and evidence behind decisions may have moved forward the understanding among implementers.

- In first few months of the pandemic, private hospitals were largely unwilling to provide services to COVID-19 patients. After consistent effort from government, private hospitals increased their role in COVID-19 service delivery in the second wave. With the increasing role of the private sector, price regulation of the service offered by private hospitals emerged as a crucial issue. More

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[iii] Situational awareness refers to perception of the elements in the environment, comprehension of the situation, and projection of future status.

structured and stable mechanisms for price regulation could be useful to improve access to services in the short- and long-term.

- With the relatively new federal structure, there were challenges associated with lack of coordination between federal, provincial, and local governments. But in the later stages, there was good coordination between the 3 tiers of government which can help in coping with the pandemics that may arise in the near future. Dedicated recording and reporting structures with skilled and ICT supported man powers in federal, provincial, and local level government.

5. Risk communication, community engagement (RCCE), and infodemic management

Summary

- Effective risk communication and community engagement (RCCE) is a central plank of any epidemic response. The MoHP's evaluation of the early phases of the COVID-19 response in Nepal highlighted ongoing issues of population compliance with measures including social distancing, mask wearing, and sanitization, which was later translated into involvement of personalities and community leaders in helping to spread key messages.

- Community-level data gathered in Nepal show high levels of trust in specific communication media (e.g., TV, radio, but also messages through community members, family, and friends). The MoHP and other partners worked closely on a multi-pronged RCCE strategy from an early stage in the pandemic. Engagement of media from the early phase of the pandemic provided an opportunity for communicating authentic scientific information to the public. Partners were also monitoring media and updating the MoHP about the media coverage on different aspects of COVID-19. This provided the MoHP an opportunity to clarify false information circulating in the community.

- Real time data collection and reporting is important tool to fight against COVID-19 pandemic. Amakomaya mHealth solution that was used to recording and tracking real time maternal and child health data from the community level in Nepal have instantly provided COVID-19 Information Management Unit (IMU) platform since from May 2020. IMU is now recognized as a single one-door COVID-19 data collection platform which is used by all COVID-19 test labs, CICT team, COVID-19 designated hospitals and Point of Entries located in international borders. This system facilitates the collection of detail personal line listing COVID-19 data as per the variables requested from concern program division such as EDCD and NPHL. From the line listing data IMU system pushes the daily basis aggregated data as per defined indicators wise to DIHS2 platform.

- COVID-19 Vaccine pre-registration concept was introduced on the first day of COVID-19 vaccine campaign. The replication of Vial-to-child application which was used to track routine vaccine program by Immunization section with the support from partner organizations. The online COVID-19 vaccine digitization system could not be rolled out on full scale and MoHP decided to pull back the vaccine pre-registration program in early phase of the vaccination campaign. Later on, under the leadership of IMU/IHIMS with support from partner organization the system was successfully implemented in selected municipalities (Tokha Municipality, Biratnagar Metropolitan, Kaliya sub-metropolitan, Hetauda sub-metropolitan, Beni municipality, Butwal Sub-metropolitan, Dhangadi Sub-metropolitan, Gurans rural municipality). This has facilitated QR code enabled certification for COVID-19 vaccine too.

- Key platforms used by government to inform the public about COVID-19 included the operation of call centers; a dedicated COVID-19 web portal; a mobile application named *'Hamro Swasthya'*; regular press meetings; educational programs on radio and TV; and push messaging through telecommunication networks like NTC, NCELL, Smart cells, and social media pages on Facebook, Twitter, and Viber groups.

- Information was delivered in different local languages including Newari, Awadhi, Bhojpuri, Tamang etc. apart from Nepali language. For those who are not able to hear, information was provided through press meetings in sign language.

- There was notable attrition in self-reported adherence over the course of the pandemic to important preventive measures such as handwashing and mask-wearing. Reasons for this are complex but appear to be linked to perceived risks to jobs, employment opportunities, or earning; reduced perception of risk; and the need to celebrate festivals, ceremonies, and jatras.

- Available data point to a number of areas in which RCCE activities could be strengthened, but it is also clear that further research is needed to understand why messages imparted using trusted sources do not appear to have resulted in notable behavioural change. Success in the RCCE domain will depend heavily on the extent to which structural factors e.g., employment insecurity, and crowding on public transport, can be addressed.

5.1.   Preparedness before the pandemic

The National Health Education, Information and Communication Centre (NHEICC) is the apex body under the federal MoHP that is responsible for planning, implementing, monitoring, and evaluating Nepal's health promotion, education, and communication activities. Before the pandemic began, Nepal had its National Health Communication Policy 2012[89] and National Health Policy 2019[90] in place that guided the scope of NHEICC. NHEICC works to strengthen, expand, and implement health communication programmes in Nepal. It uses advocacy, social mobilization and marketing, behaviour change, and community-led social change strategies to implement its programmes. It also works to prevent unauthorized dissemination and duplication of health-related messages or information and materials of different issues by maintaining quality, correctness, authorization, uniformity, and appropriateness.[91]

5.2. Risk communication

Challenges to information and risk communication especially in the early phases of the pandemic, were significant, and a range of studies have revealed that people receive information from multiple sources [92-94] which could at times have detrimental effects due to conflicting messages.[92] In the early

stage of pandemic (third week of January 2020), considering the potential impact of misinformation that could be circulating at the community level, MoHP appealed to citizens for disseminating and sharing only factual information from the authentic sources like MoHP and relevant partners.[95]

The GoN's approach was to implement a multi-faceted RCCE strategy using multiple modes of communication. Throughout the period of the pandemic, the Nepalese government continuously reinforced public health safety measures/behaviors at offices, public places, and other strategic locations.[47, 56, 57] Officials worked with media personnel to help ensure scientific information regarding COVID-19 was communicated clearly. Government also worked closely with RCCE cluster partners in delivering messages to the community particularly on social distancing, mask use, sanitization, COVID-19 symptoms, mental wellbeing focusing on depression and suicide, and respect and care for returnees through dedicated radio programmes and de-stigmatization of the disease.[96]

Photo 4: COVID-19 press briefing

There are also, however, clear data from partner organizations and others outlining some of the challenges to public engagement with messaging in this domain. For example, community rapid assessments of protective behaviours show precipitous declines in self-reported adherence to official recommendations concerning handwashing, mask wearing, and physical distancing over the course of 2020. The dominant reason for this, cited by survey participants (>70% of participants) in December 2020, was a perception that adherence to these measures would put their jobs and/or relationships at risk. These findings highlight important structural and perceptual barriers to adherence.[97]

5.3. Governance and funding for RCCE activities

The MoHP endorsed 'Risk Communication and Community Engagement (RCCE) Directive' on July 5, 2021.[98] Under MoHP, a RCCE unit has also been formed at the federal level. Under the most recent

COVID-19 response plan for Nepal, RCCE activities have been carried out with central coordination from the NHEICC and the EDCD at the DoHS, MoHP, working partnership with other organizations (who have produced much of the global guidance on community engagement activities), the UN Resident Coordinator's office, other agencies, and local/international NGOs. The plan outlined activities including development and dissemination of gender- and culturally-sensitive communication materials, and outreach activities through, for example, female community health volunteers (FCHVs).[99] While the approach to developing RCCE materials and interventions drew on evidence from a range of sources, formal mechanisms for behavioural assessments that could help to identify target audiences, community level perceptions of disease, and the viability and utility of different communication channels that facilitate more tailored and targeted risk communication interventions was lacking. Risk communications was the most common area where partners worked during the pandemic with more than 2,000 documented activities.[96, 100] However, evidence on the extent to which these activities were guided by behavioral assessments or studies, or may have duplicated activities already underway in some parts of the country, are not available.

5.4. Risk communication guidelines, protocols, and strategies

The National Health Communication Policy 2012[89] was the key policy document guiding risk communication during the COVID-19 pandemic. The risk communication strategy of Nepal was guided by the COVID-19 global risk communication and community engagement strategy, released by MoHP in collaboration with partners) on 23 December 2020.[101]

NHEICC regulated health messages produced and disseminated by other partner organizations and stakeholders.[102] Communication strategy places emphasis on utilization of popular media for communication of messages on COVID-19 including the COVID-19 portal; hotline numbers; mobile applications named *'hamro swasthya'*; daily media briefings on TV; and Facebook pages, Twitter, and the Viber community.[103]

5.5. Delivery modes for information and risk communication

The spectrum of approaches used to support information delivery and risk communication is given in Figure 16. Ensuing sections then provide further detail on implementation approaches used by the MoHP and its partners under each of these headings.

Operation of call centers

Two Call Centers, 1115 (from 6 am to 10 pm) and 1133 (24 hours), were set up and made functional from 13 March 2020 for providing counseling service on COVID-19 prevention and treatment. These call centers helped the public to obtain authentic information on COVID-19 epidemiology as well as the services available. The toll-free number 1133 was started for managing the beds in hospitals inside Kathmandu valley initially and the objectives was to start the service regarding telemedicine for the public i.e. receive medical advice from licensed doctors for ailments other than COVID-19.[104] Later, two additional numbers (9851255837 and 9851255834) were also made operational from 8 AM to 8 PM.[47, 56] These call centres also received a notable numbers of calls from health workers across the country particularly with technical queries relating to policy documents as government was not able to orient all health workers about the policies and plans developed. MoHP promptly responded to this problem dedicating another hotline number (9851255839) for settling queries from health institutions and health workers.

In the early phase of the pandemic, MoHP shared the details of the calls received in federal call centers through 'Situation Reports' published by MoHP on a daily basis. Major queries received in the federal call center were related to sign and symptoms of COVID-19, precautions to be taken at home and during travel, and the appropriate place to go for medical consultations. The queries received in the call centre differed based on the epidemiological situation and response status. For example, in early phases most queries were related to symptoms and preventive measures, while in later stages queries

related to service availability and vaccination were more common. The people were also counselled through the call centers regarding stigma, preventive measures for COVID-19. Recently we have also been receiving questions about QR codes. Questions received at the call centers that could be relevant to the wider public were also addressed through Media Briefings of the MoHP. Some of the provinces also launched call centers to address queries. Madhesh Province started operating a call center (041-590414) on 24 March 2020. Initially, the call center was made functional 24 hours a day, arranging 3 shifts for staff on a daily basis. However, the call center was closed in less than three months, in mid-June 2020.[105] The PHD in Gandaki Province started a call center from 30 March 2020 to address queries from the public.[75] The MoSD in Lumbini Province started operating provincial call center (1187) from 21 July 2020. The call center is functional from 7 AM-7 PM with an automated response system in place from 7PM-7AM.[106] In Karnali Province, the Office of Chief Minister with support from Security personnel (Nepal Police and Nepal Army) started operating a call center (1148) particularly dedicated for the rescue of COVID-19 patients.[107] Bagmati Province did not operate any separate call centers and queries were addressed through call centers at federal level.[108] Province 1 and Sudurpaschim Province did not have any separate call centers in operation during the pandemic. Although provincial call centers supported members of the public in obtaining service-related information specific to their province of residence, not all of these centers were operational throughout the period of the pandemic.

Mobile messaging and caller tones

The GoN adopted mobile messaging as an option to reach a large segment of the population in a short period of time. Health service awareness messages were circulated by NHEICC through Nepal Telecom, NCELL, and Smart Cells, the popular tele-communication networks in Nepal. In March 2020, the government also started disseminating health information about COVID-19 regularly from NTC and NCELL as caller ring back tone/personal ring back tone. Service users could also get health awareness messages by dialing 32100.[79] The extent to which these services were able to meet demand for information and were able to change the behavior of people is uncertain.

Web Portal for COVID-19 information

On 29 March 2020, the MoHP launched a dedicated website for COVID-19 (https://covid19.mohp.gov.np/). The website provides information on the most common issues of public concern such as the number of PCR tests conducted, the number of positive cases identified, total deaths reported in the preceding 24 hours, and cumulative numbers for each of these domains. Disaggregated data by province, district, sex, and age are also available on the website.[109] The website also contains info-graphics that provide information on COVID-19 epidemiology, preventive measures, and vaccination. Through the website, public can take a self-assessment test that screens people based on common symptoms for COVID-19 like body temperature, dry cough, tiredness, difficulty in breathing, chest pain, body pain, loss of taste or smell, loss of speech movement, sore throat, diarrhea, runny nose, and nausea. In the early stages of the pandemic, the number of individuals completing self-assessment forms (individuals in red, yellow, and green zones based on symptoms)

was also reported through media briefings. MoHP also conducted follow-ups with the citizens classified as being on red zone based on symptoms within a day.[109] The target audience of this page is to provide detail public concern information associated with COVID-19 cases.

Initially COVID-19 case collectors from COVID-19 test labs, hospital COVID-19 data recorders, PoE data entry personal and community antigen testing personals were using paper-based recording system and were reporting to EDCD by using google docs, e-mail, Viber, and messenger group. After the introduction of IMU web and mobile app, all the line listing data were entered in the IMU system. Local level government, districts, provinces, and federal level agencies such as EDCD, HEOC monitored live line listing data from IMU system. The web and mobile system is password protected and is accessible for only the authenticated organizations/personnel who are responsible to collect and manage covid-19 cases. This system is accessible in the link https://imucovid19.mohp.gov.np (Official IMU website)

Apart from the COVID-19 dedicated website for data recorders, official sites of the MoHP can be accessible from (https://covid19.mohp.gov.np/), HEOC (https://heoc.mohp.gov.np/), https://vaccine2.mohp.gov.np/login), Pre-registration and QR code verification(https://vaccine.mohp.gov.np/), HMIS(hmis.gov.np), eLMIS (https://elmis.dohslmd.gov.np),and EDCD (https://www.edcd.gov.np/) also provide information on COVID-19. MoSD at Provincial level were also communicating COVID-19 related information to the public through their website.[109, 110] Similarly the web portal of CCMC (http://ccmc.gov.np) provided regular updates about the key decisions of GoN related to COVID-19 response.[111] As the number of cases started increasing and people had difficulties in finding hospital beds, oxygen and vehicles, the web portal of COVID Connect Nepal (covidconnectnp.org) was made operational to help people connect with service providers. [112]

Use of a Viber community and social media

The Facebook pages of MoHP (fb.com/mohpnep), HEOC (fb.com/HEOCMoHP), NHEICC (fb.com/nheicc.nepal) IMU(https://www.facebook.com/covid19imu) and EDCD (fb.com/edcdnepal) have been sharing health educational messages on COVID-19.[113] The Facebook page of MoHP had 799,000 followers, HEOC had 90,000 followers and EDCD had 26,000 followers as of 18 October 2021. The latest notices from MoHP, preventive messages (social distancing, mask use, and sanitization), and information about vaccination (dates of vaccination and priority groups for each phase, procedure for getting vaccinated, vaccination sites and time) are posted regularly on Facebook pages. Frequently asked questions (FAQs) about vaccinations were also developed in the form of infographics and were posted on the Facebook page of MoHP.

Similar to Facebook, the official Twitter handle of MoHP (@mohpnep) provides COVID-19 and non-COVID-19 related information on a regular basis. Twitter handle had 39,400 followers as of 18 October 2021. A Viber community was created and made functional. As of 31 December 2021, 685667 members were connected in the Viber group of MoHP. The Viber group was updated with the situational reports and decisions from the MoHP on a daily basis. The latest infographics on COVID-19 are also posted in the Viber group.

Partner organizations were also engaged in raising awareness about COVID-19 and other health and social issues through social media. For example, during 2020, MoHP in collaboration with partner organization took the lead in raising awareness about child rights and COVID-19 in Nepal through social media engagement, with an impression of more than 852 million.

Mobile applications

On 29 March 2020, five days after lockdown was imposed, a mobile application named *'Hamro Swasthya'* was launched to provide unified and authentic information about the disease.[80] The mobile application has most of the features of the MoHP COVID-19 website like epidemiology of COVID-19, self-assessment form, and contact details. Similar to the self-assessment form posted in MoHP COVID-19 website, citizens could evaluate the symptoms relating to COVID-19 and obtain results through mobile application. The mobile application became a widely accepted source of information on COVID-19. By 25 December 2020, the application was downloaded more than 300,000 times.[114]

On April 2020, MoHP/ICS lunched IMU Nepal mobile app for the COVID-19 data managers who are working in COVID-19 test labs, CICT teams for case investigation, contact tracing and case follow-up and antigen testing in community or PoE. This application have multi-dimensional features used for all level of data recorders and managers engaged in COVID-19 cases management. This app can be accessible from the Google Play store with the name of IMU Nepal.

Some of the provincial governments also used mobile applications for sharing COVID-19 related information to the public. For example, Madhesh Province had separate mobile applications named 'MoSD Province 2' to provide reliable information and updates to citizens. Similarly, Lumbini Province also had separate mobile application for providing COVID-19 information to people. Information, notices, and response activities regarding COVID-19 were posted in the mobile application. However, the application did not seem well updated.[115] The mobile application of Gandaki Province named 'Gandaki Health' provides information on epidemiology of COVID-19, preventive measures, and also the contact numbers of hospitals and ambulances offered in all districts within the province.[116] The Sudurpaschim Province also had an application named 'Sudurpaschim COVID-19 Tracker'.[47]

Radio and television programmes

Social and behavioural data gathered in Nepal suggest that the most trusted sources of information are television and radio sources, partly because of accessibility to a broad cross-section of the population.[97] Daily radio programs like "Corona Capsules" and "*Jeevan Rakshya*"; weekly radio programmes like "*COVID kura in Maithili and Bhojpuri*", "*Sathi Sanga Manka Kura*", and "*Hello Bhanchin Aama*"; and the daily television programme "Corona Care" covering various COVID-19 issues were broadcasted/telecasted and is assumed to have reached more than 14 million people across Nepal.[117] More than 500 radio stations and 22 television channels throughout the country were disseminating COVID-19 related information in multiple languages.[117]

The government also tried to address the queries received through hotline numbers and social media via television and other media outputs. For example, NHEICC, with technical support from partners, produced a 5-minute daily television show programme (Corona Care), as well as a weekly talk programme and daily magazine show (*Swastha Jeevan*). The content of the television programmes was developed based on the questions, concerns, and issues raised by the general public through hotlines, social media and reporting from the radio journalists.

However, data from community rapid assessments indicates that the effectiveness of some of these broadcasts in influencing perceptions of COVID-19 risk, and particularly in steering self-reported adherence to practices such as handwashing and mask wearing, has been variable. Recent exposure to some of these programmes had positive effects on COVID-19 risk perception, but effects on self-reported behaviours linked to this are much more equivocal. These findings point to a possible need to re-evaluate the content or approach of these programmes, and to consider modifications that might strengthen behavioural effects.[118]

Messaging for illiterate, and differently abled people and in other languages

Starting from 9 April 2020, COVID-19 related information was also shared in sign language in press meetings.[90] Apart from Nepali language, educational messages through radio programs were disseminated in local languages like Newari, Awadhi, Bhojpuri, Tamang etc.[91] With support from risk communication and community engagement work stream members, more than 500 radio stations and 22 television channels across Nepal were disseminating multi-lingual (local languages) messages on COVID-19 prevention and protection, hand washing, nutrition, gender-based violence, psychosocial counseling needs and child protection.[117] For sharing COVID-19 information to blind people, pamphlets were also made in Braille lipi by the NHEICC.

5.6.   Community engagement activities

Community information and feedback mechanism

Although there was no formal and scheduled mechanism, the public could provide feedback from the Facebook page, Twitter handle, and toll-free numbers being operated. Government regularly sought opinions from medical and other health professionals about the possible ways of dealing with COVID-19 pandemic.

Engagement of community-based networks

Although it could not ultimately be implemented in full scale, the federal MoHP had planned to mobilize community networks up to tole level (smaller cluster within local governments).

In collaboration with partners, more than 30,000 volunteers from 79 municipalities were mobilized for home visits, community dialogues, megaphone announcements, and vaccination support through, for example, discussing the importance of vaccination and adherence of public health safety measures.

MoHP estimates that approximately one million people were reached through community volunteers in this way.

Some provincial governments used innovative strategies to engage communities and communicate the health education messages. Province 1 engaged school teachers in risk communication. Two hundred school teachers were taken as volunteers in most affected three districts of the province, namely Jhapa, Morang, and Sunsari, for COVID-19 risk communication at community level, particularly targeting underprivileged clusters and social gathering places. [28] Ministry of Home Affairs and Law supported security personnel for control of rumors. In Lumbini Province, with support from partners, Unite Action Teams were mobilized in most affected districts (Kapilvastu, Rupandehi, Banke, Dang, Bardiya, and Nawalparasi). Apart from tackling stigma and discrimination practices at community level, Unite Action Team also promoted hand washing, social distancing, and proper use of face mask at community level. In 12 districts of Lumbini districts, Training of Trainer (ToT) style of meeting titled 'Orientation on Community Engagement in COVID-19' were conducted targeting health coordinators of municipalities, staff of health offices, and other stakeholders. Similar meetings were also conducted at municipality level and some ward levels in collaboration with different organizations.[106]

Social media monitoring

Although in the earlier stage of pandemic the mechanism for tracking misinformation circulating in social media was not systematic and organized, it improved over time. The MoHP began tracking Facebook posts related to COVID-19 and also boosting the visibility of Facebook posts from the Ministry related to COVID-19. The RCCE cluster was also monitoring social media and updating officials from MoHP about the misinformation circulating. Misinformation was clarified through press meetings of MoHP, social media, Viber community, infographics in the web portal, and mobile applications. MoHP also developed a media crisis hub which was useful in clarifying misinformation.

Community perceptions, knowledge, attitude, and practice surveys

Some research work has been carried out to understand attitudes to COVID-19 among members of the public to inform communication approaches. In a study report published in June 2020, and based on a survey of over 3,500 individuals through the MoHP's Viber community, participants had good understanding about the preventive measures of COVID-19 like hand washing and sanitizing (99.6%), avoiding touching face (98%), avoiding close contact with sick (98%) and disinfecting touched objects (87.4%). [93] In the same study, 97% participants were ready to go for self-quarantine or isolation if they had fever, and 98.9% believed that travelling during lockdown is not safe; 55.8% believed that calling the toll-free number is the best action if disease is suspected, while 31.2% felt it would be best to go to the nearest health center if they became unwell with suspected COVID-19.[93] Adherence to lockdown measures in this survey appears to have been strong: 78.7% reported that they never breached lockdown, 16.7% reported breaching lockdown 1-5 times and the remaining 4.6% reported breaching lockdown more than 5 times.[93] In one other study in August 2020, in which researchers observed 4,502 individuals in 23 public places (vegetable market, shopping mall, hospitals, public

buses, bank, *malpot karyalaya*, temples and restaurant), 72.1% were wearing mask of which 76.7% were wearing it correctly.[119]

In 2021, MoHP in collaboration with partners conducted a telephone survey with over 6,500 households in the month of June and July to assess the public knowledge, attitudes, and practices of COVID-19 appropriate behavior and vaccine uptake and hesitancy. According to the survey, 63% participants reported handwashing with soap and water all the time and 21% reported doing it most of the time. Similarly, 52% of participants wore a mask all the time with 33% wearing it most of the time. Altogether, 26% of the participants reported practicing physical distancing in public spaces. Adherence to public health measures was observed to vary with changes in the COVID-19 caseload nationally, enforcement of lock down measures and of the extent to which public health safety measures were enforced by the administration or security personnel.[120]

Infodemic management

Tracking rumors and misinformation and addressing them is essential in an evolving pandemic, especially where the pathogen is novel and little about the epidemiology of disease is understood. More people from developing countries like Nepal have access to internet connection and social media more than ever before, increasing the risk of exposure to misinformation. On the other hand, vast coverage of internet services and social media also provide considerable reach to public institutions if appropriately harnessed could be an opportunity to address misinformation.[121]

NHEICC has been regularly conducting media monitoring and from the beginning of the pandemic, the NHEICC was continuously engaged in monitoring media outlets to track misinformation being circulated. The Press Council Nepal is a statutory body set up by GoN whose one of the activities is conducting media monitoring. With the objective of promoting the standards of free press and promoting ethical journalism, the Press Council Nepal started tracking COVID-19 related information in print media and circulated key findings to the MoHP. MoHP with collaboration with partner also performed media monitoring and the reports were shared to spokesperson of the MoHP and other stakeholders. Myths or misinformation circulating through media were clarified by the MoHP through press meetings, FAQs posted on the MoHP website, and by developing infographics posted in websites, social media pages, and among the Viber community.

The spread of misinformation has been a potent challenge in Nepal, as it has been worldwide, throughout the pandemic. Misperceptions included attributing infection risk to different non-vegetarian food items like meat and eggs. Particularly during the first wave, some believed that Nepalese are immune to disease and would not develop symptoms or severe disease. [63]Also, people believed some food items like turmeric, onion, tea, and alcohol prevent or cure disease [63] although the scientific evidence for or against these food items was not available.

A commercial product named 'Corona-Guard' was being promoted with the claim that it could inactivate coronavirus or that one does not need to wear face mask after using the device. However, the MoHP issued public information to rebut claims regarding this product, specifically the suggestion that it could somehow be used to inactivate the virus (see the image below).[122]There were also rumors

circulating that Nepal being a sacred land would be protected against coronavirus and Nepali people have killer cells, so they are immune to this deadly disease.[123] Youth volunteers across all seven provinces were mobilized via online platforms to tackle rumours and misinformation related to COVID-19.[122]

Figure 17: Message from NHEICC addressing incorrect information about "Corona Guard"

Stigma reduction

Stigma and discrimination were frequently reported in the early phase of the pandemic. A study revealed that some of the healthcare workers were expelled from their rented houses and were denied proper food and lodging in hotels. The COVID-19 positive cases and returnees were disrespected in the community and were shunned. People opposed local governments' decision to set up quarantine centers in the community. Trucks of vegetables and fruits were destroyed by local administration in some places.[92] During the early phase of the pandemic, the health workers faced social stigma with local demanding that eviction of health workers from their house/locality. [124]

In most cases, governments tried to address the stigma and discrimination through health education messages shared through social media, press meetings, and television and radio networks. Some provinces and local governments were quick to respond to the stigma and discrimination in the community. In Lumbini Province, with support from partners, Unite Action Teams were trained to support in reducing stigma and discrimination at community level. Unite Action Teams played a crucial role as a supporter for the community particularly for the COVID-19 patients.[77]

Media management

The MoHP-led 'Daily National Press Briefing on COVID-19' was held on a weekly basis in the early phase of the pandemic and biweekly on Sunday and Wednesday from 28 October 2020.[125] These press briefings covered information on epidemiology of disease, messages on disease prevention, actions taken by the government in COVID-19 response, and important announcements like that of restrictions on public gathering and COVID-19 vaccination.

The HEOC at the MoHP organized virtual interaction meetings with media personnel on a regular basis. In a virtual interaction meeting with the media on 4 September 2020 with 100 participants, including journalists and reporters, it was informed that similar meetings were planned to be held regularly every Friday.[126] Regular meetings with media provided an opportunity to clear myths circulating among the public, and simplify the scientific information for the public.

As there were suspicions about the safety and efficacy of vaccines' expedited development processes and limited availability of evidence, Nepal moved to spread awareness of the science behind vaccines. On 5 March 2021, a webinar on 'Science Behind COVID-19 Vaccine and Vaccination Campaign' in Nepal for Media Persons was organized by the MoHP and supported by partner via Zoom. A similar webinar on Science Behind COVID-19 Vaccine and Vaccination Campaign in Nepal for Members of Professional Medical and Health Associations was also organized by the MoHP supported by partners on 5 March 2021 which was hosted live on the MoHP Facebook page.[127] Such webinars help to inform the media about scientific information about vaccines which could be useful to counter misinformation circulating in the community.

The Federation of National Journalists (FNJ) supported the government in providing scientific information to media personal in all 7 Provinces. In an event titled 'Sensitizing Journalists on the Science Behind COVID-19' organized by FNJ on 23-25 September 2020 a total 690 media persons participated. In the session, panelists from MoHP and partners briefed the journalists on COVID-19 global situation, risk communication, and the challenges of infodemic and media reporting of COVID-19. The events were also telecast live on the Facebook page of the FNJ, while the WHO Nepal Facebook page hosted a 'watch party' of the same broadcast. The live telecast on FNJ on 24 September 2020 garnered more than 2,000 views, while it reached more than 7,200 people. Similarly, the broadcast reached 4,902 Facebook users on 25 September, 2020 while 962 users clicked to view it.[128]

Based on learning from the first wave, a media crisis hub was operated in the second wave of the pandemic which also provided an opportunity for clarifying misinformation and communicating scientific material in an accessible way through mass media.

5.7.   Lessons and future directions

- Although the government took a proactive role from an early stage in the pandemic in disseminating information on preventive measures like mask use, social distancing, and sanitization, RCCE interventions need to be delivered within an environment conducive to behavioural change to be effective, which often requires a multi-sectoral approach. In this respect, there continue to be important structural limitations to the impact that RCCE interventions in

Nepal have. For example, public transports are often crowded, reducing opportunities for social distancing among the general population who are reliant on it. Although the government released orders that public transport should operate only at 50% of their capacity, there was insufficient ability in the public transport system to meet this capacity restriction. In addition, implementation of social distancing in health facilities including vaccine centers has proven difficult because of the level of crowding seen there. Persistent shortages in basic PPE including facemasks were also reported particularly in the first wave, including for frontline healthcare workers, undermining government messaging on the importance of these measures.

- Apart from health education, behavior change interventions should address pragmatic and implementation challenges and devise viable ways to sustain behavior changes which requires working closely with interdisciplinary ministries such as transport, labor, media, education, and environment.[101] There is scope for the GoN to strengthen cross-cutting work to improve the prospects for success from behavior change interventions.

- Targeted interventions, which have been implemented to varying degrees so far, could make a difference. Simple and practical nudges such as the use of appropriately distanced circles (marks) for queue in government facilities could help maintain physical distancing.

- Very specific and tailored measures are needed for specific groups of populations like children, people with disabilities, daily wage earners, and urban poor. These segments of population may experience barriers in retrieving information, care and support that could be different from general population which makes them more vulnerable to the disease.

- As there were more than 2,000 activities related to risk communication from partner organizations, it was difficult to track if those activities were based on evidence. Further work in these areas could help in developing tailored behavior change messages that could be more effective than conventional messages targeted to address simultaneously all types of audiences.

- One door data recording and reporting policy urged by MoH. Although there were lots of difficulties on accessing technology in Local Level Government (LLGs) have shown their high level of technology adaptation on COVID-19 case reporting or Vaccine QR-code verification. This fact shows the readiness for adopting digital health system in Nepal.

- Data presented in this chapter also point to a need for further research to better understand the link between different RCCE approaches and behaviour change effects (if any). The compliance also needs to be checked. Data from community rapid assessments suggest some of these (e.g., radio and TV programmes) do positively influence COVID-19 risk perception but behaviour change effects linked to this appear to have been limited in Nepal. There is a need to better understand reasons for this, and to consider what modifications may be needed to strategy or message content to enhance effects.

6. Surveillance and epidemiological investigation

Summary

- Before the pandemic, the Early Warning and Reporting System (EWARS) was the main mechanism for infectious disease surveillance in Nepal. This system also supported SARI surveillance. COVID-19 surveillance systems appear to have been developed largely independently of this, linked to DHIS 2.
- There were notable limitations to situational awareness through surveillance systems throughout the pandemic. Having additional details in data that allows disaggregation of COVID-19 cases by vaccination status could be useful from planning perspective. Although most of the data were reported in crude numbers, having robust denominators for the data could allow calculation of rates that allow comparison of data across population subgroups.
- Two phases of sero-prevalence studies were conducted during the pandemic period. In the first phase (09-22 October 2020) the sero-prevalence was found to be 11.9% while in the second phase (5 July and 14 August 2021) it was 68.6%. Environmental genomic surveillance in Kathmandu valley from 26 July-1 December 2020 revealed that 16 out of 20 sites (80%) had detectable SARS-CoV-2.

6.1. Preparedness before the pandemic

The Disease Surveillance and Research Section in EDCD of DoHS is responsible for infectious disease surveillance in Nepal. Early Warning and Reporting System (EWARS), a hospital-based sentinel surveillance system, complements HMIS data by providing timely reporting for early detection of selected vector-, water-, and food-borne diseases with outbreak potential.[129]

EWARS was established in 1997 with 8 sentinel sites and was expanded to 24 sites in 1998, 26 sites in 2002, 28 sites in 2003, 40 sites in 2008, and 82 sites in 2016. In May 2019, additional 36 sites (private hospitals and medical colleges across Nepal) were declared as sentinel sites by the DoHS increasing the number of sentinel sites to 118. [130, 131 132] Although the implementation of an integrated disease surveillance system is listed as one of the objectives under section 8 of the National Health Sector Strategy for 2015-20[133], the recent pandemic has served to ignite the discussion further. A review of Influenza Like Illness (ILI) and Severe Acute Respiratory Infections (SARI) surveillance systems to improve harmonisation with wider surveillance systems and improve nationwide coverage had been planned for some time in 2020-21, but had not been carried out by the time the first COVID-19 cases were reported in-country.[134]

6.2. COVID-19 surveillance and its integration into routine information system

NHRC, in collaboration with Kathmandu University School of Medical Sciences performed active surveillance of suspected COVID-19 cases through telephone interviews, tracking individuals who had returned from foreign countries within 21 days as of 31 March 2020. The list of returnees was

obtained from ward/municipality offices and self-declaration forms completed at the POE in airport. The process also involved snowball sampling from the first contact foreign returnees about the information of their friends/neighbors or relatives who have returned from other countries within 21 days. The surveillance process tracked Acute Respiratory Infection and COVID-19 related symptoms among the foreign returnees. A total of 5,450 individuals were traced through the telephone. All symptomatic cases identified through the telephone interviews were referred to EDCD. Contact tracing was also done from EDCD positive cases were also identified through call centres. List of all positive cases are received at EDCD. Positive cases are contacted by call center (first call) Follow up call are made at 3 days interval till recovered. A standard format is filled up during 1st call and follow up calls. The extension for EDCD call center was 1115. According to EDCD Call Center 1115 (Incoming), till 30th Jan 2022, total calls received were 363,367 and the total number of calls answered were 308,224. Suspected cases identified through call centers were 8,033 and rumors/Infodemics, misinformation and concerns recorded was 565. Regarding follow up Extension Call Center, the total case management (first call) was 489,260 and the number of total follow up calls made (KTM valley) was 128,641. Total home isolation cases reached through follow up calls was 103,956. Total query related to COVID received through follow up call was 10,269 and number of total calls responded through SMS was 40 (New intervention)

The government integrated COVID-19 case reporting laboratories and health facilities in the DHIS 2 system that has been used for routine reporting from both the public and private health facilities. Under this system, facilities are required to report data on a daily basis. Case definitions are presented in Table 5.

The case definition for COVID-19 used for surveillance purposes evolved over time, and for the initial stages of the pandemic (before transmission had become established within Nepal) focused on travel-related importations. For example, version-1 of case definition was targeted more on patients travelling from Wuhan, China which was revised later to include countries with community transmission. As the number of cases started increasing in India, the case definition was further revised to include patients from India although this country was not in community transmission phase at that time. After rapid increase in cases in different districts within Nepal including Dhangadhi, Baglung and Udayapur, a new version of case definition was released and used.[135] The current case definition aligns closely with the WHO's case definition. However, evidence is lacking on how these changing case definitions impacted on the number of COVID-19 cases.

The EDCD performs the epidemiological analysis of surveillance data and presents key results with recommendations to the ICS for decision making. At present, however, the range of fields against which the EDCD can report from routine systems remains limited, with implications for the kinds of information available to support decision-making. There is currently no facility for identifying unique individuals through the testing system, so that reported case numbers may be artificially inflated where individuals have tested positive more than once in the course of a single illness episode. In addition, case numbers and mortality continue to be reported as raw figures rather than rates (and therefore also without age adjustment). Although the data projected from census 2011 were used as denominator for some statistical extrapolation, the more recent data could improve the accuracy.

Routine surveillance data continues to lack important details that could be used for planning purposes, including the outcome of disease among vaccinated and unvaccinated individuals. There was also a lack of real time data on COVID-19 cases based on clinical features and treatment they have been receiving that could be useful for providing guidance for clinical decision making. Some of these are linked to long-standing issues in ensuring robust, and timely, reported from health facilities to the MoHP.

Table 5: Case definitions used in COVID-19 surveillance

Suspected case of SARS-CoV-2 infection	Probable case of SARS-CoV-2 infection	Confirmed case of SARS-CoV-2 infection
[A] A person who meets the clinical **AND** epidemiological criteria: **Clinical Criteria:** • Acute onset of fever AND cough; OR • Acute onset **of ANY THREE OR MORE** of the following signs or symptoms: Fever, cough, general weakness/fatigue [1], headache, myalgia, sore throat, coryza, dyspnoea, anorexia/nausea/vomiting[1], diarrhoea, altered mental status. **AND** **Epidemiological Criteria:** • Residing or working in an **area with high risk of transmission of virus:** closed residential settings, humanitarian settings such as camp and camp-like settings for displaced persons; anytime within the 14 days prior to symptom onset; or • Residing or travel to an **area with community transmission** anytime within the 14 days prior to symptom onset; or • Working in **any health care setting**, including within health facilities or within the community; any time within the 14 days prior of symptom onset. **[B]** A patient with **severe acute respiratory illness:** (SARI: acute respiratory infection with history of fever or measured fever of ≥ 38 C°; and cough; with onset within the last 10 days; and requires hospitalization). **[C]** Asymptomatic person not meeting epidemiologic criteria with a **positive SARS-CoV-2 Antigen-RDT[2]** [1]Signs separated with slash (/) are to be counted as one sign. [2]NAAT is required for confirmation, see Diagnostic testing for SARS-CoV-2	**[A]** A patient who meets **clinical criteria** above **AND** is a **contact of a probable or confirmed case**, or linked to a [3] **COVID-19 cluster** **[B]** A **suspect case with chest imaging** showing findings suggestive of COVID-19 disease4 **[C]** A person with recent onset of **anosmia** (loss of smell) or **ageusia** (loss of taste) in the absence of any other identified cause. **[D]** Death, not otherwise explained, in an adult with **respiratory distress** preceding death AND **was a contact of a probable or confirmed case** or linked to a **COVID-19 cluster3** [3]A group of symptomatic individuals linked by time, geographic location and common exposures, containing at least **one NAAT- confirmed** case or at least **two** epidemiologically linked, symptomatic (meeting clinical criteria of Suspect case definition A or B) persons with **positive Ag- RDTs** (based on ≥97% specificity of test and desired >99.9% probability of at least one positive result being a true positive) [4]Typical chest imaging findings suggestive of COVID-19 include the following: • **Chest radiography**: hazy opacities, often rounded in morphology, with peripheral and lower lung distribution • **Chest CT**: multiple bilateral ground glass opacities, often rounded in morphology, with peripheral and lower lung distribution · **Lung ultrasound**: thickened pleural lines, B lines (multifocal, discrete, or confluent), consolidative patterns with or without air bronchograms.	**[A]** A person with a positive **Nucleic Acid Amplification Test (NAAT)** **[B]** A person with a **positive SARS-CoV-2 Antigen-RDT AND** meeting either the **probable case definition or suspect criteria A OR B** **[C]** An **asymptomatic person with a positive SARS-CoV-2 Antigen-RDT** who is a **contact of a probable or confirmed** case

The MoHP also strengthened the passive surveillance system to track influenza episodes in the population with an objective to be able to detect any unusual activity as well as to keep track of types of organisms causing respiratory illness in the communities.[129] Sentinel sites captured the outpatient clinic-based ILI cases[129] or admitted cases of SARI cases[4]. SARI cases did not show a notable surge during the pandemic period.

Recently, with the support from partner organization, NPHL has developed the integrated Influenza-SARS-CoV-2 sentinel surveillance plan and expanding the testing to Provincial Public Health Laboratories using the partner-supported CDC multiplex RT-PCR for Influenza and SARS-CoV-2.

6.3. Sero-surveillance

Two phases of sero-prevalence studies have been carried out as of October 2021. The first sero-prevalence study was carried out from 09 to 22 October 2020, as a supplementary exercise to the national surveillance program for COVID-19. In this cross-sectional study, serum IgG was measured in community-based participants. Serum IgG usually peaks by around 5 weeks after infection. The study was carried out among 3,040 participants aged 6 months or above irrespective of past history of COVID-19 infection, symptoms, and other medical conditions and those living in Nepal for a continuous period of at least 4 weeks prior to the first blood sampling date. In the study, the national crude sero-prevalence was found to be 11.9% and the weighted percentage was 14.4%. Madhesh Province seemed the most affected province with prevalence of 27.3%. Bagmati province had a sero-prevalence of 20.7%. The findings indicated that a large proportion of the population got infected without being diagnosed (0.3% caseload prevalence vs. 14.4% Sero-prevalence).[5]

Preliminary findings from the second phase of the sero prevalence study have also been released. This study was conducted among 13,161 samples between 5 July and 14 August 2021 and showed an unweighted population prevalence of 68.6%. In the study, 90% people who have received full vaccination (2 dose in case of Verocell/AstraZeneca/Covishield or 1 dose of J&J) had antibody in their blood samples which was 80% among the people who received only 1st dose of the COVID-19 vaccine. [136]

6.4. Genomic Surveillance

Nepal had limited capacity for genomic surveillance at the beginning of the pandemic, and a small number of genomic studies have been conducted so far. Environmental genomic surveillance was used for the rapid identification of SARS-CoV-2 variants circulating in the community. In a study conducted in 20 selected sites in the Kathmandu Valley from 26 July to 1 December 2020, sewage samples from 16 sites (80%) had detectable SARS-CoV-2. A total of 41 mutations were observed in the SARS-CoV-2 genome of which 9 mutations were novel.[137] NPHL started genomic surveillance for gene sequencing in support of partners from September 2021. In the beginning, it was challenging to

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[4] Patients with an acute respiratory tract infection with history of fever or fever measured more than or equal to 38℃ with presence of cough with onset within the last 10 days and requiring hospital admission

conduct gene sequencing due to lack of trained manpower. The partner organization assisted in the establishment of whole genome sequencing technology (Nanopore DNA sequencing machine) that is small and cost-effective. The partner organization also supported with human resources as well. Then, for genomic sequencing, a Standard Operating Procedure was created. All of the sequences were not detected in the early stages of gene sequencing because they were unreadable. Later on, though, NPHL began to successfully do gene sequencing. Approximately 250 genes have been sequenced so far. The gene sequencing is turned to readable form using bioinformatics. Some representative samples were sent to the WHO collaborating centre for quality control of gene sequencing. The alpha, delta, and kappa variants were detected in Nepal. The delta variant outcompeted the kappa and alpha variants indicating that the second wave in Nepal was primarily due to the delta variant. [49]

6.5.   Capturing mortality data in Nepal

Deaths taking place in health facilities are reported on a daily basis in DHIS 2. For deaths occurring at home, family members are required to report administration before cremation. However, a number of deaths may have been missed if family did not report to the administration.

6.6.   Lessons and future directions

- The case definition used for surveillance purposes evolved over time, initially reflecting a focus on case importations but later being adjusted to reflect the extent of community transmission within Nepal. However, data are lacking on how the changing case definition, or alterations in testing strategy, impacted case identification. Analysis of data before and after changes in case definition or before and after testing strategy changes could be useful in having better understanding of how disease evolved over time.

- Although all cases were treated in hospital in the earlier stage of the pandemic, government gradually promoted home isolation for asymptomatic cases. It is not clear how the health facilities reported cases in individuals reporting to health facilities for repeated test, and there is a risk of double-counting for these cases. It could be beneficial to keep track of such information through periodic evaluation.

- Although the COVID-19 reporting through COVID-19 IMU in DHIS 2 platform that facilitated daily reporting process, reported data lacked sufficient granularity to properly inform decision-making. The number of mild, moderate, and severe cases and case and mortality data disaggregated by vaccination status would be particularly useful from a planning perspective as the rollout of COVID-19 vaccines gathers pace.

- Family members are required to report the death to local administration before cremating the dead body. However, the extent to which the community people complied to this provision is less clear. Active surveillance of the deaths occurring in community level could be an option to capture the COVID-19 deaths more precisely. Formation of powerful structures like CDC with expertise on

disease and mortality surveillance and epidemiological investigation and modeling could be useful for future pandemic response.

- There has been work underway for integration of multiple information systems. Such integration could provide policy makers and planners with multiple data sources in a single platform thereby facilitating evidence informed decision making. The planned Centre for Disease Control will be an important addition to Nepal's capacity to assess and respond to this information.

- Artificial Intelligence (AI)-powered surveillance systems are helping health systems and public health agencies with their response to the Covid-19 pandemic. AI can be useful in extracting information from different social medias, calls and news sites which can be used contact tracing, monitoring COVID-19 cases, forecasting the spread of virus, and developing early warning systems The data can also be used for predicting morbidity and mortality, and efficient way can be useful for surveillance of COVID-19.

- Clinical symptoms of COVID-19 patients and the treatments provided to them were not available to EDCD on real time basis. These data could be useful to monitor the service being provided to COVID-19 patients and track changes in symptoms if any.

- Regular monitoring the virus's gene allows us to control the spread of infection, allowing us to make appropriate policy decisions. Because of the mobility of people, every virus observed anywhere in the world has a potential of making its way to Nepal. The start of gene sequencing in Nepal has allowed us to learn more about the virus's status, which has aided us in developing prevention and control strategies.

7.   Points of entry, international travel and transport, and mass gatherings

Summary

- Nepal started thermal scanning in Tribhuvan International Airport (TIA), particularly focusing on travellers arriving in Nepal from countries reporting COVID-19; eventually all international travel was restricted. Domestic travel was also restricted with nationwide lockdown imposed on 24 March 2020 which was extended through regular review meeting till 21 July 2020. Domestic travel was relaxed and tightened up based on the number of cases reported.

- Local governments with support from EDCD took the responsibility for setting up health desks at ground crossing points (GCPs). Based on the thermal screening and observation of symptoms, travellers were either referred for further test or were sent to quarantine.

- From 30 July 2021, a proposal tabled for implementing 'smart lockdown' was passed. Government developed a system for scoring the COVID-19 situation into Red, Amber, Yellow and Green and enforced hard, mixed, soft, and minimal lockdown measures respectively in response, according to the situation rating.

- Mass gatherings have been restricted for most of the pandemic. The GoN resorted to Infectious Diseases Act 2020 (1964) in enforcing restrictive measures which provided government with the authority to take necessary actions and issue necessary orders to prevent development or spread of infectious diseases.

On 24 January 2020, GoN installed and started thermal scanning and 24/7 operation of the Health desk at Tribhuvan International Airport (TIA).[47] In the initial stage, travelers coming from or via high risk countries were being individually scanned using infrared thermometer. People reporting fever, cough or shortness of breath at the TIA health desk were further investigated, treated and counseled. [138]

As the number of COVID-19 cases was increasing globally and in Nepal, all promotional activities related to the Visit Nepal 2020 campaign, that aimed to attract international tourist to Nepal were postponed until further notice on 3 March 2020. [139] The GoN issued a nationwide lockdown from 24 March 2020 which was subsequently extended till 21 July 2020, prohibiting domestic and international travels, border closures, and closure of non-essential services. Nepal sealed the border with India in March 2020 with the coronavirus in full rampage, only allowing trucks carrying vital supplies to pass.[47] The second lockdown was more targeted towards specific districts with high number of cases, and started from the end of April 2021.

7.1.   Entry and exit screening

Through the first meeting of HLCC on 1 March 2020, health desks were established in Pashupatinagar, Kakarbhitta, Jogbani, Jayanagar, Raksual, Sunauli, Jamunaha, and Gaddachauki.[140, 141] The GoN gradually expanded the installation of health desks in other ground crossing points (GCPs). Local governments were usually responsible for deploying medical/health personnel to GCPs with

functional health desks. Health desks were mandated to screen people with possible COVID-19. They coordinate with local governments to refer people for further tests, or sent to quarantine or isolation centres.[57, 142] Till 31st December 2021, Nepal has managed the flow at 17 health desks. Among them Kakarbhitta, Madar, Jamunaha have their building (permanent/semi-permanent); 4 health desks buildings at Trinagar, Gaddachauki, Rani and Gaur are under-construction. The health desks buildings at TIA, Jhulaghat, Pulghat, Krishnanagar, Belahaiya, Inarwa (Birgunj), Birtamod (Jaleshwor),Pashupatinagar, Rasuagadhi and Tatopani are yet to be constructed.

Figure 18: Health Desks functional across Nepal
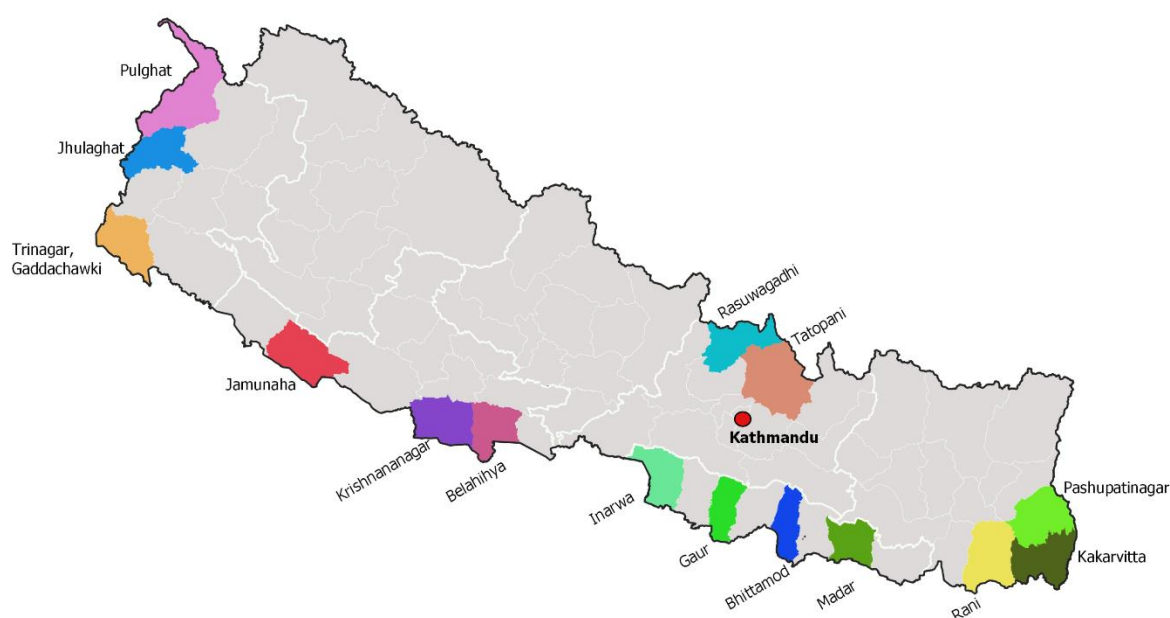
The effectiveness of the health desk screening was constrained by limited availability of resources. Resource constraints meant that testing all returnees was not possible, particularly at GCPs. Nepal and India imposed lockdowns following similar timelines and there were a large number of returnees to Nepal from India. Thousands of people were stranded at the border with limited or no social distancing measures in place. In some borders, it was not possible to record the details and screen all returnees because of the high number of people returning.[137]

Capacity and quality of health desk operations were a concern throughout the pandemic period. According to EDCD, none of the GCPs were fully equipped to meet the criteria stipulated by the International Health Regulation (IHR) 2005. Kakarbhitta and Jamunaha have screening area inside their premises while the rest are operating mostly in tents. All health desks except Pashupatinagar have testing area. Pashupatinagar refers suspected individuals to nearest PHCC for lab-testing. All have recording and recording unit (either in tents or building). Kakarbhitta, Belahaiya, Jamunaha and Gaddachauki have waiting space for travelers for testing and holding them before referral. Kakarbhitta

and Jamunaha have space for waste management. Kakarbhitta, Madar ,Jamunaha & Belahiya have water supply and toilets for staffs and travelers. Jamunaha and Belahaiya have IEC corner equipped with pamphlets. However, No health desks have proper Risk Communication materials and audio-visual aids.

Photo 5: Health desks at Mechinagar, Kakarbhitta, Source: EDCD

Regarding currently working health workers at health desk., a total of 175 health workers are currently working at health desk of Nepal. There are total 12 medical officers, 55 health assistants, 50 staff nurses, 29 lab technicians and 29 office assistants. In TIA, there are total 26 health workers working at health desk which consist of 2 medical officers, 10 health assistants, 10 staff nurses, 2 lab technicians and 29 office assistants.

Table 6 shows the province-wise performance of ground crossing health desk from March 19, 2021, to December 31, 2021. The total number of screened individuals was 831,603 and of them antigen test was conducted among 279,368 individuals with 4,635 positive cases by antigen test.

Table 6: Performance of ground crossing health desk from March 19, 2020 (Chaitra 06, 2077) and December 31, 2022 (Poush 16, 2078)

POE at provinces	SUM of Screened Individuals	SUM of Tests (AG)	SUM of Positive (AG)
Province 1	98,145	13,001	513
Madhesh Province	51,493	14289	255
Lumbini Province	413,358	83,779	652
Sudurpaschim Province	268,607	168,299	3,215
Grand Total	831,603	279,368	4,635

Note: Border on the northern side of Bagmati Province are not open

The 'Protocol for COVID-19 Screening at the point of entry' and 'Protocol for Health care facilities for COVID-19 case Management' were the two key documents guiding the process.[143] As per the plan, all travellers entering Nepal were to be subjected to temperature screening. In the next step, they were asked and observed if they have been showing any symptoms related to COVID-19. The temperature of all the passengers was being measured through thermal scanner established at TIA Health desk. Temperature measured above 100-degree Fahrenheit were being sent to Sukraraj Tropical and Infectious Disease Hospital for further investigation and treatment. But the

There was also provision of exit screening at TIA. The temperature of departing passengers were taken by the public health personnel. Departing passenger whose temperature showed 38°C (100.4°F) or above were required to submit Health Declaration Form and were quarantined in the terminal as well as in the aircraft.[144]

7.2.   Travel restrictions and health education for travel behaviour

International travel restrictions

Although in the early stage of the pandemic international travel was allowed with public health measures at points of entry, all entry visas were suspended, international flights were stopped and GCPs of entry were shut down as the number of COVID-19 cases and countries affected started to surge. [145] On 13th March 2020, following the recommendations and counter measures to be taken by the countries to cope with the pandemic and assimilating the IHR, the GoN decided to enforce additional provisions effective from 14 March 2020. These included suspension of on-arrival visas for all foreigners and requirement for mandatory PCR testing within 7 days of arrival for all foreigners with prior valid visa. While the on-arrival visa granted for NRN was suspended, those willing to travel for compelling reasons were also required to submit PCR test results issued within 7 days before arrival. Similarly, all the land ports of entry in Nepal remained closed for arrival to foreigners from third countries. Arrivals were instead requested to use TIA only. All the permits for mountaineering expeditions issued, and to be issued, for spring 2020 season were suspended. [146, 147]

On 18 March 2020 the HLCC announced the introduction of arrival restrictions, effective from 20 March 2020. All passengers coming through direct flights, having a transit at, and taking the first flight of their origin from, Europe, West-Asia, all the Gulf-Countries, Turkey, Malaysia, South Korea, and Japan were subject to arrival restrictions. Nepal issued protocol for COVID-19 screening at POE and a guideline on safety measures to be followed at the POE in the context of COVID-19 pandemic which served as guiding document.[148] With the imposition of nationwide lockdown on 24 March 2020, all international flights were suspended. However, Nepalese who had already reached the border and had been stranded were allowed to enter the country. All the returnees were subject to health screening and mandatory quarantine for 14 days [138, 149]

Over time, Nepal gradually started opening up the international flights with precautions particularly from countries less affected from COVID-19. Flights were allowed to operate with limited number

of passengers and quarantine was made mandatory on arrival.[150] The mandatory duration of quarantine was also reduced to 10 days and then to 7 days and was subsequently eliminated altogether on 23 September 2021 as case numbers in second wave started declining.[151] On-arrival visas were also resumed for all vaccinated foreign travelers in a bid to bring its virus-ravaged tourism industry back to life.[151] The GoN mandated that visitors should have received their last dose of the COVID-19 vaccine at least 14 full days prior to entering Nepal. On arrival visas were not granted for those who were not vaccinated, or for those who were partially vaccinated.[152] After the declaration of Omicron SARS-COV-2 variant of concern on November 26, Nepal issued travel restriction from the South Africa, Hong Kong, Zimbabwe, Botswana, Namibia, Lesotho, Eswatini, Malawi and Mozambique effective from December 2, 2021.[153]

Restriction in domestic travel

As stringent lockdown measures and domestic travel restrictions were imposed from 24 March 2020 with very short notice, daily wage earners, particularly staying in Kathmandu valley, had difficulty in travelling back home. [154] During the period of lockdown, the everyday groceries, fruit and vegetable shops, department stores, dairy shop, stationery shops and other shops for other essential commodities were allotted defined time slots for opening. However, having limited time slots for shops received criticism as a greater number of consumers had to visit shops in defined time slots thereby leading to crowding in the stores which could heighten the risk of disease transmission.

While the lockdown worked to contain COVID-19 and buy time for preparation, the strict measures had severe consequences on the economy. Urban daily wage earners were the most vulnerable. [126] In a press release, Faris Hadad-Zervos, the World Bank Country Director for Nepal, warned that those in the informal sector were at dire risk of falling into extreme poverty. Lockdowns took a heavy toll on children and child poverty soared.[155] A report from partner organizations estimated that the number of children living in poverty in Nepal grew substantially as a result of the lockdown.[156]

Considering the risk to the overall economy and health of people, the government took steps moving away from sweeping stringent lockdown imposed simultaneously throughout the country to risk-based restrictions. The MoHP developed a risk categorization of districts based on available epidemiological and health systems information to aid in the management of the lock-down release process on last week of May 2020.[157, 158]

The GoN started easing lockdown measures from July 2020. Short-route public transportation vehicles were permitted to resume services, with appropriate safety precautions in place, from the first week of July 2020. By the 'short distance', the government meant within Kathmandu valley in the case of Kathmandu, Lalitpur and Bhaktapur district and within the given district in the case of other districts. With the easing of public transportation, facemasks and other precautionary measures were made mandatory. The MoHA shared a circular and directed to local administrations of all 77 districts and the Nepal Police Headquarters to take action against those not wearing masks outside their homes in order to contain possible spread of COVID-19 which is in line with the provisions of Infectious Disease Act, 2020, BS.[159] As per the decision on 5 August 2020, districts CCMC (DCCMC) were also

assigned responsibility of taking decision on closing off high-risk areas/districts following risk assessment and make arrangement for more COVID-19 tests. Group meetings, parties, seminars and other gatherings in hotels and restaurants were also restricted. [160]

Despite opening up the transportation services addressing the livelihood problem of many people, government was imposing measures to limit the non-urgent mobility. Vehicles were initially allowed to operate based on odd and even rule (except those related to essential services) which received wide criticism from health professionals and transport entrepreneurs, citing that lower number of vehicles operating would lead to crowding and thus heighten the risk of disease transmission, government removed the odd and even rule. The lockdown was gradually eased after 21 July 2020. [161]

On 30 July 2021, a proposal to enforce a 'smart lockdown' was approved, according to which districts would be categorized with respect to their COVID-19 status and restrictions measures will be enforced accordingly.[158, 162] Government developed a system for scoring the COVID-19 situation in community in Red, Amber, Yellow and Green. Government used 5 criteria: weekly average positivity rate, change in percentage in infection compared to previous week, weekly new cases per million, bed occupancy percentage, and number of deaths per million per week or cumulative for scoring any area into Red, Amber, Yellow and Green.[163] As with some other decisions, this threshold value-based decision-making algorithm was not practiced at local level as some indicators like weekly cases per million, deaths per million were not possible for calculation in the local level thus making not applicable.

Health education for travel behavior

Health education during the time of pandemic mainly included display of appropriate messaging in the form of information, education, and communication (IEC) posters and leaflets targeted towards both travelers and border communities. Health education messages were displayed in TIA in Nepali, English, and some international languages. [163] The extent to which health education messages were disseminated at GCPs appears to have been variable, however. Two of the help desks i.e., Jamunaha and Belahaiya had IEC corner equipped with pamphlets. However, no health desks have proper Risk Communication materials and audio-visual aids.

Isolation and quarantine requirements

From 14 March 2020, government mandated quarantine of 14 days from the date of arrival later reduced to 10 days and then to 7 days. Effective from third week of September 2021, Nepal eliminated the seven-day quarantine requirement.[151, 152] Isolation and Quarantine services are discussed in more details in Chapter 10.

7.3.   Mass gatherings

Starting from March 2020, government decided to close schools and discouraged gatherings of more than 25 people. Social functions with less than 25 people were allowed with strict compliance to social distancing of at least three feet between individuals. A newly written law passed through Parliament,

providing special powers to the government to address the pandemic situation. Government also requested those above 60 years and below 12 years of age, pregnant and new mothers, those with serious illness and reduced immunity not to travel. [47]

As the number of cases started increasing, local government took lead of the process and prohibited mass gathering. Panicked public also refrained from gatherings despite festival like Teej were to be celebrated. The public were often blocking the roads not allowing any new person to enter into the community. The government temporarily closed down public places such as movie theatres, cultural centres, gymnasiums, night clubs, swimming pools, stadiums, and museums during most of the period in the first and second wave of COVID-19 pandemic. [47, 56, 57]

The MoHP developed a risk categorization of districts based on available epidemiological and health systems information to aid in the management of the lock-down release process on last week of May 2020.[157] With this exercise, government of Nepal (GoN) also further eased the lockdown 22 July 2020.[157] Considering the rising number of cases, on 5 August 2020, MoHA issued press release instructing all security agencies and the DAOs for compliance and effective enforcement directives like wearing mask, restriction of passenger vehicles except those related to essential supplies in Kathmandu valley, odd and even rationing of public and private vehicles (except those related to essential services) in Kathmandu and districts with more than 200 active cases. DCCMCs were also assigned responsibility for taking decisions on closing off high-risk areas/districts following risk assessment and making arrangements for more COVID-19 tests. Group meetings, parties, seminars and other gatherings in hotels and restaurants were also restricted.[160] Offices were requested to work virtually.

But as COVID-19 infections receded in November 2020, social distancing measures lapsed to dangerous lows. With the decline in the number of cases, life was resumed to normal level with large political rallies, marriage ceremonies, and festival celebrations. In most of the municipalities, schools and colleges re-opened with little to no social distancing. [164] Large political rallies, both in favor and against government could also have conveyed false sense of security against COVID-19.

7.4.   Monitoring of the implementation status

Home quarantine was monitored by health workers, elected local officials, and municipalities through home visits and through phone calls. Although CICTTs had also been mobilized for the same purpose, their involvement was limited.[165] Monitoring status also varied based on how active the local governments are on COVID-19 response and human resource available. For example, Budhanilkantha municipality visited people in home isolation and quarantine with foods so that they don't have to come out of home. Medical team in Thaha municipality also visited every house with people in home quarantine, counseled them about the provisions to be made at household level, and did follow-up through medical doctor every 3-4 days.[57]

7.5.   Legal provisions for action

The government resorted to Infectious Disease Act 2020 (1964) to fight the pandemic which provided legal basis for imposing restrictive measures and taking action for non-compliance. Section 2(1) of the Act provides GoN the authority to take 'necessary action' and 'issue necessary orders applicable to the general public or a group of any persons' to 'root out or prevent' the development or spread of an infectious disease. In order to make necessary arrangements for the implementation of this order issued in accordance with sub clause (2) of clause 2 of the Act, authority was designated to CDOs of Nepal. For this purpose, the CDOs could exercise the authority as per the Local Administration Act, 2028 (1971). Any person defying or obstructing the implementation of this order issued under the Contagious Diseases Act, 2020 (1964) shall be subject to punishment in according with that Act.

This became the basis for stringent restrictive measures by the local, provincial, and federal governments in the bid to contain COVID-19. [47] Highlighting the problems created due to lack of unified pandemic law, the Supreme Court directed the government to formulate a pandemic law. In response to the order, the government formulated COVID-19 Crisis Management Ordinance (CMO). The ordinance provided legal basis for conducting prevention, controlling, diagnosis and treatment work of COVID-19 in a unified manner. The ordinance made the provisions of a Covid-19 Directive Committee under the Prime Minister to provide overall directions to COVID-19 Crisis Management Centre under the committee. As per the ordinance, anyone violating the orders issued under the ordinance could be fined up to Rs 100,000 in case of individuals and Rs500,000 in case of institutions. Similarly, the ordinance also made provision for fines of Rs100 for those not wearing masks in public places and Rs 200 to those who violate the restriction or the prohibitory rules imposed. The vehicles breaching the restrictive measures could be fined Rs 2,000 to Rs 5,000. The Ordinance also had provision that the government deploy retired doctors and health workers who are on leave for study in combating the pandemic. CDO could be given the executive power for implementing the provisions made under the ordinance.[150]

7.6.   Lessons and future directions

- Although government decided to set up health desks, screen returnee for COVID-19, and provide isolation and quarantine services, many PoEs lacked IHR-recommended infrastructures. While the pandemic was ongoing, just before the second wave began, there were political rallies and protests in favor of and against government. Non-compliance to public health measures from political leaders set a negative example. In the following months, the administration's decision to impose restrictive measures in festival/jatra celebrations faced huge resistance from the public.
- As the disease was highly stigmatized, because of the fear of being discriminated against in the community, some of the patients were reporting wrong contact details which made it difficult to trace contacts. Similarly, there was a large influx of returnees from India and other countries which further complicated the contact process.
- Due to fear of COVID-19 transmission at the community level, DCCMC faced resistance from locals while setting up the isolation and quarantine services in different places. Although the

government signed MoU with private hotels for setting up the quarantine services, most of the hotels were not willing to provide services at the cost specified by the government. As most of the returnees from abroad were either those who lost their job because of COVID-19 or those who were forced to stay in long unpaid leaves, they found it difficult to pay for the hotel quarantine services.

- Imposing stringent measures like lockdown with very short notice had negative impact in livelihood of wage earners. Some of those workers chose to travel back home walking for weeks. As the ground crossing points were reduced, returnees from India entered through porous border, without being screened for the disease which further increased the risk of disease transmission. It was a learning that flexible time should be provided for people to return home while imposing such stringent measures.

- There was notable non-compliance (manifested in the form of large political rallies, large gathering in festival celebration, Jatras and marriage ceremonies, and crowded public places) to preventive measures when restrictive measures were relaxed. Risk communication with close inter-ministerial coordination and strategic engagement of relevant stakeholders could be an effective strategy ensuring compliance.

- Case management at point of entry and safe transport to their respective districts had been a challenge. Multisectoral approach and dividing the responsibility among various sectors could be useful for future pandemic response.

8. Laboratories and diagnostics

Summary

- The Nepal Public Health Laboratory (NPHL) started RT-PCR testing for COVID-19 in March 2020. Nepal rapidly expanded its testing capacity with a total of 104 laboratories providing RT-PCR tests for COVID-19 as of 31 December 2021. The extent and speed of this expansion in testing capacity can be considered an important success story in the context of the response. The GoN continuously updated the guideline for COVID-19 testing based on existing testing capacity and the latest evidence.

- Antibody based Rapid Diagnostic Tests (RDTs) were useful in expanding the testing capacity for a few months after the pandemic began. However, the government gradually moved to a preference for RT-PCR tests for diagnostic purposes because of their superior sensitivity and specificity profile, using RDTs predominantly for screening at community level. The NPHL performed quality assessments of designated laboratories for COVID-19 on a weekly basis.

- Despite rapid expansion in number at national level, RT-PCR testing capacity has been limited to major centres throughout the pandemic, creating problems of access in outlying areas. This situation was eased to some extent as the government started supplying antigen test kits to local governments. It was particularly useful in areas lacking laboratory capacity for RT-PCR testing and for screening high risk populations at community level.

8.1. Preparedness before the pandemic

NPHL is a national level referral lab which regulates the laboratory services in the country. NPHL is concerned to identify and confirm the agents involved in public health threats, including those which may cause PHEICs. NPHL also conducts laboratory-based surveillance and plays a crucial role during the outbreaks of various emerging and re-emerging diseases for laboratory confirmation of outbreaks. It also operates as a quality assurance body, responsible for registration and licensing of private sector laboratories and blood centers as a focal point for blood safety in the country. Before the pandemic, NPHL had the facility of biosafety level (BSL) II lab with RT-PCR which is in use for testing viral load & Avian Influenza including Swine flu and regular training for biosafety.[166, 167]

8.2. Availability and evolution of laboratory capacity

On 11 March 2020, when WHO declared COVID-19 as a global pandemic, there was only one public diagnostic respiratory virology laboratory - the National Influenza Centre (NIC) at the NPHL.[168] Thus the throat swab collected from the first Nepalese returnee (from Hubei, China) suspected to have COVID-19 was shipped to the WHO designated laboratory in Hong Kong for confirmatory diagnosis on 13 January 2020. This sample subsequently tested positive.[47] In early 2020, Nepal lacked the necessary equipment, infrastructures, supplies and trained human resources necessary for expanding testing capacity to respond the pandemic. [168]

Since mid-March 2020, with support from the partner organization, the MoHP has expanded testing capacity nationwide.[168] On 27 January 2020, the NPHL started 24/7 RT-PCR testing for COVID-19 becoming the first and only laboratory capable of such testing in Nepal.[168] By 27 March 2020, the NPHL had sufficient capacity to operate 24/7 laboratory testing for COVID-19 using RT-PCR technology.[169] By the end of March 2020, with assistance from the Global Outbreak Alert and Response Network (GOARN), Nepal had already prepared more than 20 standard operating procedures covering areas such as COVID-19 testing procedures, laboratory biosafety and biosecurity, biomedical waste handling, and training for NPHL staff. [47, 168]

The need to rapidly expand the testing capacity was quickly recognised as case numbers rose; the NPHL could not meet escalating demand for testing in the face of this. The DoHS and the Nepal Army including other health professionals and lab technician were mobilized to explore the expansion of laboratory services in different facilities.[170] By 22 April 2020, all seven provinces started providing RT-PCR testing at least through one facility within the province. As the number of cases started increasing, testing need surged beyond the RT-PCR testing capacity of even these laboratories. The government therefore introduced Rapid Diagnostic Tests (RDTs) to expand the testing capacity. By mid-April 2020, all districts in the seven provinces had received RDT kits and were using them. [171]

In the initial months of the pandemic, given the limitations of existing RT-PCR testing capacity, the government's strategy was to combine RDT and RT-PCR approaches, using RDTs as the gateway tests for further investigation. The Government issued a testing guideline that instructed health practitioners to carry out follow-up RT-PCR tests among those testing positive on RDT or were negative on RDT test but with symptoms of COVID-19. Similarly, among asymptomatic individuals with a RDT negative result, the RT-PCR test was repeated among randomly selected 10% samples, given the risk of false-negative results for those using rapid tests.[172] The government decision to use RDT tests for diagnostic purposes received criticism amidst emerging evidence of contradictory test results from RDT and RT-PCR tests. [47]

On 7 May 2020, the NPHL published a guideline for pooled PCR testing that was particularly intended to address the limited testing capacity in the country. As per the guideline, pooling could be done at the extraction station by the extraction team. The protocol suggested creating a pool of five samples. If the pooled sample was negative, all five samples were to be reported negative while if the pooled sample turned positive (ct<40) all five individual samples were to be tested to identify specific sample that was positive.[173] Pooled testing is known to be most useful when the vast majority of batches test negative. With increasing prevalence, as the proportion of positives becomes increasingly common, and more pools come up positive, pool testing will not be appropriate.

Private sector actors were consistently advocating to be allowed to perform laboratory testing. On 15 May 2020, the MoHP authorized private and community hospitals to conduct COVID-19 RDTs and on 22 June 2020 the government authorized private laboratories to conduct RT-PCR test complying to the guideline developed by the MoHP.[56] The private laboratories were allowed to charge up to Rs. 5,000 per patient for RT-PCR tests (for non-medically indicated cases) which was later reduced to Rs 4,400 (all costs inclusive) in August 2020 [174] and to Rs 2,000 in September 2020.[47] The MoHP ICS meeting held on 10 February 2021 further reduced the charge for RT-PCR from Rs 2,000 to Rs 1,000

(ceiling for the maximum charge) for PCR testing for COVID-19.[171] The cost was incurred for those who wish to confirm the COVID-19 positivity status for their personal benefit (foreign travel requisition, insurance claim, physical school exam attendance etc.) irrespective of indication by treating physician. However, no charges were required for cases referred from COVID-19 designated hospitals for confirming the diagnosis of the disease when made by the medical physician, and if labeled as a close contact during contact tracing. [175]

As of 31 December 2021, there were a total of 104 laboratories (59 Public and 45 private) providing RT-PCR testing services in Nepal. The distribution of laboratories is notably skewed with slightly more than half of all RT-PCR testing laboratories being concentrated in Bagmati Province. While the number of laboratories providing RT-PCR test services was 56 in Bagmati province, it was 4 in Karnali province as of 31 December 2021.[176] The map also shows how the laboratory service evolved over time from the date of start, to peak of first wave and the second wave. While the number of RT-PCR labs has increased from the peak of first wave and second wave in five out of seven provinces, it has remained stable in Karnali and Sudurpaschim Province.

Figure 19: Expansion of RT-PCR Labs in seven provinces across Nepal over the course of the pandemic
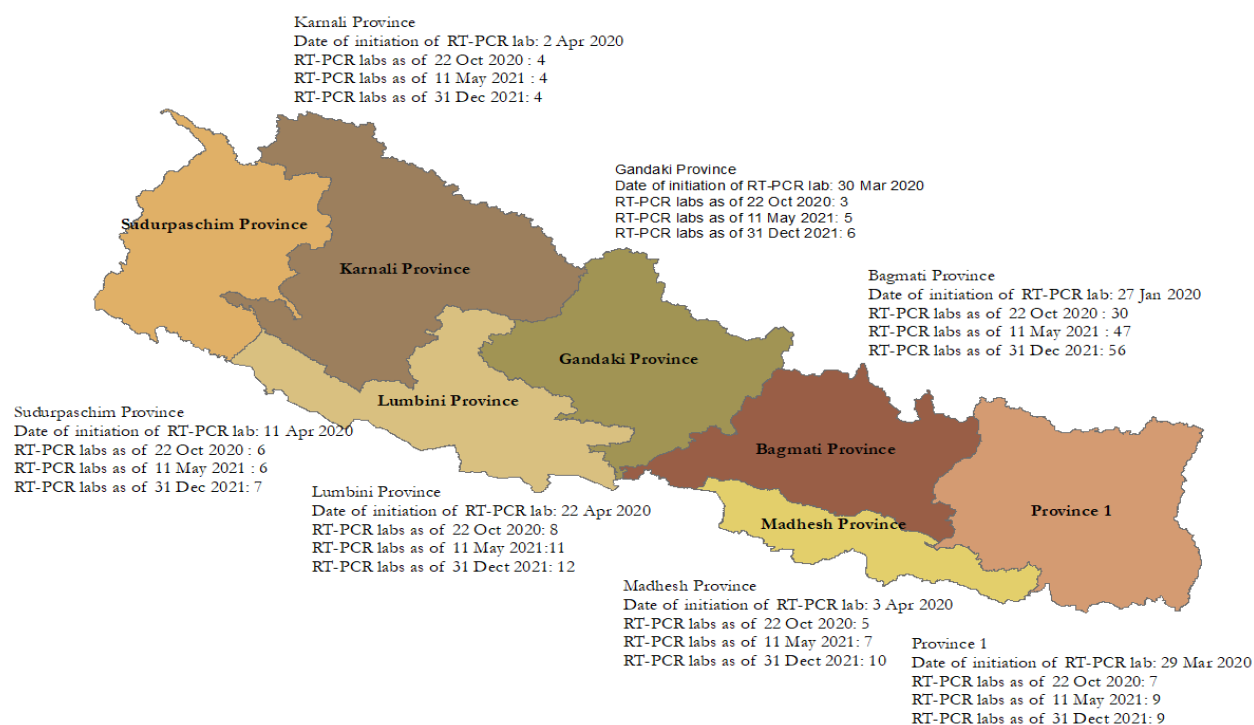
The laboratories providing RT-PCR testing for COVID-19 services were largely concentrated in a few districts within each province. For example, Province 1 has 9 laboratories located mostly located in Morang, Sunsari and Jhapa, while all the laboratories in Gandaki Province are concentrated in Kaski district (Pokhara). The concentration of laboratories in city areas could lead to delay in COVID-19 testing processes for those in outlying areas. [47, 105-108, 140, 148, 177]

Apart from RT-PCR, antigen tests are also being used for testing those with suspected COVID-19. As of 31 December, the NPHL has approved 134 laboratories for performing rapid antigen tests

(using test kits approved from the NPHL). As per guideline, laboratories could provide reports to patients as positive or presumptive negative. All those with presumptive negative reports having COVID-19 symptoms were to be suggested for RT-PCR testing. [178]

8.3.   Testing policies

Throughout the duration of the pandemic, Nepal consistently revised its testing policy to match with the testing capacity of the country. These revisions were mainly intended to make sure that those who are most in need for testing are not deprived of it because of limited testing capacity. Starting from the first week of April 2020, the government revised its testing policy. As per the new policy, lab testing for COVID-19 was only done for individuals who had a travel history or had contacts with people who tested positive for COVID-19 and showed symptoms of the disease. However, COVID-19 testing was performed for all people above 60 years of age showing symptoms of COVID-19. Similarly, all passengers who had travelled in the same flights with positive cases of COVID-19 as well as people who had come in contact with the positive cases were tested for COVID-19. [179]

On 2 June 2020, MoHP released a new testing guideline. The testing guideline indicated that RT-PCR tests to be used for diagnostic purposes while serology tests including rapid tests can be used for surveillance and or research purposes and for screening purposes during discharge from quarantine. The guideline also specified the priority groups for laboratory testing. Priority one included all suspected cases with high risk of infection; priority two included frontline health workers; and individuals in the surrounding community with rapidly increasing infection not covered by previous two criteria were included in priority three. In the guideline, individuals without symptoms and had no contact and travel history and who want to get tested without explicit referral by a physician were considered as non-priority. Guidelines also indicated that those in quarantine who are asymptomatic can be released without any testing after completion of quarantine duration. For those in isolation, all symptomatic cases who completed 14 days and spent 3 days without symptoms or asymptomatic completing 14 days of isolation were not tested as per the guideline. [180]

Further revisions to the guideline on 1 October 2020 specified that antigen-based testing could be used for mass screening, in case results were required urgently, or those being tested were living in congregate setting like barracks, prisons, and elderly care homes.[110] On 13 October 2020, eligibility criteria for free testing were further specified. As per the guideline poor, disabled and helpless citizens, single women, senior citizens, frontline health workers, supportive staff (involved in cleaning), and security forces with symptoms of COVID-19 were eligible for free testing. The guideline also specified that if the above mentioned individuals are covered by any insurance package, the cost is to be borne by the insurance company. [181]

There were challenges associated with frequent changes in testing guidelines. Even after the federal MoHP issued guidelines indicating that RT-PCR test was not required if the individual had completed the recommended duration of quarantine and had no symptoms, some municipalities were reluctant to comply with the guideline. For example, in Budhiganga municipality in Bajura individuals were kept as long as 30 days quarantine, until their test results were assessed. [70]

While some local level actors were themselves reluctant in sending home the individuals who had completed recommended duration of quarantine and had no symptoms, other local level actors could not implement the provision because of pressure from political leaders and others with influence locally.

Although testing policies helped to preserve resources, reductions in the number of tests performed could have notable impacts on the effectiveness of disease control. Continued low testing (below a minimum threshold of testing of 1 person per 100 populations per week) increases the risk that early outbreaks or clusters of COVID-19 are not detected.

8.4. Antigen/ antibody testing at community level

Although antibody based RDT testing was used for diagnostic purposes in the earlier stages of the pandemic when Nepal did not have sufficient testing capacity using RT-PCR technology, the guidelines were later modified confining such tests for surveillance and research purpose. Antigen testing was preferred in cases where an urgent result was required for treatment-related decisions. As per guideline, laboratories could provide reports to patients as positive or presumptive negative from antigen testing. All those with presumptive negative report having COVID-19 symptoms were to be suggested for RT-PCR testing. [178]

Mass testing with antigen testing kits for field based active surveillance and screening was also carried out in different hotspots particularly in Kathmandu Valley where most of COVID-19 cases were concentrated. [182] In the second week of December 2020, the MoHP ICS after reviewing antigen-based community testing from the different hotspots in Kathmandu valley concluded that there was high burden of undetected positive cases in the community (with approximately 8% positivity rate in community-based antigen testing). Based on these findings, the MoHP further decided to rapidly expand community-based screening, testing, and active surveillance using antigen-based test kits in high-risk areas. [183]

In early phases, we heavily relied on rapid antibody tests for screening people in the community. However, later evidence emerged that the results were not very reliable, so we stopped antibody testing. The antibody test kit later expired without being used. In the second wave of the pandemic, antigen test kits were very useful in our community for screening patients.

Senior Public Health Administrator, Province 1

8.5. Specimen collection and transportation

The NPHL released an SOP to guide sample collection and packaging for COVID-19 PCR Testing.[27] Anticipating the challenge of transporting samples for testing from different areas of the country to the NPHL, a local courier agency was used to ship the samples to the NPHL from all 77 districts of Nepal in the first 3 months since the first confirmed case.[168] As there were a limited number of laboratories providing RT-PCR testing for COVID-19, the government also used airlines companies for transporting samples.[64, 184] Arrangements were made to transport specimens collected from COVID-19 clinics and hospitals within Kathmandu valley despite the lockdown provision. [115]

Photo 6: Swab collection at health facility , Source: Swastha Khabar

8.6. Quality assurance of the laboratory testing

The government formulated several guidelines to ensure quality in laboratory testing for COVID-19. On 7 April 2020, a protocol for COVID-19 sample collection and testing was released which was developed by EDCD with support from the Nepal Army, Nepal Armed Police Force, and laboratory professionals.[116] Infection prevention practices in laboratory setting was guided by 'Standard Operating Procedures for Infection Prevention and Control practice in COVID-19 Testing Laboratories' developed by NPHL.[185] Similarly, there were SOPs for which guided the testing procedure using different technology and test kits[186-191], sample collection and packaging[192], sample reception and transport[40] and prevention of false positive and negatives.[193] The government also specified the requirements for setting up COVID-19 PCR laboratory, sample collection, processing and reporting details, storage retention and disposal of specimen and consideration for ensuring quality for laboratories in NPHL network and private laboratories.[177, 194]

The Quality, Standards and Regulation Division of MoHP was responsible for monitoring the laboratory quality.[174] The NPHL (with support from partner organization), performed quality assessment of designated laboratories for COVID-19 testing on a weekly basis.[195-197] The directive endorsed by MoHP on June 22, 2020 made it mandatory to send a predetermined proportion of samples to the NPHL so that they could be cross-checked when required as part of a national quality assurance program to ensure the quality of laboratories have met the standards.[47] Interim Guidelines

for SARS-CoV-2 PCR laboratories in Nepal's NPHL Network were endorsed on July 24, 2020, to ensure laboratory quality.[198] For assuring quality of the newly established laboratory, at least 10 positive and 10 negative samples tested on different days were retested from NPHL or another laboratory designated by NPHL. Five negative and all positive samples were required to be delivered to NPHL, with the positive samples including samples with varying CT values. The guideline also includes comparing results between laboratories and participating in NPHL's National External Quality Assurance Scheme (NEQAS)/External Quality Assurance Service (EQAS) program.[198] With support from partner organizations, the government established a National Quality Assurance Programme (NQAP) for COVID19 laboratories. The MoHP in collaboration with partner also applied an External Quality Assurance Service (EQAS) to 75 National and sub national laboratories.

Although all laboratories in Nepal were following basic laboratory biosafety practices including use of PPE and were processing all samples in biosafety cabinets, no biosafety manuals were available in most of the laboratories. Most laboratory staffs were trained on donning and doffing of PPE but were not adequately trained on appropriate and safe use of biosafety cabinets. The freezers used in laboratories for sample storage were not secured with lock and key. [47, 105-108, 140, 148]

Poor documentation was a common problem among laboratories throughout the country and lack of manpower was cited as the main reason for it. While national guidelines allowed reporting positive or negative results only, laboratories reported that they were facing problems in interpretation of borderline results and the interpretation was largely subjective, often classifying those cases as positive. This could have led to a higher number of false positives. [47, 105-108, 140, 148]

Frequent change in reagents and compatibility of reagents with PCR machines was a concern. Most of the laboratories had inadequate biomedical management systems. Laboratories also lacked sufficiently sized autoclaves to match the workload for decontaminating the biomedical waste and lacked appropriate documentation of biomedical waste management. [47, 105-108, 140, 148]

At the peripheral level, where reliance on a smaller number of mostly new laboratories was greatest, there were long laboratory turnaround times for test results, leading in turn to delayed admission and release of patients from quarantine and isolation centers. These delays are likely also to have affected the promptness of case investigation and contact tracing.

8.7. Lessons and future directions

- Private sector testing capacity was not widely used in the context of the pandemic in the early phase. Although the role of private sector increased during the course of the pandemic, ensuring the quality of testing service remained a matter of concern. For the future, it would be good to consider what (if any) role the private sector could play in providing surge testing capacity in the event of another epidemic, providing appropriate quality and price controls can be put in place.

- Frequent changes in the testing guidelines, although such changes were backed up with evidence, created confusion among implementers. Some of the local governments were reluctant to send home the individuals without RT-PCR test even when they had completed recommended duration of isolation and quarantine and had no symptoms of the disease. Stakeholders may find it easier

to adopt choices if they are given a clear explanation of the rationale and evidence behind the decisions. Within a few months of the pandemic, Nepal expanded the laboratory capacity in all seven provinces. It could be an opportunity to further strengthen the laboratory capacity for future pandemic of similar nature. These selected laboratories may be supported in the long run to provide laboratory surveillance and diagnostic services for prevalent, epidemic-prone, endemic diseases like Dengue, Leptospirosis, Scrub Typhus, and AMR surveillance.

- During the pandemic, the MoHP and other sectors, including the private and academic sectors, supported comprehensive health system strengthening, allowing laboratories to be expanded to every district and beyond. The key stakeholders were able to take limited resources and people and develop the laboratory capability and infrastructure by collaborating with one another.

9. Infection prevention and control

Summary

● The MoHP in coordination with Water, Sanitation and Hygiene (WASH) cluster partners accelerated expansion of WASH services in public institutions, hospitals, and public places from an early stage in the pandemic. Contactless handwashing stations were installed to prevent the spread the disease. Local government institutions also took initiatives in installation of handwashing stations in different strategic locations.

● 'Guidelines on Prevention and Management of COVID-19 Infection, 2076', 'Pocket Book for Infection Prevention and Control Measures for COVID-19 in the Healthcare Setting' and 'Health Care Waste Management in the context of COVID-19 Emergency (Interim Guidance), Mortuary Van Service and Management Guideline' were the key documents that guided infection prevention practices in Nepal.

● Although simple PPEs were broadly available at health facility level at the beginning of the pandemic, country struggled to ensure the availability of Level IV PPE, which was further compounded by procurement challenges during the first wave.

● Local government institutions took the lead in disinfecting public places. Some local governments were also disinfecting people including children by spraying disinfectants. There were concerns regarding the potential health impacts of directly spraying disinfectants on people.

● The GoN issued a dead body management protocol, and the Nepal Army was assigned the responsibility of dead body management. The dead body management protocol during the course of pandemic considering the latest epidemiological situation and emerging evidence of the disease. At the beginning, even the family members were not allowed to be present in the place where the dead body was cremated. As the numbers of deaths per day were increasing, the government had to struggle arranging vehicles and security personnel for dead body management, under subsequent amendments, and family members were assigned the responsibility of cremating the dead body.

9.1. Preparedness before COVID-19 pandemic

Before COVID-19 pandemic, not all health facilities had necessary provision of essential commodities and services for infection prevention and control (IPC). The Nepal Health Facility Survey 2015 showed that 77 % of the facilities in country safely disposed of both sharps and medical waste at that time. Similarly, 82% of the facilities had latrines for clients and 81% had improved water sources. At the time of the survey, 58% health facilities had soap and 49% had running water while only 46% had both soap and running water. Alcohol-based hand disinfectants were available in just over one-fourth of facilities. Overall, soap and running water or else alcohol-based hand disinfectant were observed in 56 % of the health facilities. Similarly, 80% of the facilities had gloves while a medical mask was available only in 19 % of facilities.[199]

At household level, 62% of the households had an improved toilet facility that is not shared with other households. Similarly, 47% of urban households and 31% of rural households had soap and water

available for washing hands. Thirty-nine percent of households in the lowest wealth quintile did not have water or any cleansing agents for hand washing.[200]

9.2. Infection Prevention in Health Care Setting

There has been provision of different protocols and guidelines related to infection prevention in health care settings in Nepal since the past. But after the COVID-19 pandemic, it was crucial to introduce the guidelines related to specific infection prevention and management in the healthcare settings. The 'Guidelines on Prevention and Management of COVID-19 Infection, 2076', and the 'Pocket Book for Infection Prevention and Control Measures for COVID-19 in the Healthcare Setting' were the key documents that guided infection prevention practices in Nepal.[63] These documents were issued during the first wave in May and June 2020, respectively.

Besides these guidance documents, there were efforts to provide direct training to healthcare professionals on IPC. Virtual training for frontline nurses from 20 May - 3 June 2020 was conducted by the Nursing and Social Security Division in the DoHS to strengthen knowledge and skills about infection prevention covering the process for donning and doffing PPE; disinfection and storage of instruments and equipment used during management of COVID-19 cases; infection prevention measures at quarantine and isolation wards, specific measures to be implemented at such sites; and infection prevention and critical care.[64]

As Nepal lacked capacity to manufacture sufficient quantities of PPEs, the government had to procure the necessary commodities from other countries. The procurement process was substantially delayed resulting in limited availability of whole-body PPEs in many hospitals. This had impact on delivery of COVID-19 and non-COVID-19 service to patients.

Health care waste management and disinfection

During COVID-19, infectious medical waste in hospital settings increased substantially owing to the additional IPCs required for treating COVID-19 patients. In light of existing waste management capacity and capability, and the additional precautions required to manage COVID-19, the government approved a guideline 'Health Care Waste Management in the context of COVID-19 Emergency (Interim Guidance)' on 3 July 2020.[201] It provided guidance for healthcare managers, health care workers, cleaners at the health facility in the context of COVID-10.[201]

Directions on management of risk/hazard allowance to human resources engaged in treatment of COVID-19 infection, 2077, were released on 5 May 2020.[202] A 'SOP on Cleaning and Decontamination of Ambulance Used in Treatment and Management of COVID-19' was also released on 5 May 2020.[202] Implementation of these guidelines was naturally influenced by local contexts, and as the quote below makes clear, some localities introduced adaptations to strengthen IPC measures for ambulance transport, for example, in a bid to reduce concern among healthcare staff about the risk of transmission in these settings.

The effectiveness of the government in preventing infection at hospitals should be assessed based on outcome achieved in reducing hospital acquired infections. However, in absence of the number of cases acquiring infection from health care setting, the effectiveness of these interventions could not be evaluated.

Stock and availability of personal protective equipment and planning for surge

The MoHP worked on the estimation of COVID-19 supplies and commodities, based on the estimated number of cases that might be admitted to hospitals under different scenarios (as indicated in the chapter on coordination and planning, the number of cases surpassed beyond projected level making the supplies and commodities insufficient). A joint project with the CCMC worked to estimate the potential number of hospitalizations and key commodity and supply requirements to ensure an appropriate level of clinical care for those admitted. The decision was made that 50% of the commodities would be kept in stock and the remaining half would be distributed according to the needs and type of hospital. To further facilitate and strengthen the monitoring and planning of logistics, the MoHP had directed all its units to integrate the information on pandemic commodities within the e-Logistics Management Information System (e-LMIS). This provided an integrated platform to track the items and facilitated the process of identification of procurement needs - although further development of eLMIS to support a dashboard of key supply chain indicators relating to COVID-19 was not completed until well into the second wave. In order to ensure the quality of materials while also maintaining uniformity of the items, the MoHP developed technical specifications for COVID-19 commodities based on the WHO Disease Commodity Package, and added these to the Technical Specification Bank.[47]

9.3. Infection Prevention at community level

Social distancing, mask use and sanitization (SMS) measures

The GoN promoted SMS measures to prevent the spread of COVID-19. Infographics developed in different languages were used to inform the public to maintain social distancing of two meters and recommending the use of surgical face masks or cloth masks with at least three layers while going out or while coming in contact with any other people. The GoN also urged all offices to have hand washing facilities or sanitizer in premises and that handwashing or use of sanitizer be made mandatory

when entering offices. It is not possible to say with certainty, however, to what extent these recommendations were observed, although data gathered by partners showed a notable decline in self-reported adherence to infection prevention and control measures in the community over the course of 2020 (see the RCCE chapter for further details).

Campaign on SMS measures was more intensified after lockdown via audiovisual aid, radio jingles, distribution of IEC materials, and other media in an effort to slow down the transmission rate of Covid-19.

On 7 August 2021, the state minister for MoHP inaugurated a week-long Nepal Mask Week Campaign (7-14 August 2021), against a background of increasing COVID-19 cases and relaxed restrictive measures. The main objective of the campaign was to highlight the importance of wearing a mask correctly and garner public commitment on wearing a face mask to prevent the spread of COVID-19. The MoHP and NHEICC coordinated with various interagency government stakeholders, such as Nepal Police and with elected officials, political leaders, social influencers and others to make the campaign successful. [203]

Photo 7: Glimpse of mask campaign, Source: Swastha Khabar

Partners supported in promoting and ensuring adoption of SMS measures working closely with federal, provincial, and local governments. For example, partner organizations in collaboration and leadership from Municipalities in Kirtipur and Dhangadhi, office of Chief Minister, and PHD in Madhesh Province ensured ownership for the compulsory mask initiative in the public places with the theme "No Mask, No Entry", "No Mask, No Talk", "No Mask, No Service".

The National WASH Cluster was coordinating the activities of partners to promote the WASH-related activities and building local level capacity. It has been functional since the 2015 earthquakes. However, after March 2020, the WASH cluster focused its attention on improving WASH facilities in holding, quarantine, and isolation centers across the country and coordinating with the local governments on COVID-19 management and mitigation. The WASH cluster with a total of 65 cluster members had presence in seven provinces and 325 out of 732 local governments. In 2021, the cluster's response (including partner contribution) reached 1.3 million people with hygiene promotion messages, and 500,000 people with at least one or more WASH services including supplies. Similarly, in 2021, MoHP

in collaboration with partner organization reached out to about 199,252 people (16,250 first wave and 183,002 in second wave) including 148,720 returnees with at least one or more WASH services and supplies (hygiene kits, soap, sanitizers, and drinking water) including risk communication messages. With COVID 19 cases declining and resumption of business, engagements of cluster member became limited in past few months that was also evident in provincial and local level coordination.

Quarantine centers faced sanitation challenges. It has been estimated that more than three quarters of toilets in schools that were used as quarantine facilities or isolation centers were not fully functional and required repairing.[204] Many hospitals and quarantine facilities lacked basic sanitation infrastructure and proper waste disposal facilities, and fecal sludge management has been unaddressed too.[204] MoHP coordinated with relevant stakeholders in making sure that quarantine centers are well resourced for maintain the sanitation facilities.

Early data from 2020 showed a notable increase in hand-washing practice among the general population, against a backdrop of rising COVID-19 case numbers. An assessment by WaterAid that included phone surveys of 380 households across the country conducted in July 2020 reported that approximately 97% had increased their handwashing behavior during COVID-19 (10). The study also reported use of hand sanitizers was increased during the pandemic especially in urban areas.[204] With support from partners, contactless handwashing stations were developed in different institutions and public places at strategic locations after the emergence of COVID-19 pandemic. However, later analyses from partner organizations showed notable declines in self-reported observance of basic measures including handwashing and mask-wearing as 2020 wore on.

Environmental cleaning

As there was increasing concern about the risk of disease transmission through contaminated waste/ materials in the environment, many municipalities moved to disinfect public places. A vehicle disinfection tunnel was set up in Nagdhunga, the main entry point in Kathmandu in the last week of April 2020. Some local governments opted to spray disinfectants on people including children, triggering public concern about the potential impact on the health of people as it was not recommended by the government of Nepal. On 18 June 2020, the MoHP approved the 'Interim Guidelines on Environmental Cleaning and Disinfection in the context of COVID-19' with an aim to reduce transmission of COVID-19 from infected person to non-infected person via regularly used convenience materials.[205] The guideline set the criteria for disinfecting isolation centers, quarantine facilities, public places, health care facilities, and personal residences where infected persons reside. The criteria states that triage areas are to be disinfected twice a day, while daily cleaning is needed inpatient rooms. As per the guideline, areas where the infected or suspects were mobile, quarantine centers and the personal residences of infected and suspected cases were to be disinfected daily. It also provided details about the quantity of the chemicals that can be used, depending upon the purpose of their use. [47]

Framework of School Reopening 2020 was approved on November 5, 2020 by Ministerial decision which was made by Ministry of Education, Science and Technology in collaboration with MoHP and

other partners.[206] Before reopening schools, students' intake, teaching learning activities, conducting postponed examination, the local level and schools were asked to follow the guidelines from the viewpoint of COVID-19 pandemic and public health by streamlining the core actions to be taken in the context of the preparations to be made.[206]

9.4. Dead body management

Timely management of the bodies of those who have died of a serious pathogen is an essential public health function in the event of an epidemic. For those who had died of COVID-19, an early decision was made to give operational responsibility for management to the Nepalese Army, with logistics support from district authorities. Handling of dead bodies was run through the CCMC in the first instance, to whom all notifications of in-hospital deaths had to be sent. The CCMC passed on relevant information to the Nepal Army locally. A brief guideline covering management of bodies was issued by the MoHP on 7th April, with fuller guidance published in June 2020.[207, 208] This guidance covered operational responsibilities but also set out provisions for burial rites and religious ceremonies linked to this. Burials or cremations were handled by the Army, with relatives of the deceased present. In March/April 2021, a guideline for Mortuary Van Service and Management Guideline 2021 was endorsed to make the transporting of dead remains easier. The major goal was to make it easier to arrange for burial rituals and religious ceremonies for people who died in hospitals, accidents, at home, or in the community.[209] The guideline also issued that the driver to be trained regarding COVID-19 preventive measures, disinfect the mortuary van and the dead bodies, and make arrangement of necessary materials and equipment inside the van.[209]

Photo 8: Glimpse of Nepalese army officials paying homage to the bodies of coronavirus victims at a crematorium in Kathmandu, Nepal, on May 1. Bikash Karki/AFP/Getty Images

There were some challenges in dead body management starting from the beginning of pandemic. In some locations, the government faced resistance from the local community in managing dead bodies. In some localities in Gandaki and Sudurpaschim Provinces, community people created obstacles to dead body management stating that the government had not consulted local people to select places

for burial or cremation.[57] Among other challenges in dead body management at the local level was the lack of vehicles for transporting the dead bodies.

9.5. Lessons and future directions

- There were difficulties in procurement of higher-grade whole-body PPEs in earlier phase of pandemic because of the global disruption of the supply chain. Preparation for future epidemics will need to consider domestic productions of PPE or timely initiation of procurement process of the PPEs that cannot be produced domestically. In both circumstances, having a quality control mechanism in place for personal protective equipment could secure the safety of health care professionals and the general public.

- As the information was lacking and the disease was largely stigmatized, the government faced resistance from the local community in burial or cremation of the dead body. With the increasing number of deaths on a daily basis, the responsibility for the management of dead bodies was handed to family members. Although the family members were required to report administration before cremation, studies are unavailable on the proportion of deaths that were reported or have been missed. Engagement of local leaders, sharing of relevant evidence, and assuring them of the safety procedures taken during dead body disposal to minimize the spread of infection would all help to reduce community resistance. There is also a need for a robust system to track deaths that occur at home. Following the outbreak of the COVID-19 pandemic, contactless handwashing stations were deployed in different strategic locations and hospitals. Such contactless handwashing stations could also help in prevention of other infectious diseases of similar nature. Local governments and institutions need to be capacitated to sustain the stations in future.

10. Case investigation, contact tracing, isolation, and quarantine services

Summary

- The GoN formed Case Investigation and Contact Tracing Teams (CICTTs) led by public health professionals. The GoN had envisioned deploying five teams in metropolitan cities, three teams in sub-metropolitan cities, two teams in municipalities and one team in rural municipalities with a total of 1,075 teams across the country. There was provision to hire staff where there was lack of health professionals but hiring process was not initiated.

- All the returnees were kept in quarantine centers in early stages of pandemic. However, as the number of returnees surged beyond capacity of quarantine centers, Nepal started a home quarantine service too.

10.1. Preparedness before the pandemic

The focal point for outbreak investigation and contract tracing in the years leading up to the pandemic was the EDCD, which had issued a series of guidance documents to govern approaches to case identification. These mostly focused on the role of rapid response teams (RRTs) – with training for these teams addressing outbreak response among a range of other emergencies that the EDCD might expect to encounter.[210] However, standing capacity in the EDCD through the RRT was designed to address an outbreak of slightly lower scale; nothing on the scale of the COVID-19 pandemic was envisaged or explicitly prepared for before 2020.

10.2. Case identification and contact tracing

Following the detection of the first case in late January, 2020 the government trained health workers on contact tracing, isolation, quarantine, and screening by the second week of February, 2020.[56] CICT was formed on the reflection from the 1st Knowledge Cafe` which was focused on the learning from China. The Health Emergency Response Plan, May 2020, had first envisioned the provision of CICT. On 21 March 2020, MoHP released an interim version of the 'Standard Operating Procedure for Case Investigation and Contact Tracing of COVID-19'. The document recognizes contact tracing as the single most important activity to break the chain of transmission of the COVID-19 disease.[67] By the end of March 2020, five confirmed cases of COVID-19 were isolated in designated hospitals of Kathmandu.[56] While Nepal had seen only a few imported cases by this point, EDCD mobilized a team for contact tracing based on the flight details of the passengers and movement history to identify the infected persons mobilized trained personnel. [56]

The contact tracing guideline advised forming CICTTs to be deployed in each local level. CICTTs comprise public health professionals (coordinator of the team), health workers (doctors/paramedics/nurse) and laboratory technician/assistants. The emergency response plan

released in May 2020, had envisioned deploying 1,075 teams across the country, with at least five teams in metropolitan city, three in sub-metropolitan city, two teams in municipalities and one in rural municipalities.[56] In 10 June 2020, MoHP approved the 'Case Investigation and Contact Tracing Team Mobilization Guideline' and directed every local level to form and deploy the teams as per guideline. The guideline also made it clear that priority should be given to health personnel in government service and additional health workers could be hired if the existing health workers were not sufficient on contractual basis. But the process of hiring of additional health workers was delayed. CICTTs were responsible for contact tracing of close and casual contacts using contact tracing form developed by EDCD and worked in close coordination with local level RRTs for follow-up (7 days from the point of first contact).[56] Case finding and contact tracing was adopted as a measure to identify the individuals who had been in contact COVID-19 patients within the last 14 days. The identified contacts were followed up on days 1, 3, 7, 10, and 14 days to check for development of symptoms, and where necessary provide recommendations regarding isolation. [56]

Lalitpur was the first district to start contact tracing on 26 July 2020. Bhaktapur district and Kathmandu district started contact tracing on 3 August 2020 and 8 August 2020, respectively. As the numbers of cases were increasing and situation demanded more personnel, additional human resources (with at least three public health professionals) were deployed in all 32 wards of Kathmandu metropolitan city. CICT activities were monitored using standardized CICT supervision and monitoring checklists developed by EDCD. [47]

Despite being recognized as the single most important strategy for breaking the transmission chain, only 650 out of planned 1,075 CICTTs were formed by the end of August 2020. There were problems in forming CICTTs as per the 'CICT Team Mobilization Guideline'. Formally, CICT was the responsibility of local governments who lacked capacity to properly support team activities. Human resource shortages were a major problem. A study conducted by NHRC found that most of the local governments did not have officers with a public health degree to lead the CICTTs. Most of the public health officers who were in public service before the implementation of federal set-up were now designated at federal and provincial level. Non-health personnel like trained community health workers, teachers, and local club members were also included in the CICT teams due to the lack of human resources in rural areas for contact tracing and were provided with logistic supply and financial support.[57] Finally, CICTTs sometimes did not always have access to sufficient numbers of test kits to support testing for identified contacts particularly during the early phase of the pandemic.

Even in the local areas where CICTTs were formed, there were several challenges in contact tracing. Some COVID positives reported incorrect contact details because of the fear of stigma and discrimination, impeding effective tracing. In addition, CICTTs were not able to efficiently trace contacts particularly in large cities. The influx of large number of returnees from India further complicated the contact tracing process as receiving systems were overwhelmed and unable to keep pace with contacts. Later, the government tried to ease the contact tracing process through risk communication with the aim of reinforcing to the public the importance of contact tracing. [56]

Later on the community people and the local authorities played supportive roles for identifying the individuals exposed to COVID-19 cases which made contact tracing a little easier in rural as well as urban areas. [56]

10.3. Use of ICT in contact tracing

'COVID NP' App was launched under the initiation from Office of the Prime Minister to Trace COVID-19 Infected cases. This app has been developed by the National Information Technology Center (NITC) under the Ministry of Communications and Information Technology (MoCIT). Furthermore, Nepal COVID-19 Surveillance System and Self-Assessment App in collaboration with partner organization. Another app named 'COVID-19 Response App' was also started by Nepal Army. The app takes information from the general public about the symptoms of COVID-19 and the information provided by public is used to service-related make arrangements as necessary. Similarly, MoHP, with support from partner organization launched a port of entry surveillance app powered by the Community Health Toolkit to enroll all incoming travelers entering Nepal through Kathmandu Airport, facilitating more effective screening of Covid-19 as well as follow up for travelers advised to self-quarantine. The app was designed and built adheres to MoHP and WHO guidelines for the detection and management of ill travelers suspected to have Covid-19 at ports of entry.

10.4. Isolation and quarantine services

The federal government issued a directive in March 2020 stating that any person returning from abroad and those with symptoms of COVID-19 was to be put in quarantine centers for a mandatory 14-day period.[165] One of the earliest exercises in quarantine service for COVID-19 was after the evacuation of Nepalese students from Wuhan, China. The GoN formed a working team led by the Secretary at the Office of the Prime Minister and Council of Ministers to oversee the evacuation. On 3 February 2020, Nepal issued 'Standard Operating Procedure-Quarantine Procedure for Nepali Students repatriating from China, 2076'. A total of 175 (Female: 40, Male: 135) Nepalese were repatriated safely from Hubei China and quarantined at Kharipati, Bhaktapur, Nepal on 16 February 2020. All the evacuees were kept under quarantine for 15 days, following health standards stipulated in SOP. After the throat swabs collected for laboratory testing tested negative for all the evacuees, they were allowed to return to their families on 16th day. Under the leadership of the CCMC, the working team continued to evacuate Nepalese from other countries particularly from Gulf countries.[56, 66]

The federal government instructed provincial and local governments to establish holding sites and quarantine services for returnee migrants. As schools were closed, most local governments used schools as holding centers. A study led IOM from 23 June to 8 July 2020 that covered 730 local levels, had found that almost half of the local units (48%) had used schools, followed by government buildings (18%), open spaces (8%), hotels (6%) and community centers (6%) as holding centers. Municipality buildings, rented houses and health facilities were among other sites used as holding centres.[165] The quarantine centers were established and managed by the local government in coordination and support from other sectors including private organizations. [57] The returnees were kept in holding centres for few hours and were being sent to their respective quarantine centres [165] Separate Committees were formed for logistics arrangements, monitoring and supervision of the quarantines. [57] In the study, screening facilities were available in 72% of [89 municipalities (N=124)] the sites and hygiene kits (sanitizer, gloves, masks, sanitary pads) were available in 68% of [84 municipalities] of the holding centres. Similarly, food, beds and separate toilets were available in 66% of [82 municipalities] the centers and 44% (55 municipalities)] had transportation services. Despite its importance, counseling service was largely neglected with only 4% of the holding sites having counseling service. Similarly, the survey found that almost all of the establishments had food services, and 90% issued hygiene kits, including masks, sanitizers, and toiletries. Beds were provided by 85% of the centers, and toilets were available in 84 %. Over 50 % also had internet services. A few (2 %) also provided yoga and meditation facilities. [165]

In the beginning, when the number of people staying in quarantine was limited, most of the quarantine centers were well managed, complying to the guidelines provided by federal MoHP. Later, however, as pressure on the centres intensified, human resource shortages became more acute, and there were challenges in terms of proper management of hygiene/sanitation and food supply. One of the most common reasons cited for poor management was the limited number of health workers. As the number of cases started increasing, health workers got infected and the deficit of human resources impacted management of quarantine centres. [57] Nepal also promoted home quarantine as the influx of returnees exceeded the institution-based quarantine capacity. To attract the private sector in providing treatment services to COVID-19 patients, the government decided to reimburse private hospital at the rate of Rs 200 per asymptomatic patient or patient with mild symptoms staying in home isolation (for clinical monitoring).[67]

In Jhapa's Kanchankawal rural municipality of Province 1, 25% of those staying in the quarantine center were found to be infected from COVID-19. Around 400 returnees from India were kept in the quarantine centers set up in local schools. Lack of appropriate social distancing measures was blamed for high infection rates in the quarantine centres. In Madhesh Province, nine people who tested positive for COVID-19 in RT-PCR were not isolated for four days at Chandra Higher Secondary School Quarantine at Bode Bersain-5 in Saptari. In the Sammarimai Quarantine Centre in Lumbini province, people left the quarantine center complaining of lack of appropriate provision for food and bed. Similarly, 44 people escaped from quarantine center in Yashodhara rural municipality. In Tilottama, local people protested blaming lack of quality in quarantine centers and the possible risk of spreading disease in the community. One person committed suicide in Sitganga municipality quarantine.[70]

Local governments faced several challenges in setting up the quarantine centers. In several places, local communities resisted or protested against the local government's decision of setting up quarantine centers in schools or other public buildings because of the fear of transmission in the community. In several local governments, political parties permitted use of party offices as quarantine and isolation centers. This decision from political parties provided local governments with some infrastructure for setting up the quarantine and isolation centers. It also reinforced messaging to the community about the need for collaborative effort in fight against COVID-19.

The CICT in the local government were responsible for monitoring patients in the home isolation within their area. They were responsible to monitor the patients with COVID-19 for seven days. In the beginning of the COVID-19, the monitoring was done in regular basis but when the COVID-19 cases rose in the areas, it was difficult to monitor the patients in the homes. The CICT teams also used to phone the patients on regular basis.

As the holding centers and quarantines were geographically separated, local governments faced difficulty in transporting returnees from holding centers to the quarantine centers. Even those suspected of having COVID-19 or were found with fever were transported to quarantine centers in the same vehicle as other returnees. This could increase the risk of other returnees getting infected while being transported from holding center to quarantine center.

Senior Public Health Officer, Province 1

From 14 March 2020, all foreign nationals entering Nepal were required to stay in self-quarantine and Nepali nationals including non-resident Nepalis were subjected to home quarantine for 14 days from the date of their arrival. Similarly, foreigners with diplomatic and official visa entering Nepal for the first time or travelling back to Nepal, foreigners with business, study and working visa travelling back to Nepal were required to stay in self-quarantine for 14 days.[143]

The MoHP signed a Memorandum of Understanding (MoU) for collaborations with hotels and restaurants to provide quarantine services for returnees. However, most of the Nepalese expecting to return home were those who lost their jobs in companies or who were asked to stay on a long unpaid leave in their current place of work and who were struggling to manage airfare and quarantine cost. They are not in the position to afford the cost to stay in hotel quarantine. [57]

As the COVID-19 progressed, there was an influx of returnees. As the quarantine centers started running out of space, Nepal moved to home quarantine and asked people without symptoms to stay under home quarantine. Before the government issued guideline regarding home quarantine in the early stages of the pandemic, local level governments initially sent all the returnees to their homes and asked them to stay under quarantine. There was a growing consensus that individuals having a travel history should be kept in quarantine in order to break the transmission chain and reduce the risk of community transmission. As a result of this, many people with travel history outside the country were kept in institutional quarantine centers. The MoHP also issued 'Home Quarantine Guideline-2077' on 17 July 2020, which clarified the basic criteria that should be complied with during home quarantine. The guideline states that individuals in home quarantine should be closely supervised and monitored by delegates from their respective local governments.[165] However, local capacity to enforce this supervision and monitoring was limited to meet demand; it is unclear to what extent home quarantine

was observed. Several factors contributed to reducing the effectiveness of home quarantine measures. A study by NHRC shows that unavailability of separate room (42.8%), unavailability of separate toilet/ bathroom (26.1%), difficulties in bringing groceries (20.7%), lack of cross ventilation (5.7%), difficulties in bringing medicines (3.2%), and lack of family support (1.7%) were the common problems encountered by people staying in home isolation. [71]

Effective from the third week of September 2021, Nepal eliminated the seven-day quarantine requirement and resumed issuing on-arrival visas to all vaccinated foreign travelers. On arrival visa were not granted for those who were not vaccinated or partially vaccinated. [151, 152]

10.5. Lessons and future directions

- Guidelines developed at federal level envisioning mobilization of public health professionals could not be fully implemented due to lack of human resources at local levels. Although some CICTTs were mobilized, the number was well below the total originally planned, and in many parts of the country, teams did not become active until well into the first wave, reducing their utility at a time when community transmission was already well established. Additional measures should be taken to ensure the availability of human resources for deployment of public health professionals.

- The level of public compliance with contact tracing and quarantine interventions is unclear – comprehensive data on this in Nepal are not available. Fear of stigmatization in the community appears to have hampered participation in contact tracing in certain small-scale investigations. RCCE work will be needed to address this for the current response, and for the future. Furthermore, recommendations and guidelines should also take into consideration the local context.

- Data or studies are also not available to make any conclusion about the effectiveness of case investigation and contact tracing during different periods of the pandemic. For example, the effectiveness of CICT could vary during different phases of pandemic particularly when country only had imported cases, had case clustered in specific localities and when there was widespread community transmission. Documenting such information or commissioning studies to evaluate the effectiveness could be useful to guide if strategies need to be modified. Such evidence could also be useful for future pandemic of similar nature.

- Although technical documents specify the requirements for home quarantine, households may not be able to fulfill the requirements owing to the household conditions like sharing of common bed room, toilets etc. Arrangement of hotel quarantine or paid quarantine centres could be out of reach of the poor people. Making arrangements for, and ensuring quality of, free or subsidised institutional quarantine for those in need should be a part of any future response.

11.   Case management, clinical operation, and therapeutics

Summary

- Clinical care for COVID-19, even for those in intensive care settings, is primarily supportive through timely and appropriate oxygen delivery and/or ventilators, and there remain few proven therapeutic options for the infection.

- Although Nepalese health providers had had important recent experience of clinical response in outbreaks, there was less experience of managing epidemic acute respiratory infections, and crucially, limited high dependency and intensive care bed capacity. Shortage of qualified health personnel was among other factors that impacted case management and clinical operations.

- The sectoral response plan issued in early 2020 established three tiers for clinical care from pre-hospital through to tertiary (referral) levels. Although guidelines and protocols were issued for care in each of these, the extent to which these could be delivered in practice varied and, in some areas (e.g., pre-hospital care), shortages of some essential supplies and appropriately trained personnel limited care effectiveness.

- COVID-19 Emergency Medical Deployment Teams Mobilization Guidelines were adopted by the Ministry of Health in May 2020, and they were recommended at an early stage to help health facilities with limited human resources manage mild and severe COVID-19 patients. Care for severe and critically unwell patients with COVID-19, especially at the height of the second wave, was undermined by shortages in essential supplies including oxygen. These were to some extent addressed – through the MoHP and with support from partners.

Effective clinical management of COVID-19 depends, as with any other acute respiratory infection, on prompt recognition of symptoms and in particular an ability to triage for more intensive intervention those patients with more severe symptoms. While moderate disease may effectively be managed in community settings including the home, severe or critical illness requires intensive clinical intervention with an emphasis on respiratory support, and at the time of writing there remain very few therapeutics with proven efficacy. Currently, dexamethasone is the only low-cost therapeutic that is widely available in low- and middle-income settings that has been shown in clinical trials to improve outcomes in severe disease. Heavy reliance on specific forms of supportive case including invasive ventilation in severe COVID-19 has placed a significant burden on health systems in many countries including Nepal, not least because oxygen supplies to health facilities may be unreliable. In this chapter we review clinical case management approaches for COVID-19 in Nepal throughout the pandemic, but with a particular emphasis on the second wave in 2021.

11.1.   Preparedness before the pandemic

Although substantial progress had been made in improving basic health indicators in Nepal in the 20 years before the beginning of the pandemic with a particular emphasis on preventive, primary and community care services, the health sector has suffered from chronic workforce shortages. In common with most LMICs, high dependency unit and intensive care capacity before the pandemic

was also very limited, at 1,395 and 480 beds, respectively. [211, 212] By contrast with some regional neighbours, the health sector in Nepal had also largely escaped the worst effects of recent outbreaks of pathogens with pandemic potential including SARS-CoV-1, H5N1 influenza, and H1N1 influenza (cases of the latter were reported but appear to have been less severe than widely reported elsewhere and managed through ward-level care in the sickest cases). [213] This meant there was less institutional memory and clinical experience of handling large-scale outbreaks of respiratory infection, and the surge capacity necessary to support this, by comparison with some regional neighbours.

11.2. The early stages of the clinical response to COVID-19

Pre-hospital pathways

The Health Sector Emergency Response Plan published in May 2020 set out the governing approach to clinical case management from the perspective of the MoHP.[80] The core service tier for identification and, where necessary, referral of cases under this plan were district level provincial hospitals and dedicated COVID-19 clinics set up by the MoHP. These facilities, staffed by medical officers, nurses, and paramedics were intended to provide a site for collection of samples for testing from patients with suspected COVID-19 and to arrange for referral to COVID-19 hospitals as necessary. The plan also set out provisions regarding referral via ambulance for those in clinical need, and for decontamination of these vehicles after drop-off, including through patient transport guidelines.[84] However, the provision of pre-hospital care was limited by severe resource constraints and a shortage of qualified personnel.. Shortages of more advanced PPEs, and lack of training to support correct use of it, were the most common problems during first wave response [214] which the government eventually improved during the course of the pandemic.

Patient flow management and management of moderate illness

Three tiers of hospital services beyond district level hospitals were envisaged under the MoHP sector emergency plan. Mild cases were to be managed in level 1 COVID-19 hospitals, with the option for transfer to level 2 centres for moderate/severe disease and finally to level 3 referral centres for those patients with other comorbidity. Sukraraj Infectious and Tropical Disease Hospital (STIDH) in Teku, Kathmandu was designated by the GoN had the primary role for managing COVID-19 patients with Patan Hospital and the Armed Police Forces Hospital in the Kathmandu Valley in the early phase of pandemic which gradually expanded to cover other hospitals

Data from the first wave indicate important challenges at hospital level in terms of the extent to which decisions were translated into change on the ground. One such study, conducted across 110 hospitals nationwide in late April 2020 and early May 2020, found that even among large secondary and tertiary centres, 33% had not yet allocated bed capacity for isolation of suspected or confirmed COVID-19 cases. This study also documented regional variations in the extent to which available resources were disbursed to hospitals nationwide.[215] In August 2020, the MoHP removed the tiered approach to designating care facilities, in favour of a uniform approach in which all the central hospitals, provincial

hospitals, medical colleges, academic institutions and hub-hospitals were designated to provide treatment care for COVID-19 cases.[1]

COVID-19 emergency medical deployment teams (EMDT) Mobilization

In order to provide guidance on management of mobile teams by hub or hub and satellite hospitals for sending them to hospitals where there is lack of human resources to treat and care COVID-19 cases, COVID-19 Emergency Medical Deployment Teams Mobilization Guidelines was approved on May, 2020.[216] The number of staff is estimated for the management of 50 suspected or confirmed COVID-19 in-patients with mild symptoms. The hubs or satellite hubs prepared two COVID-19 Management Mobile Teams, according to the guideline (EMDT). If hub hospitals are unable to meet demand for human resources, satellite hospitals can assist. One physician (junior consultant or above), one doctor (MD resident or above), six nurses or health assistants, and three attendants made up each team. Each team performed a 12-hour shift for seven days, after which they might be replaced by another team.[216] Each team members have their own roles and responsibilities for the management of COVID-19 patients.

Case management COVID-19 in health care settings

On April 5, 2020, the interim clinical guidance for the care of patients with COVID-19 in healthcare settings was published, with the goal of assisting physicians and other health care providers in properly managing people with suspected or confirmed COVID-19 and bringing consistency in case management across the country.[217] Case definition, including common COVID-19 symptoms, screening and triage, which includes a screening questionnaire, temperature checks, co-morbidities, diagnosis, COVID-19 pregnant and post-partum women, isolation, and documentation are all part of the treatment protocol. COVID-19 is divided into four categories based on the severity of the disease: mild, moderate, severe, and critical.[217] The case management guideline is followed in the health care facilities according to disease severity.

Different hospitals employed different types of drugs for the therapy of COVID-19 patients in the early stages of the pandemic beyond the recommendations from MoHP. But later, the irrational use of medicines was regulated by MoHP issuing different guidelines related to following the rational use of drugs while managing COVID-19 patients. Government of Nepal issued guidelines and protocol related to medicines while treating and managing COVID-19 patients, but the compliance also remained a challenge.

ICU and ventilator capacity and critical care management

Estimates for current intensive care bed capacity in Nepal vary but as at April 2020 were reported to be around 1,500, of which only around half had ventilator capacity. [218] There were also constraints on the extent to which recommended IPC measures could be observed – including, for example, shortages of N95 masks and other level IV PPE, and a lack of negative pressure isolation space. [219]

As in many other countries, however, perhaps the principal challenge to effective management of severe and critical illness was the lack of established treatments during the first wave. Clinicians in Nepal faced a newly, and at that time poorly, characterized pathogen. As a result of this a wide range of medicines were prescribed in those with moderate, severe, and critical illness without clear supporting evidence or evidence from scaled studies.

Table 6 shows the management of actives cases by provinces in on peak of 1st, 2nd wave and on December 31, 2021, based on ICU and ventilator capacity. On 21 October 2020, there were total 961 ICUs and 419 ventilators of which 28% of the ICUs and 20.8% of the ventilators were occupied. Bagmati province had higher capacity of ICU and ventilators with higher occupancy in ventilators on 21 October 2020 and Lumbini had higher occupancy of ICU. During the second wave, on May 11, 2021, the total capacity of ICU and ventilator was 1380 and 567 respectively and there was greater increase in the occupancy as compared to the peak of first wave. The occupancy of ICUs were higher than the capacity in Lumbini and Karnali province. On December 31, 2021, ICU and ventilator capacity across Nepal was 2726 and 1089 respectively. The occupancy of ICU and ventilators was 3.3% and 2.2% respectively.

Table 6: Management of active cases by Provinces on COVID-19

Province	21-Oct-20				11-May-21				31-Dec-21			
	ICU		Ventilator		ICU		Ventilator		ICU		Ventilator	
	Capacity	Occupancy (%)	Capacity	Occupancy (%)	Capacity	Occupancy (%)	Capacity	Occupancy (%)	Capacity	Occupancy (%)	Capacity	Occupancy (%)
Province 1	89	31 (34.8)	30	16 (53.3)	134	127 (94.8)	71	29 (40.8)	313	9 (2.9)	166	3 (1.8)
Madhesh	45	9 (20)	21	1 (4.8)	112	60 (53.6)	52	37 (71.2)	402	1 (0.2)	124	0 (0)
Bagmati	484	152 (31.4)	242	59 (24.4)	835	529 (63.4)	329	184 (55.9)	1314	65 (4.9)	583	20 (3.4)
Gandaki	176	20 (11.4)	61	4 (6.6)	110	82 (74.5)	29	11 (37.9)	252	3 (1.2)	84	0 (0)
Lumbini	82	47 (57.3)	24	5 (20.8)	91	160 (175.8)	41	13 (31.7)	270	10 (3.7)	68	1 (1.5)
Karnali	62	7 (11.3)	26	0 (0)	55	102 (185.5)	22	8 (36.4)	97	0 (0)	35	0 (0)
Sudurpaschim	23	3 (13)	15	2 (13.3)	43	24 (55.8)	23	8 (34.8)	78	1 (1.3)	29	0 (0)
Total	961	269(28)	419	87 (20.8)	1380	1084 (78.6)	567	290 (51.1)	2726	89 (3.3)	1089	24 (2.2)

Institutional isolation, self-isolation, and at-home quarantine

Although the early focus for case management had been on hospitalization, the number of first wave cases rapidly surged beyond capacity of hospitals, and the cabinet of ministers on 20 August 2020 decided to manage asymptomatic and mild cases at home isolation and isolation centers if needed but without a requirement for hospitalisation.[220] The shift to at-home isolation for mild cases was accompanied by guidance for monitoring the health of cases in home and hotel isolation, issued in late September 2020. Health workers were supposed to monitor the health of those in hotel or home isolation on daily basis through direct visit or by telephone. The government also urged caretakers to contact health workers in case if patients in isolation encountered problem in respiration, experienced chest pain or any other serious conditions. [221]

11.3.   Changes during the second wave

Governance and coordination

Governance and coordination responses to the pandemic are covered in detail elsewhere (see Chapter 4). However, important changes to the governance structure for the clinical response were brought into effect in 2021, in the midst of the second wave. These included a range of measures to rapidly scale-up capacity for care delivery, including permission from the GoN for the MoHP to sign agreements with private sector providers to provide care, and increasing the pool of available doctors, health workers, officials, sanitation workers and security personnel by providing an additional 50% allowance on salaries. [222]

In addition, there were efforts to centralize coordination and monitoring of intensive care capacity and particularly essential medical commodities such as oxygen. This was achieved initially through deployment of joint-MoHP and partner organization teams to carry out hospital-level needs assessments. [223] This was followed by the establishment of a newly designated Unified Central Hospital at Bir Hospital in Kathmandu. This change was ultimately implemented after some delay (the initial announcement was in early May).[224] It was supported by a coordination centre at the hospital, established with partner support.[225]

Adjustments to care for moderate and severe illness

Given the workforce shortages outlined above, constraints on rapid expansion of critical care capacity during the second wave were significant. As the second wave wore on, availability of key commodities – particularly oxygen – became a rate limiting factor for care delivery (see below). With support from partner, the MoHP worked to expand training in critical care skills for health workers nationwide, including through the delivery of a virtual training course in late May and early June 2021 which attracted over 11,500 participants from across the country.[223] One important focus of this training course was on rational use of resources in light of supply constraints during the second wave. In addition, clinical guidelines on intensive care for critically unwell COVID-19 patients were developed by the Nepalese Society of Critical Care Medicine. [226]

Elsewhere, important improvements were noted notwithstanding the pressures imposed by rising caseloads. Triage and referral pathways were felt to have operated better during the second wave compared to first wave as the pressure of incoming patients forced service providers to adapt practices quickly. Ambulance services were made more responsive and also had more capacity than in the first wave. The MoHP approved National Ambulance Guideline 2078 on September 3, 2021, with the goal of improving prehospital care services. The guideline envisions to enroll all ambulance in an integrated system so that the patients would get emergency health care in the pre-hospital pathways.[227] The government of Nepal established toll-free numbers to provide emergency assistance in the wake of the COVID-19 pandemic, with toll-free number 102 designated for ambulance service.[228] GPS tracking for ambulance services meant patients were able to call for locally available pre-hospital care more quickly. On 2020, a new guideline titled "COVID-19 Patient Transport Team (PTT) Guideline" was endorsed for transporting COVID-19 suspected and confirmed patients to hospitals.[229] The guideline also intends to treat patients in pre-hospital routes, reduce COVID-19 transmission, and provide a framework for patient handover to hospitals or isolation facilities.[229]

Management of medicines and other supplies

The effectiveness of the clinical response to COVID-19 cases – especially for severe and critical disease – was hampered during the second wave by challenges in access to critical supplies, including oxygen. Initial MoHP forecasts, covering a COVID-19 wave of 4 months' duration, estimated a need for some 60,000 oxygen cylinders and 10,000 oxygen concentrators.[230] However, Nepal has limited domestic oxygen generating capacity for healthcare use (in around 45 hospitals currently) [231] and relies heavily on imports from neighbouring countries, especially India. During the peak of the second wave, cross-border movement of these and other essential supplies was substantially reduced by a combination of border closures and supply-requisition to support the response to the catastrophic epidemic in India. [232] Limited availability of oxygen impacted service delivery, with some hospitals turning away critically unwell COVID-19 patients.

Government addressed the shortage of oxygen supply through more close collaboration with partners. The MoHP moved early in May 2021 to requisition supplies of oxygen for industrial purposes by manufacturers and suppliers to support hospitals for the COVID-19 health response. The UNDP provided 400 oxygen concentrators in June 2021; [233] the World Bank provided financial loan for the arrangement of around 1,000 concentrators and install oxygen generation plants in seven regional centers around the country in June 2021;[234] and the partner organization provided 2,000 oxygen concentrators (as an alternative to oxygen cylinders) and accompanying consumables to the MoHP in August 2021. Government also mandated hospitals to install the oxygen plant in hospital also providing incentives for installation.

Unified Central Hospital

The COVID-19 Crisis Management Ordinance (CMO) that was formed after the order from Supreme Court stated that Bir Hospital should remain as a COVID-19 Unified Central Hospital with the federal MoHP taking responsibility for its operation. The COVID-19 Unified Central Hospital could also

coordinate with the provincial governments and designate the central hospital or provincial hospital within each province as COVID-19 Unified Provincial Hospital. Such hospitals would operate under COVID-19 Unified Central Hospital.[150]

COVID-19 Unified Central Hospital was responsible for making estimations about the number of patients requiring hospitalization based on infection rate, coordinate with other health facilities and give direction for treatment of COVID-19 patients, monitor COVID-19 hospital, provide direction to health facilities for converting them to COVID-19 hospitals, procure medicine, oxygen and other equipment necessary for Central Unified Hospital and issue protocol for treatment and control of COVID-19.[150]

The ordinance also envisioned a unified referral system. As per the provision, any COVID-19 hospital not able to treat any COVID-19 patients would inform COVID-19 Unified Central Hospital which would then coordinate with other COVID-19 hospital and make arrangement for the referral of the patients so that hospital not able to treat could refer patients to hospital identified by COVID-19 Unified Central hospital. [150]

11.4.   Lessons and future directions

The second wave of COVID-19 cases in Nepal was of such magnitude that it is unlikely that clinical services could ever have been adequately prepared to respond, especially given long-standing financial and human resource constraints at every level, from pre-hospital and ambulance service provision through to critical care capacity. However, these challenges were exacerbated by shortages of critical supplies at key junctures in the response some of which were anticipated through early Ministry forecasting, especially the availability of oxygen and related consumables, and of therapeutics at the peak of the second wave. Efforts to strengthen central coordination and particularly control over scarce resources were also implemented, particularly in the peak of the second wave.

While better preparedness for the future must focus on preventive measures to reduce COVID-19 caseload, especially given resource constraints, there are important steps that can be taken to help strengthen clinical responses to any future waves. In the near term, measures to consider include:

- Prioritization of access to medical oxygen: although this was flagged in the sectoral response plan in early 2020, there were delays in ensuring the supply. It was also not possible to immediately expand the domestic oxygen generating capacity in very short period. Ensuring compliance to governments' instruction for installation of oxygen plant could be useful for pandemic response in future, both in short and long run.

- Expanded workforce training opportunities for essential critical care delivery and use of key technologies including oxygen concentrators, ventilators could further ease the case management particularly during the peak times.

- There is an opportunity for developing and strengthening mechanisms for knowledge collation and exchange on best clinical practice in managing COVID-19 patients with varying severities of

illness. This would be a quick and relatively low-cost way of improving clinical care across the country in the near term, and ensuring that interventions drawn from guidelines are implemented in a way that is contextually appropriate. Reviewing the existing compliance related programs and protocols and risk management procedure and record keeping could help to decrease the challenges related to compliance of medicines used during COVID-19.

Longer term, there is an important strategic question for the MoHP to consider concerning the proper focus of resources for clinical management. Intensive care unit capacity comes at very high cost per patient and is also intensive in terms of trained workforce requirements; in addition, there is limited scope for generating surge capacity because workforce skills for this level of course are highly specialized and need to be maintained. Care should therefore be taken not to prioritise increases in critical care and particularly invasive ventilatory capacity at the expense of high quality, essential care[235] for those with moderate/severe illness who can be managed in high dependency or even ward level settings.

12. Operational support, logistics, and supply chains

Summary

- Important strides had been made in strengthening procurement, logistics and commodity supply chains in Nepal in the lead-up to the pandemic, including the introduction of an electronic information management system (eLMIS). However, stock-outs for essential commodities continued to be reported at facility level.

- The logistics and supply chain response to COVID-19 was coordinated, as for other domains, through the CCMC and the ICS, but day-to-day activity was led by the Logistics Management Section of the DoHS.

- Availability of essential supplies was hampered by global supply chain disruptions, and during the second wave by the closure of the border with India. Although the influx of COVID-19 commodities to support the second wave response was considerable, these supplies arrived in many cases after the case peak. Domestic oxygen generating capacity in particular was insufficient to meet rapidly escalating demand in the second wave which could be one area for improvement for better pandemic response in future.

- The presence of a responsive logistics system supported by integrated information management was identified as a priority area for action for the MoHP's initial lesson-learning report in April 2021 - and steps have been taken with donor support to address this for the COVID-19 response.

This chapter considers approaches to operational support and logistics in the context of the COVID-19 response in Nepal. In this chapter, we review approaches to operational support, supply chain management and procurement over the course of the pandemic and the extent to which improvements were made during the second wave. We consider here aspects of preparedness prior to the pandemic, governance of the logistics and supply chain response, and also two case studies in operational support and supply chain management - looking at oxygen delivery, and dead body management.

12.1. Preparedness before the pandemic

The MoHP's logistics and supply chain management functions have, fallen under the Logistics Management Section (LMS) in the DoHS. The LMS has a wide range of functions spanning procurement, storage, cold chain maintenance, vaccine management and supply, in addition to information management and monitoring roles.[236] Activities to strengthen supply chains and procurement procedures for essential medicines had been an area of intensive action for some years before the beginning of the pandemic, bringing together the MoHP with donors including partner organisations. Key focuses for this work included strengthening supply chain management information systems, human resource development and forecasting capability.[237] Some partners had had a prominent role over some years in supporting supply chain strengthening through its Global Health Supply Chain-Procurement and Supply Management (GHSC-PSM) program. A central aspect

of logistics and supply chain strengthening work in the years leading up to the pandemic was the development and implementation of an electronic logistics and supply chain monitoring systems. With support from partners, MoHP developed eLMIS dashboard for COVID-19 commodities in order to ease timely decision-making by the decision-makers.[21] It has been a revolutionary and cost-effective system of health data management which safeguards commodity security and improved health outcomes in a country. This system was, at the outset of the pandemic, operational across public primary care service providers, primary and secondary hospitals, but did not have effective coverage in tertiary care centres and did not cover providers in the private sector.[236] Also, there was no live information about logistics of below Palika level health facilities.

Ongoing efforts to strengthen real-time reporting from eLMIS helped to address the shortage of essential commodities during the pandemic. However, shortage of human resources constrained scope for action in some instances.

Finally, the HEOC provided a mechanism for governance and coordination of emergency responses in health - including with respect to logistics and supply chain management - that had been in place since 2014. The HEOC functioned as an operational command centre for the MoHP, working through an extensive provincial network, and with ongoing work to pre-position in hospitals within the public network a range of commodities and supplies likely to be needed in the event of an emergency. [55]

12.2.   Governance and coordination of the logistics and supply chain response

Although national arrangements for emergency response already existed prior to the pandemic (including through NEOC and HEOC), oversight of logistics and supply chain activities in response to COVID-19 fell under the CCMC, under which a logistics committee was established. The ICS in the MoHP also provided advice on supply chain and delivery aspects. Wider support was provided by the Nepal National Logistics Cluster bringing together partner organisations in the humanitarian sector (see further detail below), but lines of communication between this and the CCMC were blurred, contributing to low take-up of some of the services the Cluster provided during 2020. This was identified as a priority area for action by the Cluster in a gap analysis published in December 2020.[238]

The initial approach to the response was guided by forecasting performed by the DoHS in partnership with the CCMC of expected supply and commodity requirements based on projections of likely hospital admissions during a first wave, drawing on published guidance from the partner organizations and others concerning care requirements (this forecasting work occurred in April 2020), and feeding into the first sectoral response plan. An early decision was made to stockpile around 50% of supplies and to issue the remaining 50% according to projected needs across Level 1, 2 and 3 health facilities then in operation (as noted in chapter 11, the tiering approach was subsequently abandoned). The Health Sector Response Plan set out a series of actions to strengthen logistics and supply chain management and delivery during the initial phase of the response, including provisions for local manufacturing of some critical commodities (including PPE and oxygen) and adaptations to the eLMIS to facilitate reporting relevant to COVID-19.[80]

Partner organizations have played an important role in this aspect of the response, coordinated through the Nepal National Logistics Cluster. This grouping held its first meeting relating to the COVID response in early March 2020 and worked principally in three areas: (i) strengthening coordination; (ii) information management; and (iii) support to common services for logistics in health and other domains. The National Logistics Cluster and its members had a particularly important role in supporting logistics at district and local level - addressed in further detail below. The way in which the Cluster was engaged in logistics and operational support changed over time. Initially, the key points of contact were with the CCMC, the Nepalese Army and the MoHP; during the worst phase of the second wave, however, Management Division, DoHS acted as the main point of contact, working with the partner organizations. [239]

12.3. Supply chain control and management over the course of the pandemic

In this section, we consider operational support and logistics activities on the ground, how approaches to this have varied across Nepal over the course of the pandemic, and the national level tools and mechanisms put in place to support it. Nationally, the governance and coordination roles exercised by the LMS and other parts of the MoHP were supported by information from the eLMIS, a central plank of the supply chain control and management system. Adaptations were made to eLMIS to facilitate logging of relevant commodity and equipment needs on the system, including a COVID-19-specific dashboard. [240]

The role of the National Logistics Cluster in supporting the response also varied over time. In the first wave, a key role was to support information management, focusing mainly on information sharing and collation of process and guidance documents including SOPs, custom clearance procedures, and other materials to support operational planning by the GoN and its partners. The Cluster also prioritised common service activities provided storage support to the government response including through fixed storage space for critical supplies[238], and loaning mobile storage units to the CCMC and to provincial actors.[241] As the government moved to mobilise for vaccination delivery in early 2021, the logistics cluster also supported provision of cold chain storage and other activities to support cold chain maintenance at local level[238] (activities relating to vaccination are covered in more detail in Chapter 14).

The common services of the Cluster were suspended for all actors except the MoHP and provincial authorities (acting at DHO level) in March 2021 owing to low demand.[239] Common services were remobilised from 10th May 2021 in response to a direct appeal from the MoHP for support to bring in and distribute essential commodities, working in partnership with the different partners.[239] These proved important in responding to the large influx of commodities and other essential supplies from neighbouring countries, donors and their partners from May 2021 onwards. The list of contributions was extensive and included donations of oxygen concentrators and related consumables from a wide range of EDPs, NGOs and the private sector.[242]

Finally, the supply chain picture varied across the country. Supply chain assessments conducted by international partners including during second wave noted the centralisation of stocks and logistics

networks through Kathmandu,[243] and the implications this might have for the effectiveness and particularly timeliness of delivery to outlying areas.

Stock status of COVID-19 key commodities during the peak of 1st wave, 2nd wave and December 23, 2021, is given in table 7. The list and number of stock status has been continuously increasing during the course. During the second wave, vaccines were also introduced and are continuing till date.

Table 7: Stock Status of COVID-19 Key Commodities

S.N.	Particulars	October 20, 2020	May 11, 2021	December 23, 2021
A.	Laboratory and Vaccine commodities			
1.	Janssen COVID-19 Vaccine 5 Dose	-	-	479,719
2.	AstraZeneca 10 Dose	-	-	40,456
3.	SARS-COV-2 Vaccine (Vero Cell) Inactivated	-	508,243	1,788,861
4.	COVISHIELD 10 Dose	-	56,072	432,454
5.	Real Time RT-PCR Kits	243,404	272,589	333,844
6.	Viral Transport Medium (VTM)	309,873	368,779	491,222
7.	RNA Extraction Kit	302,544	279,872	410,262
B.	Personal Protective Equipment			
1.	PPE Set	41,722	53,210	79,806
2.	KN95 Mask	160,201	239,937	33,214,396
3.	Surgical Mask	2,715,804	5,741,647	4,696,799
4.	Gown	563,799	294,274	41,618
5.	Face Shield	32,697	162,971	845,972
6.	Shoe Cover	235,904	159,012	295,851
7.	Surgical Gloves	221,162	284,434	369,574
8.	Head Cap	45,488	100,262	64,371
9.	Goggles Polycarbonate	26,447	20,814	15,439
10.	Safety Goggles	79,340	106,199	538,268
C.	Others			
1.	Dead Body Bag	-	1,127	14,452

Note: N95 includes N95 Mask and KN95 Mask; Surgical Mask includes Mask and Surgical Mask; Gown include Disposable Gown and Gown for reusable and Head cap includes Head Cap and Surgical Cap

12.4. Procurement

The DoHS initiated a procurement process for medical equipment two weeks after the first case of COVID-19 in Nepal through special procurement method based on the forecasting of quantification finalized by DoHS and approved by MoHP. In the initial phases of the pandemic, pressure on global supply chains was considerable; there were disruptions to air, land and sea freight, and panic buying from high income countries contributed to immense difficulties in securing essential commodities for LMICs, many of which were vulnerable to supply chain problems before the pandemic.

On 16 March 2020, the DoHS awarded a tender worth Rs 340 million to Omni Business Corporate International for procurement of medical equipment essential for fighting the pandemic. The GoN awarded the procurement deal to the Nepalese Army. In a meeting on 16 May 2021, the CCMC meeting directed the Ministry of Law and other concerned bodies to prepare legal instruments to address procurement-related problems saying that the prevailing provisions were not adequate. The Foreign Affairs Minister pointed out that existing public procurement law did not allow payment in advance for procurement processes, which was often a precondition for vaccine procurement, for example.

12.5.   A case study in essential commodity supply management: oxygen

A full analysis of logistics and supply management for all essential commodities is beyond the scope of this report, but an assessment of approaches to management of oxygen supplies is instructive. Ensuring adequate oxygen supplies to meet forecast demand was a priority identified early on through the Health Sector Response Plan, and forecasting of oxygen demand was supported with inputs from clinicians and epidemiologists.

However, it rapidly became clear during the first wave that availability at facility level was variable. In a study led by the Medical Operations Division of the CCMC in June 2020, all COVID-19 treatment facilities (69 facilities that participated in study) reported that they had at least one form of oxygen available (e.g., central supply, oxygen concentrators, cylinders). Centrally supplied oxygen was available in only half (36, 52%) of treatment facilities while the portable oxygen cylinders were available in the majority of facilities (61, 88%). Twenty-five facilities (36%) had their own oxygen plant, and 45 (65%) relied on oxygen concentrators. The majority of clinics (38/49, 77.5%) and hospitals (12/20, 60%; 10/12 Level-2 and 2/3 Level-3) had sufficient stock of oxygen cylinders (threshold: ≥5 pieces for clinics; >20 pieces for hospitals), which were mostly procured from the private sector (54/69, 78%). [244]

In May 2021 as cases rose exponentially, the MoHP designated two high-level officials (at Director level) to coordinate the oxygen production and supply system. The team supporting these officials also worked with hospitals through guidance on oxygen filling stations/plants. The 29 oxygen factories that were operating at only half of their capacity in the pre-pandemic period went into full scale production which - even with this scale-up in production - could not meet the demand. Meanwhile, factories relying on liquid oxygen tankers were affected by an Indian ban on exports. Empty cylinders from China, Oman, and other countries alleviated the shortage somewhat, while oxygen plants grappled with increasing generation capacity. [37]

As a crisis resulting from shortage of oxygen was in focus during May 2021, the CCMC took over responsibility for distributing oxygen to COVID-19 treating health facilities. The GoN also formed a six-member monitoring team led by the Joint Secretary in the Ministry of Industry, Commerce and the Supplies Ministry. However, the GoN decision to cap the supply of oxygen affected the operation of many hospitals in shortage of oxygen. Some hospitals were unable to admit new cases while other had to transfer patients to other hospitals in absence of oxygen. [41, 42]

At a cabinet meeting on 26 April 2021, the government decided to exempt various taxes on import of medical grade oxygen, oxygen cylinder and oxygen concentrator.[40] However, it could not increase the supply of oxygen in the country as per the demand. As the hospitals started returning COVID patients in absence of oxygen supply, the government ordered all private hospitals (more than 100 beds) to install their own oxygen plants within 15 days on 12 May 2021.[245] However, owing to the short time-frame for response and the costs involved, there was push-back from private sector providers against this government order.

12.6. Lessons and future directions

In this chapter, we have seen that while there were established operational support, logistics and supply chain management systems in place prior to COVID-19 - many of them linked to disaster risk reduction activities following a series of recent humanitarian emergencies - the existing MoHP architecture was not well integrated with the novel governance and coordination mechanism established to guide the response in the early months of 2020. Communication between the new structure, led by the CCMC, and donor- and partner-led support through the Cluster was also identified as an area for improvement following the first wave. During the second wave, administrative changes were introduced to link the Cluster's activities more closely to MoHP needs. Strengthening coordination through reform of these governance structures for the future, including clarifying the role of HEOC in COVID-19 response work could be one area for improvement

From a supply perspective, the response in Nepal suffered because of global supply chain disruptions, and particularly from the border closure with neighbouring India during the second wave, both of which contributed to shortages of key commodities. While Nepal was able to overcome an acute shortage of PPE in the first wave, the shortage of oxygen during the peak of second wave. Some hospitals were not able to admit patients in absence of oxygen supply. This suggests a need for improvements to scenario-planning capability including modelling of projected burden, health infrastructure, and commodity requirement to properly inform supply need estimates. This also suggests that there is need of special provision of special procurement legislation during pandemic for logistic preparedness and strengthening supply chain management.

While steps were taken to improve oxygen generating capacity at hospital-level, and to strengthen central coordination of supply monitoring and disbursement, these measures were primarily reactive rather than anticipatory to the rise in cases in April and May 2021. Cluster common service functions had also been stood down before the April/May 2021 case increase, introducing delays as logistics capability was ramped up again. Access to this capability was essential to help manage the inflow of COVID-19 commodities from neighbouring countries, donors, and other partners in May-September 2021. For the future, the MoHP may wish to strengthen domestic generation/manufacturing capacity for essential commodities, and to expand pre-positioned supplies in preparation for future outbreaks, resources permitting.

13. Maintaining essential health services and systems

Summary

- Transport restrictions, uncertainties on essential service delivery and PPE use for service providers, diversion of human resources to the COVID-19 response, cancellation of outreach services, reduced priority on non-emergency services, and problems in referral services were the key reasons essential service delivery was impacted during COVID-19 pandemic.

- After about a month, sexual, reproductive, maternal, newborn, child, and adolescent health (SRMNCAH) services gradually started to rebound. Immunization services also gradually resumed largely nullifying the reduced coverage during the first month of the pandemic. However, the impact on disease control programmes, including impacts on case detection rates for TB and Leprosy, lifestyle interventions to reduce NCD risk, and delayed diagnosis of NCDs and cancers could have far-reaching implications for population health.

- Interim guidelines were issued to resume essential services by MoHP. In collaboration with partners, MoHP trained service providers about the guidelines for resuming services and preventive measures to be taken while providing core services. Partners supported in ensuring continuous supply of medicine and commodities, monitoring service utilization, and addressing challenges.

13.1. Status before the pandemic

Nepal has made remarkable progress in improving vital health indicators over the past 20 years, most notable those relating to child and maternal health. Between the year 2000 to 2019, maternal mortality declined by 76%, still births declined by 58% and neonatal mortality declined by 62%. [47] Similarly, the institutional delivery also increased by four folds in between 2001 and 2016.[246] One of the major concerns during COVID-19 was that these achievements could be slowed down or some of the progress made in past decades could be reverted.

As in many countries, there were significant challenges in Nepal in ensuring continuity of essential service delivery during the pandemic. COVID-19 appears to have disproportionately affected specific populations, with notable impacts on maternal and child health service delivery (including for higher-risk intrapartum care - although there is some evidence that infection prevention and control practices may have improved at the same time), people with chronic diseases, differently abled etc. as the health system has been challenged by the rising demand for care of COVID-19 patients.[247] The vulnerable populations may have reduced health facility visits due to fear of contracting COVID-19, although there is evidence from delivery of routine childhood vaccination at least of enduring population commitment to accessing these services where this was possible. Outreach services were also cancelled or reduced during the early phase of lockdown which reduced access to some services. [167]

This chapter considers the effects of the pandemic, and in particular, the impact of non-pharmaceutical measures including lockdowns, on essential service delivery.

13.2.   Service utilization amidst COVID-19, and strategies adopted

Reductions in service utilization were mainly related to fear of disease transmission, lack of PPE for service providers, travel restriction and lack of transportation services. Disruption of transportation also led to disrupted availability of some essential commodities.[123] Health facilities also encountered problems in referring patients to higher level facilities due to transport restrictions. In order to respond to the COVID-19 pandemic and to continue the regular services, various plans, guidelines, standards, and protocols were developed and made available through the MoHP website. Major documents included: the Health Sector Emergency Response Plan for the COVID-19 Pandemic, Rapid Action Plans, Interim Guidelines for continuity of specific health services, such as those in Reproductive, Maternal, Newborn, Child and Adolescent Health (RMNCAH), leprosy, geriatric health care services, rehabilitation and physiotherapy of persons with COVID-19 in acute care settings, services for people with disabilities, dental services, ambulance services and Ayurveda and alternative medicine services.[248] In the sections that follow, we outline some of the key changes made to ensure continuity of essential service delivery in Nepal during the pandemic.

Figure 20: Trends for inpatient and outpatient service visits across public providers in Nepal
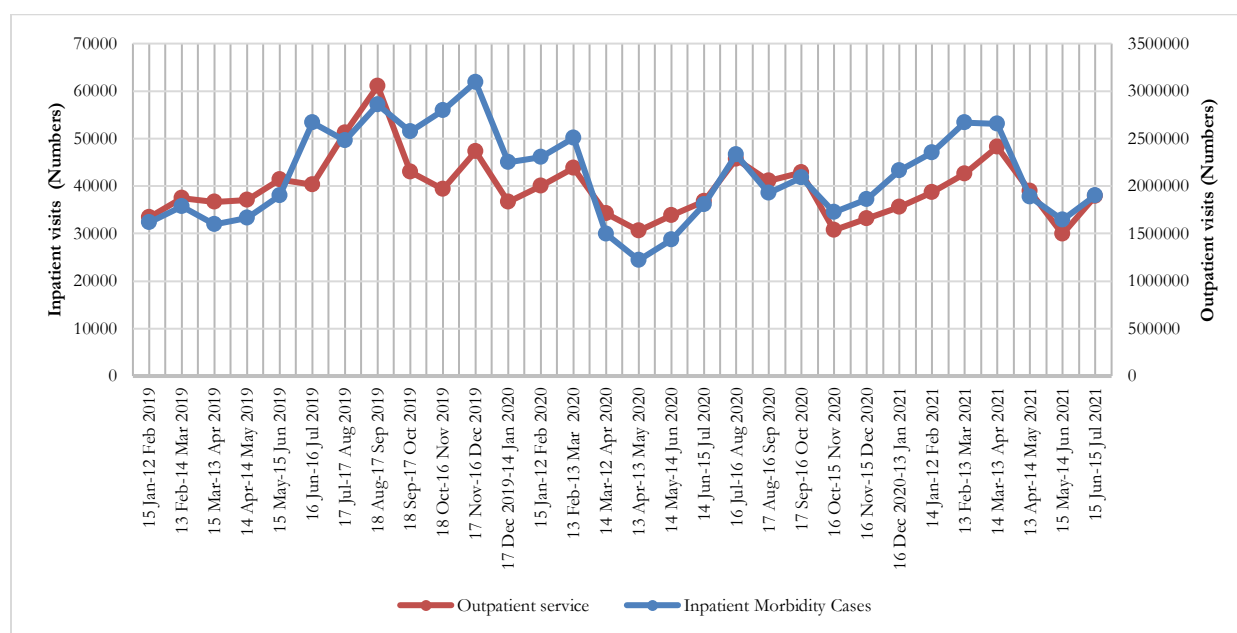
Source: IHMIS

RMNCAH services

The Reproductive Health Cluster was continuously tracking the service utilization pattern after lockdown. Health facilities reported continuous declines with some hospitals reporting only 20-25% of their typical delivery caseload. [123]

Following the decline in reproductive health services, a dedicated helpline service was initiated for reproductive health services. Messaging and infographics on danger signs during pregnancy and births

were prepared and disseminated through social media, radio, and television. By 24 April 2020, 139,476 pregnant women and mothers of children under two years of age had been reached through COVID-19 prevention massages in SMS.[123] Interim guidelines on RMNCAH were prepared and orientation was provided at provincial and district level.[47] The MoHP in collaboration with multiple partners provided orientation on RMNCH service guidelines to over 4,000 health workers across the country. After the lockdown, the health facilities also closed as a result, the services from the Birthing Centers (BCs)/Basic Emergency Obstetric and Neonatal Care (BEONC)/ Comprehensive Emergency Obstetric and Neonatal Care (CEONC) sites were also affected. Birthing Centers (BCs)/Basic Emergency Obstetric and Neonatal Care (BEONC) sites were open after 23 April 2020 (11 of Baisakh, 2077) and the Comprehensive Emergency Obstetric and Neonatal Care (CEONC) sites were open after 08 May 2020 (26 of Baisakh, 2077). [248] The birthing centers at the peripheral level had higher number of deliveries than the hospitals as there was restriction of the transportation. Only in case of emergencies and severe cases, the people used to go to the higher centers.

Weekly monitoring of maternal and newborn health service showed a gradual improvement from the month of June 2020.[181] Paropakar Maternity and Women's Hospital (PMWH), Amakomaya mobile health system, Prenatal Society of Nepal (PSON), Nepal Society of Obstetricians and Gynecologists (NESOG), Young midwife committee and Amakomaya Mobile health system have initiated tele-consultations services for pregnant women by installing toll free number 166001100046 in PMWH. Pregnant women and their family members were requested to register their information from the Amakomaya mobile app. Till November 2021 total 15,860 mothers were registered in the Amakomaya app and received online consultations services from midwife from Maternity Hospital. Mothers who have access to smart phone could measure their risk indicators from the Android app and they could post their message to get immediate response from midwife. Such Tele-consultations services were also promoted for different services including antenatal care (ANC) and postnatal care (PNC) services.[52]

Although there were notable impacts in months immediately after lockdown was imposed, service utilization rebounded to a large extent after government took decisions to open up the health services. Studies in later stages provide a better picture of the impact of COVID-19 pandemic on utilization of SRMNCAH services.

A study titled 'Impact of COVID-19 pandemic in selected health services with estimation of 'excess maternal deaths' was conducted covering a total of 16 referral hospital, 109 CEONC sites and 164 birthing centers and BEONC sites from Chaitra 2076 to Asoj 2077. [248] Study reveals that the average of institutional delivery was higher than the pre-COVID-19 levels at national level as there was immediate bounce back after a decline in a couple of months. Regarding family planning methods, permanent sterilization witnessed a 56% decline in the number of procedures. For new users of long-acting reversible contraceptives, the proportion declined by 56% and witnessed the average higher than the pre-COVID-19 levels in the following few months. A total of 153 maternal deaths were reported in the COVID-19 months (Chaitra 2076 to Bhadra 2077). The equivalent period of last year (Chaitra 2075 to Bhadra 2076) recorded 104 deaths. The preliminary estimates from modelling suggest that there were 47 excess maternal deaths in COVID-19 months. [248]

Case story: Improving access through strengthened ambulance services
The COVID-19 pandemic disrupted access to life-saving sexual and reproductive health (SRH) services, as the health system remained stretched, and resources were diverted from various programs to address the pandemic. An analysis by the Reproductive Health Sub-Cluster under the Health Cluster showed lack of transportation during lockdown was an important factor that limited access to services. To address this problem, UNFPA Nepal in coordination with FWD initiated free ambulance services in partnership with the Nepal Red Cross Society in selected districts. The intervention covered 16 districts[5] in 2020 and 28 districts[6] in 2021. The Nepal Red Cross Society (NRCS) mobilized ambulances services through its district chapters and sub-chapters in consultation and collaboration with the local government and district health offices. Information about the availability of ambulance services was disseminated through the Health and Reproductive Health sub-clusters at the federal and provincial levels, mobilizing NRCS volunteers and also media at local level. There was also periodic review of the ambulance service that helped to identify and solve the bottlenecks. Criteria were developed to facilitate services to the pregnant women with poor economic status, and women from quarantine/isolation sites. This was important especially in communities where lockdown and mobility restrictions prevented pregnant women from accessing the emergency obstetric services. A total of 366 pregnant women (that included 239 Janajatis and Dalits), from 26 districts of 6 provinces accessed the ambulance services to reach health facilities. They all received lifesaving emergency obstetric and neonatal care.

Routine immunization

In absence of clear guidelines, the immunization services were also impacted in the early phase of lockdown. Immunization programs were affected as there was a lack of immunization supervisors at the federal and district levels. Immunization programs were affected as there was a lack of immunization supervisors at the federal and district levels. On 13th April 2020, Interim guideline for COVID-19 and other essential/basic health services during COVID-19 pandemic-2076 was published by MoHP. After the preparation of the interim guideline, training was given to the health workers for continuing the essential health services during COVID-19. After the 3 months of interruption in the delivery of essential health services, the health facilities started to deliver the services routinely. Due to which the indicators of maternal and child health increased after the ease. Immunization, diphtheria, tetanus toxoid and pertussis vaccine (DPT3) declined by 55 % in the first COVID-19 month but

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[5] Province 1 (Udaypur), Province-2 (Dhanusha, Sarlahi, Rautahat and Parsa), Bagmati province (Sindhuli and Dhading), Lumbini province (Kapilvastu, Palpa, Gulmi, Arghakhanchi, Pyuthan, Rolpa and Rukum-East) and Sudurpaschim province (Achham and Bajhang)

[6] Province 1 (Jhapa, Morang, Sunsari), Privince-2 (Dhanusha, Mahottari, Sarlahi, Rautahat, Bara), Bagmati province (Sindhuli, Chitwan, Dhading), Gandaki province (Kaski and Nawalparasi-East), Lumbini province (Rupandehi, Palpa, Gulmi, Arghakhanchi, Dang, Pyuthan, Rolpa, Banke, Bardiya and Rukum-East), Karnali province (Surkhet) and Sudurpaschim province (Kailali, Kanchanpur, Dadeldhura Bajura)

bounced back with an increase in the next three months.[248] The health workers were occupied in COVID-19 response and some of them were infected with the disease. [57]

During the COVID-19 pandemic, there was a measles outbreak and for this NIAC recommended to conduct Outbreak Response Immunization (ORI) based on risk benefit analysis on case by case basis and on 01 May 2020, measles ORI was started and conducted in 7 outbreaks, with over 31,000 persons immunized. [47] A total of 94 ORI centres were set up to support reactive vaccine deployment as part of the outbreak response.[249] On 6 May 2020, all immunization services (including MR SIA) was continued by the decision of cabinet decision as the achievement of the immunization program may derail which has been achieved over the years.[47] During the pandemic, rotavirus vaccine was introduced in National Immunization Program on 02 July 2020. [167] Measles Rubella vaccination campaign was also impacted by COVID-19 and restrictive measures. The first phase of the MR vaccination campaign was carried out from 13 February to 13 March 2020 in Provinces 1, 2, and Lumbini Province. The second phase of the campaign was implemented from 14 March 2020 and was planned to be completed by 12 April 2020 in Bagmati, Gandaki, Karnali and Sudurpaschim provinces. However, the campaign was halted because of nationwide lockdown implemented in the bid to contain COVID-19. As a result, the MR vaccination campaign halted for a month in 43 districts[182] although this was resumed as early as June 2020.[249]

While the health system was largely focused in COVID-19 response, measles outbreaks were reported in different parts of country. MoHP resumed the National MR vaccine campaign that was interrupted by COVID-19 and the lockdown. MoHP circulated new guidelines to continue the campaign.[183]As the MR vaccine campaign resumed, despite unprecedented challenges brought on by the pandemic, over 2.6 million children received the MR vaccine this year in Nepal across the two phases of the campaign. [250]

Disease control programmes

During the pandemic, HIV and AIDS related services including HIV testing, prevention of mother to child transmission, as well as early infant diagnosis were impacted.[251] A qualitative study among women with HIV who use drugs, participants had shared that they had difficulties in reaching to lab for HIV testing and ART clinics for medication. They had also shared that they feared contracting COVID-19 while visiting hospital for ART services.[251] The interim guidance for managing PLHIV and harm reduction program for people who inject drugs was developed on 27 March 2020 and was then updated on 2 August, 2020.[47] Several other guidelines like the 'National HIV Testing and Treatment Guideline', 'National Guideline for Screening, Care and Treatment of Hepatitis C Infection in Nepal', and the 'Standard Service Package for Key Populations' were endorsed. Other programs and activities conducted were: vehicle pass for in-reach workers for continuing harm reduction programs, stakeholder meeting for improving service delivery quality, virtual training for healthcare workers on new guidelines, opiate substitution therapy, early warning indicators, and logistics.[47]

'Rapid Assessment Report on Effects of COVID-19 Pandemic on Tuberculosis Control Programme in Nepal', conducted from May to June 2020 revealed that there was 67.3%, 45.5%, and 41.7% decline, respectively, in the mean number of sputum courier, enrollment, and follow-up of TB patients during

the COVID-19 lockdown. There was partial disruption of reporting of TB data, with substantial variations in the completeness of reporting to national data systems according to the province. COVID-19 and restrictive measures did not have notable impact on TB drug stock and supplies. As per the interim guideline, patients took TB drugs at home and few developed minimal side effects that were locally managed. [252]

On March 2020, an interim guidance for management of essential TB series during the COVID-19 pandemic was endorsed by the GoN. The key reflections under the guidance were to ensure essential services and operations to protect the lives of people with TB, to support national TB programs, health personnel and TB patients for continuity of essential services for people living with TB during the pandemic and measures to be applied in order to provide quality service and to prevent any stigmatization and discrimination of people affected by either TB or COVID-19. The treatment and care for the TB patients during the pandemic were patient-centered directly-observed therapy, short-course (DOTS) which means that the Daily DOTS has been shifted from health facilities to household till the pandemic situation comes under control. [253]

Like other disease control programmes and services, COVID-19 and stringent restrictive measures impacted Leprosy control activities in Nepal. Satellite clinics run every month were impacted, which resulted in problems in the detection of new leprosy cases and the management of complications. Regular skin camps and contact tracing, which are essential for early case detection, were interrupted.[254] The new case detection rate dropped from 11 per 100,000 population in the two preceding years to 6.2 per 100,000 in year 2019/20. Similarly, the prevalence rate dropped from 0.9 per 100,000 in the two preceding years to 0.7 per 100,000 in 2019/2020. These declines are likely due to reduced case detection rates because of COVID-19 disruptions to Leprosy control related activities rather than to the improving performance of these programmes.[167]

The GoN issued interim standards for service management of Leprosy Control Programme in the context of COVID-19 pandemic (Nepali language) on 20 July 2020 (Asad 30, 2077). The guideline also proposed to halt active case finding at community level. The guideline suggested to have sufficient stocks of leprosy medicines and to provide patients with medicines sufficient for 3 months so that they can take medicines at home. However, prednisolone, a medicine which is used to manage reactions for up to 30 weeks in leprosy patients is also an immunosuppressant with potential implications for the ability of those taking the medication to mount an efficient immune response to infection. The guideline therefore also suggested that the use of these medicines should be shifted back by 2-3 weeks in the event that the patient was suspected of having COVID-19. With the suspicion of higher chances of infection of leprosy patients staying in quarantine centers, arrangement was made for regular monitoring of the patients status by health workers. [255]

The ongoing scale-up of the package for essential NCD prevention and care was also affected by COVID-19. Similar to services described above, patients had difficulties in seeking care for NCDs in the few months after lockdown.[167] This could have largely impacted the detection of NCDs and its risk factors because of reduced health facilities owing to lack of transportation services and fear of contacting disease.[256]As restrictive measures largely reduced the mobility, physical activity level and morning walk among people, the impacts could be long term. Although nationally representative

studies were not available, a small scale study (667 participants from Kathmandu valley) revealed that 45.3% of participants had gained body weight, 63% of participants had increased sleep duration and 86.8% had increased use of mobile/TV/Laptop.[257]

The standards for delivering services to senior citizens during COVID-19 pandemic also covered services related to NCDs among senior citizens. The guideline called senior citizens to continue taking medicines they had been taking until they come in contact with health workers and asked to maintain stocks of medicine for at least 30 days. As per the guideline, senior citizens were suggested to visit a health facility in case they have difficulty in breathing, chest pain, loss of appetite, persistent fatigue, loss of consciousness or other related symptoms.[258]Adverse outcomes may have resulted because some critically unwell patients or those in need of transplantation (for example) had to be referred to other hospitals as the beds were already occupied with COVID-19 patients. Experts also suggested that there could have been delay in diagnosis of disease like cancer.

Mental health is another dimension that has been studied for its linkage with COVID-19. In one of the previous studies in Nepal, 11% of participants were found to have mild to moderate psychological distress and 0.5% had severe psychological distress.[257] In another web-based survey among 475 health workers conducted between 26 April and 12 May 2020, 41.9% of health workers were found to have anxiety symptoms, 37.5% had depression symptoms and 33.9% had symptoms of insomnia. In the study, stigma faced by health workers was identified as an important factor that increased the risk of anxiety, depression and insomnia. [259]

To address increasing concern regarding the risk of suicides during the pandemic, Nepal finalized and endorsed child and adolescent mental health (CAMH) training packages for doctors, nurses, and paramedics in 2020, and also developed a mental health strategy. MoHP in collaboration with partner supported children and adolescents, parents and caregivers, frontline health workers and COVID-19 patients in isolation centres and COVID-19 designated hospitals, with mental health support to cope with the mental health challenges that have been brought about by the pandemic. Kanti Children's Hospital, in partnership with multiple partners, directly reached a total of 92,060 people with mental health support services and promotion activities by trained counsellors and mental health workers. This included 59,625 children and adolescents, 28,060 parents, teachers, care givers, and 776 youth. The Nepal Health Training Centre, in collaboration with partner, rolled out an online training manual on mental health for frontline health workers. The purpose of this training was to help frontline health workers cope with COVID-19-related stress. A total of over 3,000 frontline health workers working in isolation centres and COVID-19 designated hospitals benefitted from these sessions in 2021. Likewise, MoHP in collaboration with partner supported a total of 599 COVID-19 patients in isolation centres and COVID-19 designated hospitals.

With support from partners, eight Mental Health Self-Help Groups were formed and mobilized in five municipalities. Similarly, community champions who have recovered from COVID-19 were identified and trained on improving stress and symptom-management techniques. 100 people received orientation training on COVID-19 infection, prevention, and control, and coping with stress during pandemic through 37 sessions conducted by the Self-Help Groups.

Processes for service prioritization during COVID-19

The government's Smart Lockdown guidelines briefly discussed the delivery of essential services and in particular the prioritization of core services that should be delivered under different lockdown scenarios: hard lockdown, mixed lockdown, soft lockdown, and minimal lockdown. In case of hard lockdown (most stringent restrictive measures), only emergency services would be operating.[163] COVID-19 and non-COVID service delivery guidelines in context of COVID-19 pandemic defines emergency and severe (including acute) conditions as any life and limb threatening conditions (acute coronary syndrome, acute limb ischemia, stroke, etc.) or injuries, abscess, acute painful conditions, acute on chronic conditions (e.g. heart failure, acute exacerbation of COPD, hemodialysis, ketoacidosis, etc.). [260] In case of mixed lock down, emergency services and out-patient services for people with chronic diseases are also permitted. Out-patient services for all people in case of soft lock down, and all the health services are permitted during minimal lock down. [260]

Regarding the delivery of essential and basic health services, priority was given to all critical priority public health programs. The essential health services given major focus were the continuation of safe motherhood services (critical ante natal care [ANC], safe delivery services, critical Postnatal Care [PNC], management of complicated pregnancies, comprehensive abortion care); management of life and limb threatening emergencies, management of acute and chronic conditions; immunization (continues session with safety measures); longer period dispensing of family planning commodities; Anti-Retrovirals (ARVs), NCD medicines, mental health medicines, and TB and Leprosy drugs.[57] MoHP also moved to the decision of providing the regularly used medicines/equipment for 3 months if possible. Priority is also given to the diagnostic services necessary for essential and basic health services. In order to avoid crowds and minimize the pressure to health facilities, different measures were taken to reduce hospital visits by people with minor health problems. [261]

13.3. Monitoring delivery of essential health services

It was very crucial for monitoring the delivery of essential health services during COVID-19 pandemic as the health services may become disrupted or the service utilization may decline due to fear or travel restrictions during the pandemic. Regular monitoring was done by different divisions and centers under the DoHS under regular programs. Health sub-clusters were also supporting MoHP in monitoring the delivery of essential services. Analysis of IHMIS data provided an opportunity to track any drop in service utilization so that it can be immediately responded to. Functionality and readiness of the services were assessed. The reproductive health sub-cluster was engaged in tracking utilization of SRMNCAH services, challenges encountered, and addressing those challenges. Mapping of key partners for essential services facilitated a better coordinated response. [47]

During the first few COVID-19 months, there was a small decrease in the timeliness of reporting, but it bounced back to pre-COVID-19 levels. There were some difficulties in the initial phase due to fear of COVID-19 but there were no considerable obstructions in the functioning of HMIS.[248] Coordination via Skype/Zoom was conducted in order to support the timely operation of HMIS in all provinces. Due to the regular monitoring and mentoring from the IHMIS to the focal persons of different tiers, it was possible to ensure the timeliness in the reporting system which provided an

opportunity to track the status of essential services throughout the period of the pandemic. Different online meetings and follow-up conducted by phone supported strengthening the online data system.[180]

13.4.   Lessons and future directions

This chapter has shown that, as in many other countries, there were significant challenges to maintenance of essential service delivery in Nepal, particularly during the early phase of the pandemic. Substantial recovery was seen, however, in some service areas, notably RMNCAH and particularly routine immunisation delivery. This reflected to some extent the easing of lockdown measures after the initial phase, but also the commitment of the GoN to prioritising essential services such as immunisation, and the implementation of service maintenance strategies.

- Imposition of lockdown with short notice impacted delivery of essential services. Facilities lacked commodities for family planning and other maternal health services. Lack of PPEs and proper guidance to health workers impacted service delivery in the early phase of pandemic. It would be appropriate to impose restrictive measures only after ensuring that facilities have essential commodities for service delivery. For future preparedness, there is a need to explore options for stockpiling key commodities (specifically PPEs), to facilitate rapid deployment and service adaptation in the event of a future outbreak.

- As tertiary hospitals were designated as COVID-19 hospitals and were overwhelmed with COVID-19 patients, patients with other serious conditions had to be referred to other facilities. Patients outside Kathmandu had difficulty in travelling to tertiary level hospitals in Kathmandu for specialized care. Referral mechanism should be strengthened to ensure that patients in need of critical care (for other health conditions that may, for example require organ transplantation or dialysis service) are not deprived of services.

14. Vaccination

Summary

- COVID-19 vaccination received a high degree of political commitment with both the ruling parties and political opposition being in favor of accelerated vaccine acquisition and roll out process.

- The MoHP constituted the National COVID-19 Vaccine Advisory Committee (COVAC) to guide the vaccine procurement and rollout process. Eight working committees were formed to further accelerate the process. Nepal also moved to amend Drug Ordinance 2077 which was intended to overcome legal barriers in vaccine procurement.

- The 'National Deployment and Vaccination Plan for COVID-19 Vaccine 2021' was the guiding document for the vaccine rollout. The document detailed the available vaccine infrastructure, priority groups for three phases of vaccine rollout and their estimated population, and the governance structure for vaccine roll out, drawing closely on WHO SAGE advice.

- The national COVID-19 vaccination campaign started officially from 27 January 2021, vaccinating frontline health workers with the Covishield (AstraZeneca) vaccine in the first phase. Subsequently, Vero-cell vaccine and Johnson and Johnson vaccine were introduced and rolled out among other priority groups such as senior citizens and media personnel.

- As of 19 October 2021, approximately 21.4% of total population, 32.6% of the population ≥ 18 years of age and 29.9% of population ≥ 15 years of age had been fully vaccinated. This represents a remarkable achievement for Nepal against a backdrop of much lower coverage rates in many other LMICs, given that the COVID-19 vaccination delivery program has been established from a standing start since the beginning of the pandemic and enormously challenging context of the second wave.

- The Child Health and Immunization Service Section of the Family Welfare Division (FWD) took overall responsibility for implementing Adverse Event Following Immunization (AEFI) surveillance in close collaboration with the Department of Drug Administration (DDA), and technical support from WHO-IPD.

- There has been provision of online certification from FWD and has been implemented in the local level from November 3, 2021.

- Overcrowding and noncompliance with social distancing measures was also noted in some vaccination centers, which could be an area for improvement for future response of similar nature.

The speed of vaccine development for COVID-19 has been unprecedented. The process of new product development that typically takes 10-15 years from inception to regulatory approval and early rollout was achieved in under a year for the Pfizer-BioNTech and AstraZeneca vaccines. Speed of development relied on the prior existence of novel platform technologies (principally the mRNA and

chimpanzee adenovirus vector platforms) that had been developed initially for use in vaccines for other pathogens but were now rapidly repurposed for COVID-19 vaccine development using genomic data supplied open access by health researchers in China. It also relied on major, up-front financial commitments from a series of high-income countries and, in time, the COVAX facility which was established with the expressed purpose of ensuring broad access for LMICs to new vaccines against COVID-19.

However, rapid development of novel vaccines cannot translate into meaningful preventive effects unless robust procurement and delivery systems are in place at country level. Like many other LMICs, Nepal faced significant challenges in these domains. As Chapter 11 showed, there had been significant efforts to strengthen procurement and supply chains for essential communities in Nepal, but stock outs at local level remained common and cold chain maintenance and ongoing challenge. In addition, although the national expanded program on immunization (EPI) is well established as a priority 1 (P1) program in Nepal, with the exception of tetanus and diphtheria vaccination for pregnant mothers there was no experience of delivering a large-scale adult vaccination program prior to the pandemic.

14.1. COVID-19 vaccine planning and preparatory works

On 21 September 2020, the MoHP constituted the National COVID-19 Vaccine Advisory Committee (COVAC) with the responsibility for providing guidance on regulatory provisions regarding vaccine access, selection of vaccine, procurements, financing, delivery mechanisms, equitable distribution of vaccine, prioritization of population groups to be vaccinated, vaccine safety surveillance, and communication and media response. This group consisted of experts on immunization, research, and representation from the National Immunization Advisory Committee (NIAC) which gives the information and message related to COVID-19. An overarching steer regarding the criteria by which vaccine products for use in Nepal were to be selected was given by the Council of Ministers in November 2020 - which specified that this decision should be made according to vaccine availability, vaccine cost, available infrastructure to deploy the chosen products, (such as cold chain requirements and capacity), and vaccine quality (including available data on safety and efficacy).

As the prevailing Drug Ordinance 2077 did not have the provision for emergency use authorization, the government decided to make an amendment to the ordinance. The third amendment on Drugs Ordinance 2077 (2020) was issued by the Rt. Hon'ble President of Nepal upon recommendation of The Council of Ministers on 18 November 2020. This amendment allowed the emergency use authorization of vaccines and drugs in the context of the COVID-19 pandemic. Department of Drug Administration (DDA), the National Regulatory Authority, was in position to expedite emergency use authorization of potential COVID-19 vaccines for use in Nepal. Based on this amendment, the DDA later approved the Covishield vaccine manufactured by Serum Institute of India on 15 January 2021.[262]

To further accelerate the vaccination procurement and rollout process, on 8 December 2020, the MoHP formed 8 working committees with very specific responsibilities, namely, Concept Note Committee, Infrastructure Assessment Committee, Priority Listing Committee, Development Plan Committee, Vaccine Fund Committee, Communication Committee, Immunization Secretariat Committee and Monitoring, Regulation and Research Committee. [182]

At the time that Nepal accelerated the preparatory work for vaccine rollout (as of 2 December 2020), there were 215 vaccine candidates in the pre-clinical phase and 59 in clinical phases. COVID-19 mRNA vaccine, BNT162b2, by Pfizer-BioNTech had received temporary authorization for emergency use from UK Medicines and Healthcare Products Regulatory Agency (MHRA) on 2 December 2020. After Pfizer-BioNTech, Moderna's vaccine mRNA-1273 received emergency use authorization from U.S. Food and Drug Administration (FDA) on 18 December 2020, and Oxford-AstraZeneca's non-replicating viral recombinant vector vaccine (ChAdOx1), AZD1222, received emergency use authorization from MHRA on 30 December 2020.[262]

While discussions on the choice of appropriate vaccines were ongoing, some vaccines like China's Sinopharm, Russia's Sputnik V, and UK's AstraZeneca had approached Nepal for participation in phase II clinical trials. The NHRC took the lead in responding to these proposals and organized a discussion programme to get feedback from experts about appropriateness of different vaccines and Nepal's potential participation in clinical trials. Some of the experts suggested that there could be advantages for Nepal in the vaccine procurement process if Nepal decided to participate in vaccine trials while others suggested separating the vaccine procurement process from clinical trials. In the meeting, experts had a consensus opinion that the effectiveness of vaccines, side effects, cost, and capacity of the country should be considered while procuring vaccines. [145]

Some experts have pointed out that Nepal's reluctance or delayed decision on participation in clinical trials in the early phase of the pandemic was a missed opportunity. Participation in phase III clinical trials could have been an opportunity for Nepal to gather experience of conducting evaluations of near-to-use vaccine candidates, would have kept Nepal in a preferential position for vaccine purchase, and would have been an opportunity for laying infrastructural foundations for vaccine production. This could have long lasting impact as those infrastructures could also be used for vaccine production for other infectious diseases too. [145]

The decision regarding which COVID-19 vaccine product to deploy in Nepal was made for pragmatic reasons as well as available evidence on vaccine efficacy and effectiveness. From the deployment perspective, Nepal did not have the storage capacity for vaccines that require cold chain maintenance at -70^0C, and although there was capacity to store vaccines at -20^0C centrally, maintaining the cold chain at these temperatures while rolling out vaccine at peripheral level would have been much more challenging.[262] Considering the available infrastructures for cold chain maintenance, the Covishield vaccine (which can be stored and transported at 2-8^0C) was found to better suited for delivery in Nepal. [263] There were also encouraging efficacy data available at the time the decision on vaccine selection was made: based on Phase 3 results of AstraZeneca, the vaccine was estimated to have an efficacy of 76% in reducing the risk of symptomatic disease 15 days or more after receiving the two doses, and 100% against severe disease. [264]

On 4 January 2021, The Council of Ministers decided to provide indemnification to manufacturers, distributors, and donors in case of occurrence of adverse events following immunization (AEFI) for COVID-19 vaccination. [262] Furthermore, the Government also decided to exempt tax and tariffs while importing vaccines. [265] Together with these decisions, MoHP was directed to form a negotiation committee for vaccine procurement. [265] A delegation led by Hon'ble Minister for Foreign Affairs

discussed with Indian counterparts about COVID-19 vaccine supply, particularly intended for frontline health workers. The GoN requested Government of India for the assurance of 4.7 million doses of the Covishield vaccine as a first installment. [266]

An application filed by Serum Institute of India, which manufactured Covishield vaccine, responding to call from DDA for listing and registration of vaccines suppliers and distributers on 13 January 2021, was approved on 15 January 2021. [263] On 20 January 2021, the COVID-19 'National Deployment and Vaccination Plan (NDVP) for COVID-19 Vaccine 2021' was endorsed by ICS. [266]

The governance mechanism at each level (federal, province, district, and local level) was ensured by establishment of coordination and monitoring committees and the task force at all levels. Nepal already had immunization coordination committees at all levels; these committees were expanded in the context of COVID-19 vaccination program governance, coordination, and monitoring. The GoN also ensured adequate funding (operational costs) for vaccinating 20% of the prioritized population and beyond.

The MoHP worked closely with partners to support microplanning of immunization in all 77 districts. Partner organizations also supported the MoHP in the procumbent, shipment and inland transportation of a total of 21.04 million doses of COVID 19 Vaccines. Funding for this came from the Nepal Government, the COVAX facility (an advance market commitment designed to reduce costs and improve access to COVID-19 vaccines for LMICs through pooled funds and procurement), and from bilateral donors.

The Prime Minister of Nepal formally launched COVID-19 vaccination campaign on 27 January 2021 virtually through Zoom platform.[266, 267] Vaccination campaign started with the first one million doses of vaccine received as a gift from Government of India, which was sufficient to cover almost half of the targeted population planned in the 1st phase of the vaccination campaign. A second lot of one million doses was received about a month later as the delivery of first installment of purchase deal for two million doses at a cost of $4 per dose.[145] About the same time in February 2021, Nepal also received 348,000 doses of the Covishield vaccine through WHO COVAX program.

During the COVID-19 pandemic, while Nepal had an accelerated vaccine procurement process, the vocabulary 'vaccine corruption' gained prominence. MoHP made a deal with Serum Institute of India for purchase of two million doses of Covishield vaccine in February 2021. Of the agreed, one million doses arrived while the remaining doses were substantially delayed for months. As India had been swamped with the second wave of COVID-19, it imposed a ban on the export of vaccines to other countries. However, as the deal was signed much before the vaccine export was ban, it ignited discussion in Nepalese intelligentsia. On 11 May 2021, the Health Minister stated that COVID-19 situation was responsible for the delay. [145] The supply delay impacted second dose vaccine administration among senior citizens substantially beyond the prespecified schedule.

The vaccination process got easier in all three levels due to the presence of a routine immunization structure. Routine immunization had a solid network that served as the campaign's backbone. The demand side was far stronger than the supply side, and the vaccination campaign was carried out with tremendous dedication by the health personnel. There was no budget for the operation of the

vaccination facility at first, but health personnel toiled day and night to ensure that vaccinations were completed on time.

14.2. Governance structure

The MoHP was responsible for overall policy guidance, quality assurance, resource allocation, and multi-sectoral coordination. The COVAC provided guidance to the MoHP on vaccination-related issues. DoHS took the overall responsibility for implementation of the immunization programme. Coordination and Monitoring Committees were formed at federal level, provincial level, district level and municipal level. These committees were assigned the responsibility of coordination, oversight, and guidance at respective level (federal, provincial, and local). The Task Force facilitated the implementation of the COVID-19 vaccination program ensuring micro-planning, logistic management, data compilation and transmission, and supporting AEFI related preparation and activities. [262]

Figure 21: National governance structure for COVID-19 vaccination in Nepal
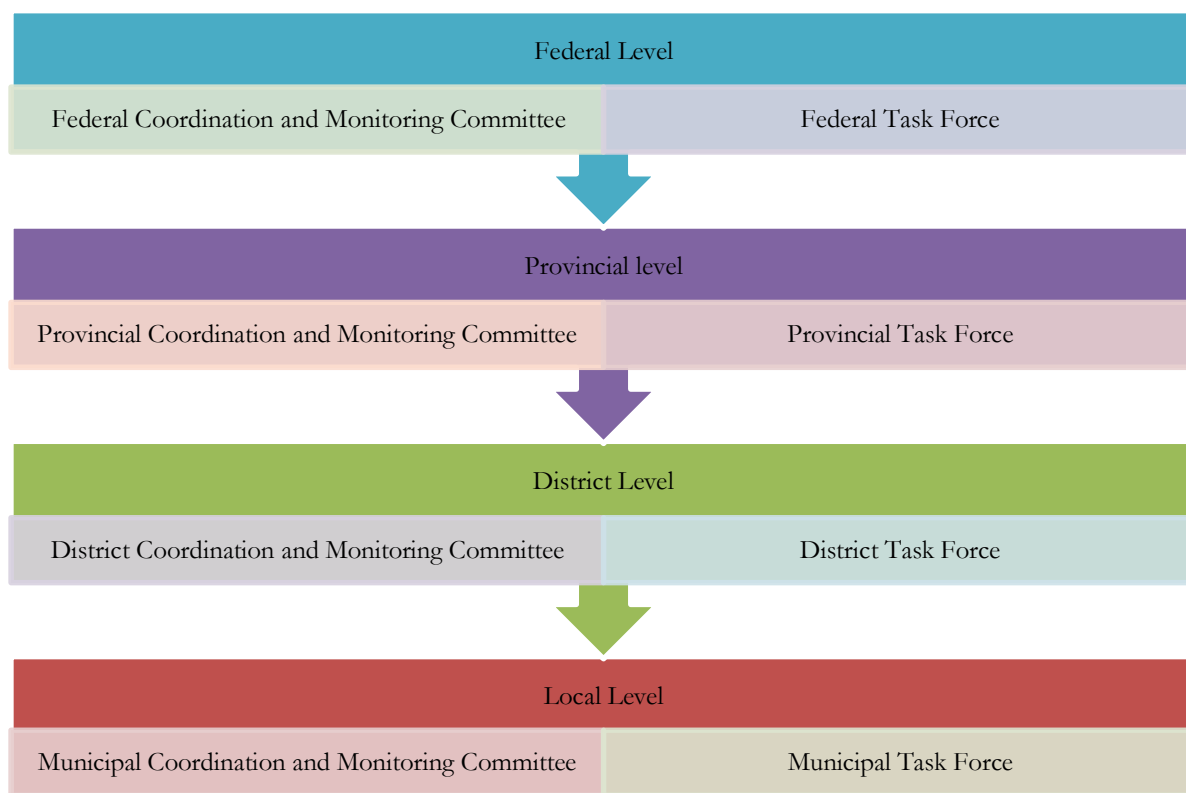
14.3. Priority groups for vaccine rollout

The NDVP for COVID-19 Vaccine provided clear guidance about the priority groups for vaccine rollout. Based on WHO SAGE values framework and prioritization guidance, and disease epidemiology in Nepal, population prioritization and vaccination phases were mapped out. This prioritization was recommended by the advisory committees and endorsed by the Council of Ministers. The priority groups in Phase 1, Phase 2 and Phase 3 was estimated to cover 3%, 17%, and

52% of the population, respectively. The priority groups in each phase and the rationale for prioritization are shown in Table 8 below.

Table 8: Priority groups for different phases of COVID-19 vaccination and rationale

Phase	Priority groups	Rationale
1	Frontline workers of health and social sector • Health care workers, including hospital/health facility staff • Sanitation/garbage/waste management collectors and drivers Ambulance and mortuary van driver and helper • Volunteers and security staff deployed in immunization centres • Workers directly involved in dead body management • FCHVs • Health workers and staff working in international point of entries • Elderly and their caretakers at old age homes • Prisoners and security staff in prisons	Frontline workers in health and social sector additional risk of acquiring as well transmitting disease. This group also works with vulnerable population (who are at high risk of COVID-19) and is also essential to continue COVID-19 and other essential services. Based on the nature of placement too, may have higher exposure to infection or may not be able practice infection prevention or control adequately or may acquire infection despite their best efforts.
2A	All elderly ≥55 years of age	Based on age-specific CFR data, COVID-19 deaths increase significantly from age 55 years and above.
2B	Persons with comorbidity in 40 –54 years age-group Diseases prioritized were: • Chronic obstructive pulmonary disease (COPD) and severe asthma, • Persons with organ transplant, • Chronic renal failure, • Cancer, • Serious heart conditions (heart failure, coronary artery disease, or cardiomyopathies, etc.), • Diabetes mellitus • Sickle cell anaemia	Regardless of age, people with co-morbid conditions were found to be at higher risk of mortality from COVID-19
2C	Migrant Labor with co-morbidity and refugees with co-morbidity	Migrant labourers are at high risk due to their mobility. Co-morbidity in this group could increase the risk of deaths. Similarly, refugees are the vulnerable yet often neglected population, and are usually not under the health care system.
3A	Remaining 40 – 54 years	
3B	Remaining 15 – 39 years	

14.4.   Vaccination deployment plan

The National Immunization Deployment Plan was implemented at all levels of government. The National Deployment and Vaccination Plan was filed by Nepal's MoHP. Through the COVAX Facilities, the objective was to procure enough doses to vaccinate 20% of the people at highest risk of COVID-19 sickness and death. Due to some reasons like pressure from political leaders, the vaccines were given to the people who were not in the priority groups. Many people have been registered the vaccines informally. The delegation for vaccination was given to the districts due to the pressure. It has affected in the proper data regarding vaccination.

14.5.   Supply chain management and vaccine rollout

Vaccine rollout

Although processes for vaccination delivery were comprehensively set out in national guidance documents, the reality of vaccine deployment on the ground sometimes diverged in ways that affected population-level access. For example, while the strict social distancing policies were in place, most of the government vaccination centers were crowded with notable noncompliance to the policies. The management of the vaccination centers was severely criticized as they lacked appropriate markup for social distance and enforcing compliance to it. Experts also pointed out that overcrowding at vaccination could have been the source of infection for many. Senior citizens who were prioritized could not receive vaccine shots despite waiting for hours as the centers ran out of COVID-19 before the allotted time of scheduled vaccination.[12]

Photo 8: Glimpse of crowd for COVID-19 vaccination, Source AP news

Supply chain management

Vaccines are received at TIA directly from the manufacturer (or may involve transit international airport in some cases) by the central store. The vaccines are then transported in a refrigerator van and are stored in walk-in cooler rooms in the central vaccine store located inside premises of DoHS, Teku. The extended central store in Pathlaiya (near the Nepal-India border) receives and stores the vaccine related logistics supplies (syringes, safety boxes, cold chain equipment and other dry goods) from manufacturers through the roadway via India. These are then distributed to the Provincial Health Logistics Management Centres (PHLMC). [262] PHLMCs receive vaccines and immunization supplies

from the central vaccine stores. The provincial stores distribute vaccines to district-level stores or health facilities. Out of the seven provinces, Madhesh Province and Karnali Province do not have a provincial vaccine store. Madhesh Province is currently supplied from the provincial stores in Biratnagar (Province 1) and Hetauda (Bagmati Province), and the Karnali Province is supplied from Nepalgunj (Lumbini Province) respectively. [262]

There are a total of 77 district vaccine stores, one in each district, which receive vaccines from provincial stores. In some instances, these stores (especially for districts in and near Kathmandu Valley) receive vaccines directly from the central stores. Service delivery points receive vaccines from the district vaccine stores. The lowest supply chain level is sub-store/local level government service delivery points (SP) such as health centres and health posts.[262] The supply chain is detailed in 21 below.

14.6. AEFI surveillance system

Nepal used the AEFI surveillance network (instituted in support of routine immunisation) for COVID-19 vaccination too. The surveillance system including reporting, investigation, and causality assessment in Nepal was conducted as per WHO guidelines for AEFI surveillance and causality assessment. The overall goal of AEFI surveillance is to ensure that vaccines are administered safely, trust in vaccines is sustained, vaccine safety is monitored, and AEFI is managed properly and promptly. [262]

Figure 22: A schematic representative of the COVID-19 vaccine supply chain in Nepal, at time of writing
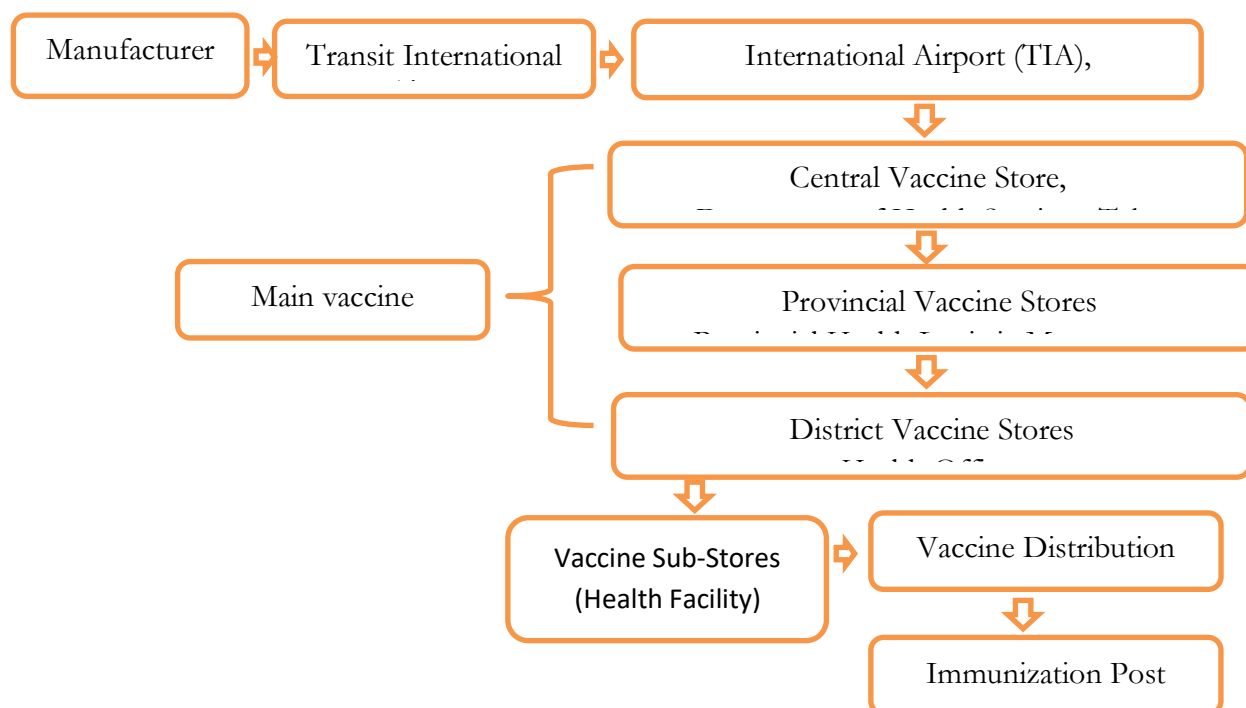
Nation-wide virtual training from central level to AEFI focal persons was conducted on 26 Jan 2021.[11] The surveillance cycle involved seven steps (see Figure 23): AEFI detection, notification, reporting, investigation, analysis, causality management, and feedback. [262]

Considering the need to differentiate the AEFI associated with different brands, brand name of the vaccine, manufacturer along with details such as batch numbers and documentation of dates, as well as contraindications and special populations (such as pregnancy, lactation) were documented. A network of surveillance medical officers (WHO-IPD) provided technical assistance at field level.[1]

The National AEFI Investigation Committee is a multi-disciplinary and independent committee for investigation and causality assessment of AEFI. As COVID-19 vaccination involved age groups beyond regular immunization, provision was made for investigation committee to invite multi-disciplinary experts (e.g., cardiologists, anesthesiologists, neurologists, geriatricians) based on the nature of AEFI under investigation.[1]

Figure 23: The AEFI surveillance cycle governing COVID-19 vaccine rollout in Nepal
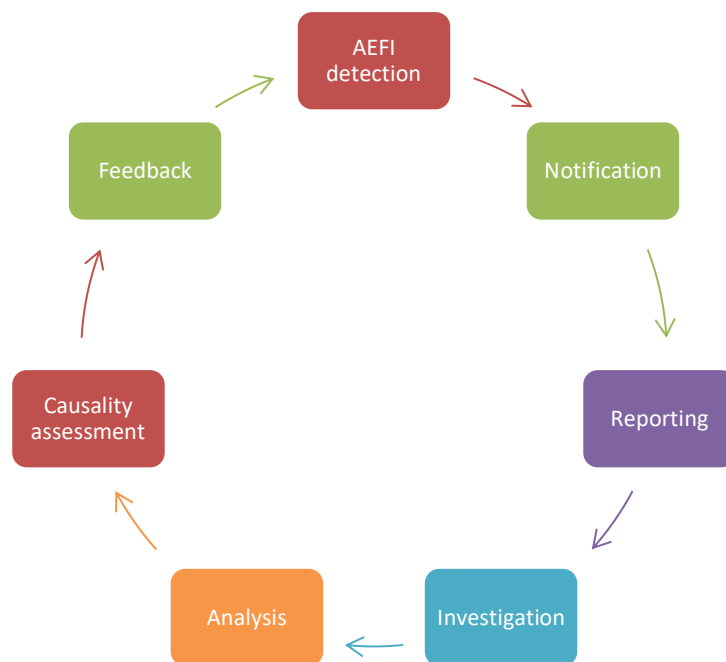
During the first phase of vaccination, 5 in 1000 people had some minor reaction and 4 in 100,000 people had moderate reactions which could be managed by health workers.[267] The government decided to keep an ambulance on standby and to ensure supplies of adrenaline and other equipment for the management of AEFI in each vaccination site.[16]

14.7. Vaccination coverage and vaccine hesitancy

Vaccination coverage

Starting with vaccination of frontline health workers in limited sites, Nepal swiftly moved to vaccinating almost one third of its total population through a network of vaccination centres throughout the country. Three vaccine products were deployed as part of this effort: Covishield (2 doses), Vero cell (2 doses), Pfizer (2 doses), Moderna (2 doses) and J&J (single dose). To make estimation of the vaccine doses required and facilitate the planning process, pre-registration for vaccine through web portal was considered.

As of 31 December 2021, over 24.4 million doses of vaccine have been administered. A total of 14 million people have received at least one dose while more than 10 million people have been fully vaccinated. This equates to approximately 34.2% of total population, 52.1% of the population ≥ 18 years of age having been fully vaccinated at the time of writing.[176] See Figure 24.

Figure 24: Vaccination coverage in different target population, as of 31 December 2021

Total Population	Target Population (≥18years)
Population 30,378,055	Population 19,922,164
First Dose 46.2%	First Dose 70.5%
Full Dose 34.2%	Full Dose 52.1%
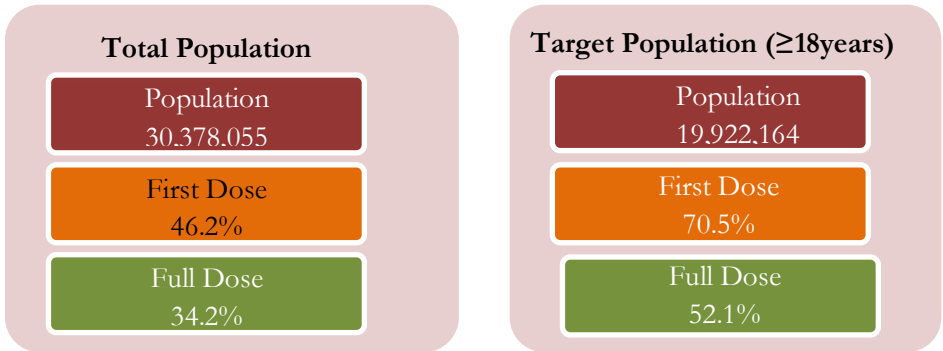
Provincial breakdown of vaccination shows that Bagmati province has the highest coverage of vaccination (79.7% fully vaccinated) which was also the most affected province. See Table 9.

Table 9: Province-wise breakdown of vaccination status as of 31 December 2021

Vaccine	ChAdOx1-S*			Vero Cell			Pfizer			Moderna			Total			Janssen (Single dose vaccine)	Fully Vaccinated
	1st Dose	2nd Dose		1st Dose	2nd Dose		1st Dose	2nd Dose		1st Dose	2nd Dose		1st Dose	2nd Dose			
	N	N	%	N	N	%	N	N	%	N	N	%	N	N	%		
Province 1	708,799	501,027	70.7	1,329,604	818,882	61.6	5,984	5,369	89.7	81,385	0	0	2,125,772	1,325,278	62.3	266,836	1,592,114
Madhesh	717,373	433,820	60.5	1,268,766	711,226	56.1	7,441	3,382	45.5	198,754	0	0	2,192,334	1,148,428	52.4	385,281	1,533,709
Bagmati	847,648	602,139	71	2,427,184	2,104,154	86.7	26,458	18,752	70.9	116,854	0	0	3,418,144	2,725,045	79.7	387,468	3,112,513
Gandaki	413,115	259,528	62.8	944,916	820,617	86.8	3,391	3,057	90.2	151,829	0	0	1,513,251	1,083,202	71.6	143,782	1,226,984
Lumbini	880,339	321,964	36.6	1,540,469	960,275	62.3	5,300	5,102	96.3	283,063	0	0	2,709,171	1,287,341	47.5	255,854	1,543,195
Karnali	158,332	121,506	76.7	463,882	277,285	59.8	2,208	2,005	90.8	106,962	0	0	731,384	400,796	54.8	85,850	486,646
Sudurpaschim	324,737	231,919	71.4	851,378	503,035	59.1	3,951	2,148	54.4	166,539	0	0	1,346,605	737,102	54.7	152,588	889,690
Total	4,050,343	2,471,903	61	8,826,199	6,195,474	70.2	54,733	39,815	72.7	1,105,386	0	0	14,036,661	8,707,192	62	1,677,659	10,384,851

Source: IHIMS/IMU, as of 31 December 2021, 2:00pm
*COVISHIELD (Manufactured by Serum Institute of India), Japanese-made COVID-19 AstraZeneca vaccine, Swedish AstraZeneca vaccine)

14.8. Vaccine hesitancy

One large, cross-country study that incorporated survey data gathered directly in-country suggests that attitudes towards COVID vaccination are very positive especially by comparison with other low- and middle-income countries.[268] In the beginning there was confusion among people regarding the effectiveness of vaccine due to which vaccine acceptance was low. But in the second wave, the mortality of COVID-19 increased, the demand for the vaccine was high but at that time supply was low in Nepal.

In a telephone-based survey by UNICEF among 6500 households, 96% of population was willing to take vaccine if available. Almost 77% of the population felt taking vaccine is very important and 18% felt it was moderately important. The decision to take the vaccination was based primarily on wanting to protect self and prevent transmission to others but varies by respondent's perception of Covid-19 vaccine importance. [116]

There is, however, some suggestion of increased hesitancy among specific population groups, notably health workers (linked in this case to concerns over safety).[269] As the people are willing to accept the COVID-19 vaccines, vaccine hesitancy did not appear as a major issue in Nepal. However, as the vaccine was new and developed in a relatively short time frame, GoN reinforced the vaccine safety messages through mass media. Major concerns regarding vaccine were addressed through an infographic posted on website of the MoHP. As the media is likely to influence the perception across wider segment of population, the MoHP engaged media in pre-vaccine phase, during vaccine roll-out and post vaccine introduction phase.

The MoHP (with support from partners) also developed experience sharing videos to overcome vaccine hesitancy in Nepal. There were 26 short videos of experience sharing of getting of COVID-19 vaccine by frontline health and sanitation workers including medical doctor, nurse, paramedics, ambulance driver, cleaners, security persons/guards at hospitals and 23 short videos by second priority population that are civil servants, security personals, bankers and journalists Similarly, 93 testaments videos and short videos of experience sharing of getting of COVID-19 vaccine recorded originally in 10 languages with elected officials, parliamentarians, ministers, and ex-ministers. Twenty-six public service announcement videos with health minister and MoHP officials about vaccine safety and AEFI were developed.

14.9. Online Certification

For persons traveling/going overseas for various reasons, an online certification process is available. Initially, the cards were used as proofs of immunization, but later rules mandated that the cards be confirmed by the Department of Health and Human Services. Teku hospital, Patan hospital, Civil hospital, and Armed Police Force hospital have been given the authority to validate immunization cards for this reason. However, countries such as Dubai and Qatar later amended their regulations and began to follow international practice for immigrants (electronic immunization card with QR code). The MoHP of Nepal has launched a new online service to deliver COVID-19 vaccine

certification with QR codes. The Department of Health Services created an online form for this process using IMU software. Passports, pictures, and a vaccination card were required to fill out the online forms, and the certificate was accessible within 24-48 hours. The service began on Palika level on November 3, 2021, to make it more accessible (Kartik 17, 2078). The duration of time it takes to get the certificate depends on the Palikas.

14.10. Lessons and future directions

With the exception of tetanus and diphtheria vaccination, there was no prior experience in Nepal of delivering adult vaccination programmes. This was commonly observed in other LMICs in the pre-pandemic period, and meant that Nepal, like many other countries, was obliged to set up an adult programme for COVID-19 effectively from scratch. The challenges involved in doing this in the context of a pandemic response are considerable. Current coverage estimates reported here suggest a very successful rollout to date, backed up by close adherence to WHO guidance on prioritization and delivery, secure procurement agreements, clear delivery pathways, a high degree of political commitment from the government and political opposition alike, and very high levels of public acceptance for COVID-19 vaccines in Nepal. Nevertheless, there have been challenges relating to:

- Demand management: overcrowding has been reported at some vaccination sites, contributing to issues of IPC as vaccine rollout has progressed. This may partly have been linked to scheduling issues (in setting up appointments for attendance). Nepal may need additional effort in preparing health facilities for ensuring compliance to social distancing measures which could be through appropriately distanced marks in health facilities.

- Supply chains: it was not always possible to ensure adequate supplies at facility level to allow to vaccines to be delivered to priority groups on time. Further work is needed to shore up facility capacity to store and deliver vaccines to ensure timely delivery.

- Data: To support better informed decision-making in the next phase of the pandemic (especially in light of the risk of new variants emerging) surveillance systems can capture data on disease outcomes by vaccination status. Data of informally registered people was also a challenge.

- Pre-registration: There was shortcoming regarding pre-registration of people before vaccination. FWD had started the provision of pre-registration of vaccination but was not implemented successfully. It was failed as the elderly and illiterate people could not pre-register for vaccination. For booster dose, the pre-registration has been successful which can help in availability of actual data regarding vaccination.

- Communication: For behaviour change communication activities, the information in local language should be focused especially in Madhesh Province. The national media should also focus to provide information especially in the language where there is low vaccination rate.

15.   Research, innovation, evidence-informed decision making

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Summary
- Robust mechanisms for evidence production, synthesis and integration into policy are prerequisites for effective epidemic responses. While the international institutions have played important roles in generating and disseminating evidence-based guidance on epidemic response globally, the effectiveness of the local response in Nepal depends on being able to translate research findings into contextually appropriate policies and system interventions.

- The Nepal Health Research Council (NHRC) as an apex body on health research in Nepal identified and published a list of priority research questions in 15 different areas related to COVID-19 through publication of National Guideline for Strengthening Evidence Generation On Covid-19 in 2020. Research studies are conducted on priority areas.

- The NHRC has also released the full report of some research activities that were ongoing during the first wave of COVID-19. Other studies assessing the severity of COVID-19 among vaccinated and unvaccinated people, adverse events following immunization, and factors associated with COVID-19 deaths are ongoing.

- In a pandemic situation where governments cannot address all the knowledge gap from its funding, developing a mechanism to pool result results produced by other academic and research institutions and independent researchers could substantially improve the availability to policy makers of appropriately contextualized evidence to guide decision-making.

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The NHRC is an autonomous oversight body for health research that is responsible for providing ethical clearance for research being conducted in Nepal. NHRC also conducts research and studies with the objective of facilitating evidence informed decision making in health sector. NHRC played a crucial role on health research governance (capacity building, evidence generation, research regulation and promoting use of evidence) during the COVID-19 pandemic.

15.1.   Research policies and evidence generation

According to a letter received by the NHRC from the Government of Nepal, MoHP dated 2077/12/15 (March 28, 2021), the Member Secretary (Executive Chief) of the council was appointed the Communication Officer with TOR by the ICS under the command of the Health Secretary, by a decision dated 2076/12/14 (March 27, 2020). As per the decision of ICS, NHRC conducted several research studies on COVID-19 and submitted the policy briefs and report to MoHP. In a letter received by the NHRC from the GoN, MoHP, dated 2077/1/15 (April 27, 2020), five-member committee was appointed, and the council was instructed to prepare the National COVID-19 Research Guidelines, as per the TOR. The protocol was prepared accordingly and approved by the 188th executive committee meeting of the NHRC on 2077/02/23 (June 5, 2020), and then submitted to the GoN, MoHP, for approval on 2077/03/01 (June 15, 2020). It was approved by the Government

of Nepal (Secretary Level) on 2077/3/15 (June 29, 2020). Research studies into COVID-19 were conducted in accordance with the guidelines.

The national COVID-19 research guideline prepared by NHRC was approved on 29 June 2020. In the guideline, guiding principles of COVID-19 research, ethical considerations for research during COVID-19 pandemic and priority research questions under 15 areas[7] relating to COVID-19 were covered.[270] As of 31 December 2021, 425 research proposals on COVID-19 are approved by Ethical Review Board of NHRC [271] and their distribution as per the priority areas is given in Table below

Table 10: Priority areas of research

Research Priority Areas	Total
Emergency Preparedness and Response	70
Monitoring and Evaluation	7
Infection Prevention and Control (IPC) Practices	9
COVID-19 related Knowledge, Information and Data	73
COVID-19 related Fund and its Economic aspects	3
COVID - 19 Epidemiology	10
Clinical Characterization, Presentation and Testing	64
Rapid learning about Immunity for Public Health Impact	22
Treatment and Rapid Impacts for COVID -19 Treatment	30
Non – Pharmaceutical Intervention: Adherence and Mobility	6
Public Health Response	10
Genetics of COVID – 19	3
Psycho - social dimension of COVID-19	110
Food and Nutrition during COVID - 19 Pandemic	3
Risk Communication	4
Total	**424**

Despite identifying priority research questions to guide the COVID-19 response, the NHRC lacks mechanisms to disseminate findings of all these research studies being conducted under each of these research areas or priority research questions which could be useful in preventing duplication of resources and full fill the knowledge gaps. During the COVID-19 pandemic, NHRC conducted virtual training workshops and trained more than 12,000 participants. NHRC also conducted virtual meetings of ethical review committed and expedited review of COVID-19 related research. The findings of

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[7] NHRC identified research questions under 15 areas: emergency preparedness and response, monitoring and evaluation, infection prevention and control practices, COVID-19 related knowledge information and data, COVID-19 related funds and its economic aspects, COVID-19 epidemiology, clinical characterization, rapid learning about epidemiology for public health impact, treatment and rapid impacts of COVID-19 treatment, non-pharmacological intervention: adherence and mobility, public health response, genetics and COVID-19, psycho-social dimension of COVID-19, food and nutrition during COVID-19 pandemic and risk communication.

research were communicated to MoHP through ICS meeting and as well as regular dissemination workshops for evidence informed decision making.

15.2. Research activities

In the earlier phase of the COVID-19 pandemic, particularly during the first wave, research activities of NHRC were more related to preparedness of hospitals for COVID-19 response, compliance to preventive measures like SMS measures, accuracy of RDTs, policy audits assessing the implementation status and challenges in implementation of COVID-19 related policies, whole genome sequence, and observational studies on Remdesivir and Convalescent Plasma therapy. Since the introduction of COVID-19 vaccines, the NHRC has been doing research on vaccine related areas like occurrence and severity of COVID-19 among vaccinated and unvaccinated individuals in Nepal, AEFI and factors associated with COVID-19 deaths. [272]

Results from some studies led by the NHRC or other government agencies relating to COVID-19 are discussed briefly as below:

- An assessment of the preparedness and readiness to respond COVID-19 among designated COVID-19 hospitals was performed from 26 April-27 May 2020. Out of 30 hospitals included in the study, 23 (92%), 22 (88%) and 19 (76%) of the hospitals had waiting/holding areas, separate examination areas and triage systems respectively while only 7 (23.3%) hospitals had designated emergency service for COVID-19. Similarly, more than a quarter (30%) of the COVID hospitals did not have the provision of investigation in the same hospital and 13.3% did not have separate designated areas for sample collection. [273]

- The National Tuberculosis Control Centre conducted a rapid assessment of the effect of COVID-19 Pandemic on the TB programme in Nepal. The study was conducted from May-June 2020. The study revealed that TB control programme was impacted by COVID-19 with 67.3% decline in mean number of sputum courier, 45.5% decline in enrollment and 41.7% decline the follow-up of TB patients during the COVID-19 lockdown period. [252]

- The NHRC conducted a study on compliance to SMS measures with most of data collected on 5-6 August 2020 from different public places (including vegetable markets, shopping malls, temples, buses, restaurant/hotels, hospitals) in Kathmandu valley. The study revealed that 27.9% of participants did not use masks, and that among those who did use them, 27.34% did not do so appropriately. Only 37.5% of public places included in the study had marking for social distancing. Similarly, 33.3% of shopping malls and 46.6% of public vehicles had sanitizer of hand washing facility. [119]

- In the face of ongoing controversy surrounding the accuracy of RDTs in Nepal, the NHRC evaluated the use of commercially available RDT kits for the use of screening of suspected cases of COVID-19. Compared to the reference standard (RT-PCR), the sensitivities of the Wondfo RDT Kits (which had been in use in Nepal after procurement from China) was found

to be 50%, with specificity of 99.5%. Positive and negative predictive values of the test kit stood at 66.7% and 99% respectively. In the study, accuracy was calculated as 98.5%. [272]

- NHRC conducted a rapid policy audit that assessed the implementation practice of COVID-19 related policies, guidelines, and directives in Nepal. The full report was released in November 2020. The study revealed that local level actors lacked legal frameworks and capacity for implementation of policies developed at federal level. The study also revealed that Nepal lacked appropriate mechanism for coordination between three tiers of government. [57]

- The NHRC published the report with results of Whole Genomic Sequencing of SARS-COV-2 Isolated from COVID-19 Patients in Nepal in November 2020. From the analysis of fifteen (15) retrospective/archived samples (nasopharyngeal/throat swabs) within 26 June to 10 August, 2020 study concluded that SARS-CoV-2 in Nepal mostly belonged to GH and GR (that mutated from strain G at the end of February, 2020). [273]

- The NHRC conducted an assessment of the health status of COVID-19 patients in home isolation. In the study, 88.4% of the participants were found to be maintaining social distancing. Approximately 20.5% participants were found to be facing difficulties in home isolation of which 42.8% did not have separate rooms, 26.1% did not have separate toilets and 5.7% did not have cross ventilation. Slightly more than half of the participants (58.2%) of the participants had some degree of a mental disturbance at some point of time during home isolation. [71]

- The Integrated Health Information and Management Section, Management Division, DoHS performed an analysis assessing impact of COVID-19 pandemic in selected health services and made estimation of excess maternal deaths. The study involved analysis of routine data from February/March 2019 (pre-COVID-19) to August/September 2020 (COVID-19 period) along with qualitative data collection and analysis. While some of the service utilization indicators had rebound to pre-pandemic period, the study estimated that there were 47 excess maternal deaths in COVID-19 months. [248]

- On 23 February 2021, the NHRC released a report of a study on the use of Remdesivir and convalescent plasma therapy (CPT) in treatment of COVID-19 patients. The study was conducted from 30 July -31 October 2020. The study covered 1315 patients from 30 hospitals. In the study, patients with severe and life0threatening COVID-19 treated with Remdesivir were found to have a recovery rate of 84%. Similarly, patients treated with CPT had recovery rate of 39% while the patients treated with both the Remdesivir and CPT had recovery rate of 54%.[274, 275]

- NHRC has been leading Randomized Evaluation of COVID-19 Therapy [RECOVERY] in collaboration with Oxford University, UK and its sister organizations Oxford University Clinical Research Units based in Vietnam and Nepal. This global trial is a randomized, controlled, open-label, adaptive platform trial, where several possible treatments are compared with usual care in patients admitted to the hospital with COVID-19. It aims to identify treatments that may be beneficial for people hospitalized with suspected or confirmed

COVID-19. The study is being conducted at 190 active sites globally and has recruited over 46,000 participants so far. In Nepal, five participating sites viz. Shukraj Raj. Tropical & Infectious Diseases Hospital, Armed Police Hospital, Nepal Police Hospital, HAMS Hospital and Pokhara Academy of Health Sciences have collectively recruited over 661 participants and is ongoing.

- NHRC is recently leading global randomized controlled adaptive design trial collaboratively with WHO. The trial aims to identify lifesaving therapeutics against COVID-19 disease by evaluating repurposed drugs in addition to standard care for hospitalized patients with moderate to severe forms of infection. The study is being continued across 52 nations including Nepal, guided by a consortium of an independent expert group.

- Epidemic Intelligence is a consortium project to collect and sequence SARS CoV-2 samples from COVID19 patients, to improve our understanding of the emergence and ongoing transmission of the virus in Nepal. The consortium partners include NHRC, Birat Nepal Medical Trust, Centre for Molecular Dynamics-Nepal, Liverpool School of Tropical Medicine, University of Cambridge, Oxford University Clinical Research Unit-Nepal, Bheri Hospital Nepalgunj, Sukraraj Tropical & Infectious Disease Hospital Kathmandu, and Koshi Hospital Biratnagar. The project has recruited over 1,000 participants since July 2021 and over five hundred patient samples have been successfully sequenced by 16 November 2021. All samples sequenced to date are Delta variants and sub-lineages, with no community transmission of Omicron identified in Nepal by 16 November 2021. However, continued surveillance to monitor for emerging variants is essential. The cohort will be followed up at 3 and 6 months for clinical and mental health outcomes, LONG COVID symptoms and the association of variants with vaccine types

- Effect of COVID19 pandemic and lockdown on provision and utilization of essential sexual reproductive maternal neonatal child and adolescent health and nutrition services in Nepal: NHRC conducted a descriptive mixed-method cross-sectional study design to explore the effect of COVID 19 pandemic and lockdown on the provision and utilization of essential sexual reproductive maternal neonatal adolescent and child health (SRMNCAH) and nutrition services to women and children in Nepal. The study explored the effect of COVID 19 and lockdown on the essential SRMNCAH and nutritional services. It helped to identify the barriers in the provision and utilization of the services due to COVID 19. In addition, the study helped to estimate the proportion of the population that availed essential services during the national lockdown period and compare that with the pre-lockdown period.

- NHRC is leading a nationwide retrospective survey in collaboration with the MoHP Nepal to explore underlying cause (s) and associated factors of COVID-19 deaths. The results from this study provide an insight into the COVID-19 deaths in Nepal and hence help in addressing the urgent need to either amend or continue with the existing plans and policies for COVID-19. It also aid in developing protocols and treatment guidelines for COVID-19 patients. This

in turn will help the government in improving the quality of care of affected people, thereby decreasing the overall mortality due to COVID-19 in the future.

- NHRC is conducting a mixed-method (QUAL-QUAN) study aiming to assess the impact of Covid-19 on the health care delivery system and its utilization for people living with non-communicable diseases (NCD) in Nepal. The study is being conducted in the selected hospitals of all the seven provinces of Nepal amongst people visiting to the health facility with Cardiovascular Disorders, Diabetes Mellitus (DM), Chronic Obstructive Pulmonary Disease (COPD), Cancer, and Chronic Renal disease. The findings of the study will help to identify the impact of the COVID-19 pandemic on the management of NCDs from both supply and demand sides: patients with NCDs and the health care delivery system. This study will also give insight into the service providers' perception of challenges and barriers for delivering health services to chronically ill patients during times of the pandemic.
- NHRC is investigating health complications within six months of COVID-19 recovery among Nepalese people and its association with socio-demographic status, treatment, COVID-19 vaccination, mental health, and existing health conditions. This is a cross-sectional analytical study with a timeline of three months and includes 427 participants. Data collection has been recently completed. Identification of possible health complications of COVID-19 infection after recovery may better define the possible burden to healthcare systems in the aftermath of the pandemic and inform for necessary preparedness plans in advance for complications management.

The GoN also approved a third phase clinical trial of a messenger RNA (mRNA) COVID-19 vaccine candidate. A Cabinet meeting on 26 August 2021 decided to allow the Chinese company (Walvax Biotechnology) and its local partner Deurali-Janta Pharmaceutical Pvt. Ltd to conduct the third phase of clinical trials of the vaccine in Nepal. As per the clinical trial procedure in Nepal, research proposal is judged suitable based on ethical clearance guideline of NHRC by ERB of NHRC is forwarded to Council of Ministers (GoN) through MoHP for approval. [276]Although there were discussions for trials of the ChAdOx1 vaccine developed by AstraZeneca and Oxford University, for the Sputnik-V vaccine developed in Russia and Sinovac vaccine developed in China, none of these ultimately were implemented. [275] . Other two vaccine trials approved in Nepal are " A parallel group, phase III, multi-stage, modified double-blind, multi-armed study to assess the efficacy, safety and immunogenicity of two SARS-COV-2 Adjuvanted Recombinant Protein Vaccine (monovalent and bivalent) for prevention against COVID-19" and "A global multicenter, randomized, double-blind, placebo-controlled, phase III clinical trial to evaluate the efficacy, safety and immunogenicity of recombinant COVID-19 vaccine (sf9 cells), for the prevention of COVID-19 in adults aged 18 years and older".

15.3.   Mechanism for evidence-informed decision making

The PPMD at the MoHP leads the Knowledge Café secretariat which engages policymakers, programme managers, researchers, and health professionals from MoHP and the broader health system in a series of knowledge translation activities that promote or facilitate open and creative

conversations on the relevance of recent evidence for health issues, programmes, and policies. As the evidence on COVID-19 was updated, the PPMC conducted a series of Knowledge Café sessions to update policy makers about the emerging evidence and ignite discussion on how this evidence could impact the current practice of COVID-19 response in Nepal (see table 11 for details of the main events hosted under this programme).

Table 11: The main sessions or knowledge products from Knowledge café to date

SN	Knowledge café sessions /evidence summaries	Details
1	Effective measures to control transmission of COVID-19	Effectiveness of screening measures, management of asymptomatic cases, non-pharmacological interventions like travel restrictions, school closures, contact tracing and isolation, mass gatherings adopted in different countries were discussed in the meeting. The meeting had recommended adoption screening measures at POE, travel restrictions with contact tracing and Quarantine of exposed. The meeting also recommended that treatment should be taken along with preventive measures.
2	Landscape of diagnostic tests for COVID-19	While Nepal was struggling to expand the diagnostic services, this Knowledge café meeting discussed the sensitivity and specificity of different diagnostic tests, validation of rapid diagnostic tests, testing strategies adopted in different countries like South Korea, Germany, Singapore, and India. The meeting also discussed the possibility of pool testing in case of a capacity surge. There was in addition discussion of private sector engagement in laboratory testing. Issues discussed in the meeting were subsequently reflected in the testing guidelines and policies. For example, experts suggested pooled testing as one of the options for expansion of testing capacity and later NPHL issued a guideline relating to it.
3	Clinical spectrum of COVID-19	The meeting discussed about the spectrum of disease, evidence on comorbidities, laboratory and radiological features, and clinical management of the cases. The meeting had invited speakers working in COVID-19 response in different hospitals in United States of America.
4	Breaking the transmission chain of COVID-19	The evidence summary covered latest evidence on physical and social distancing measures adopted in different countries, evidence from large scale studies on effectiveness of distancing strategies, evidence on effectiveness of mask use (disaggregated by type), the effectiveness of hand hygiene and sanitation measures.
5	COVID-19 vaccine update	While there were concerns regarding the efficacy of different vaccines, the summary updated ministry officials about the vaccine development process, status of different vaccines, efficacy, dose and storage conditions for different vaccines and approval status.

Apart from the Knowledge Café, ICS meetings, health cluster meetings, dissemination meetings of NHRC, a national summit of health and population scientists organized by the NHRC, and a national health summit organized by Nepal Medical Association (NMA) were the keys for facilitating evidence

informed decision making. Recently, MoHP has made decision to host secretariat of knowledge café' at NHRC and play a crucial role on research communication for evidenced informed decision making.

On 13 April 2021, the MoHP moved to establish the IMU under ICS through secretary level decision as envisioned in emergency response plan. IMU was assigned the responsibility of coordinating with relevant stakeholder for data generation and analysis particularly on following domains:

- Logistics (in coordination with Logistic Management Division)
- Case investigation, contact tracing, surveillance, and health desks (in coordination with EDCD)
- Human resource (HR) (in coordination with administration division and the team working in HR mobilization plan)
- Laboratory (in coordination with laboratories), clinical management (in coordination with hospitals
- Quarantine (in coordination with NEOC and Provinces
- Policy, Plans and Guidelines (in coordination with HEOC)
- Provincial and Local level activities (through provincial reports, HEOC and HDC)
- Continuation of regular services (in coordination with IHIMS, MD)
- Health Cluster (in coordination with HEOC) and
- Immunization (COVID-19 vaccination and QR certification (in coordination with FWD)

There were six teams, namely information management unit coordination team, data/information collection team, data quality assurance team, data analysis team, report preparation team, and Information Technology (IT) management team. Different teams in IMU provided data to facilitate evidence-informed decision making through ICS. There were lots of profit and non-profit organizations developed different types of applications to identify and manage COVID-19 cases. Out of many initiatives Amakomaya the organization which have been worked for maternal and child health recording and tracking system have developed the COVID-19 patient tracking system with the name of "Hamro Survey" in April 2020. Later on, MoHP/ICS have decided to adopt the "Hamro Survey" system for COVID-19 case recording and reporting tool and rename it as COVID-19 IMU Nepal app. It is a good example to share for Nepal to utilize existing country capacity and technical expertise that has been growing from home land have used the existing system software to fight against the COVID-19 pandemic. All code, and digital health technical database framework that is designed for recording and tracking Maternal health system is customized an appropriate tool to track COVID-19 cases in couple of weeks' time. Under the leadership of IMU/IHIMS section chief small technical team of engineers from Amakomaya started to improve the existing software features and performance by sitting inside the IHIMS office space. The team have provided continuous tech support and series of training (zoom and even physical training) was conducted as per need on all modules e.g., Community test Model (Antigen), Laboratory Model (PCR test), Hospital Model (Patient tracking), POE Model (Monitoring Point of entries), CICT (Case investigation and Contact Tracing) Model, Vaccination Model including QR certification and aggregate reporting in HMIS on DHIS2 platform.

The IMU was decided from secretary level as well as CCMC level as only one mandatory source for covid-19 related data management and getting reimbursement of cases payments (cabinet decision) managed by isolation centers and hospitals. Series of decisions regarding to CoVID-19 data management were as following.

Figure 25: Governance structure of IMU
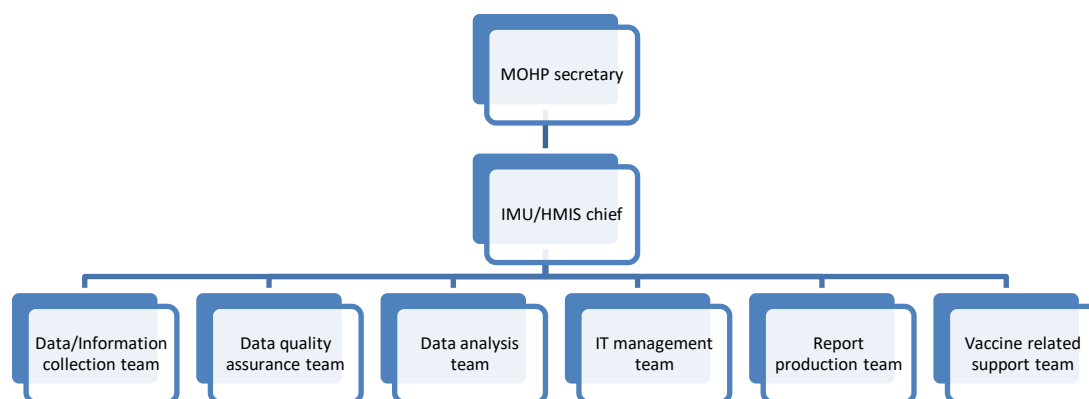
15.4. Lessons and future directions

- There is a need for periodically updating the priority list for research considering the evidence generated within and outside the country. Furthermore, having a system or mechanism in place to track the ongoing and completed research could facilitate evidence-informed decision making and also help in preventing duplication of resources.

- A primary route for uptake of new evidence appears to have been through Knowledge Cafes organised through the PPMD which was particularly helpful in evidence-informed decision making during the first wave of the pandemic. Sustaining the Knowledge Café initiative could improve the evidence informed decision making in future during normal circumstances or during the time of pandemic. NHRC role in sustaining the Knowledge Café initiative could be crucial as one the mandate of NHRC by an Act is promoting use of evidence.

- To strengthen the pandemic response, there is a need for establishing a mechanism to develop and synthesise a pool of research results conducted within Nepal, so that policy makers can have access to locally-contextualised evidence.

16.   Conclusion

In this concluding chapter, we focus on synthesizing lessons learnt from material presented in this report and on identifying priority areas for action both for the near-term COVID-19 response, and with a view to longer-term preparedness for potential epidemics in the future. The list given below is non-exhaustive, focusing instead on high priority actions from the response domains covered in this report (fuller lists of suggested future directions are given at the end of each chapter in the main report).

- Clearer alignment of institutional structures governing the response should be a top priority for action. This report has documented evidence of overlapping remits between newly established bodies at various levels of the health response and potential duplication. To improve governance effectiveness in the near term, there should be sufficient support and space to the ICS to enable it to continue overseeing the health response. In the longer term, it will be necessary to further strengthen the role and capacity of HEOC, which coordinated pandemic response in multiple ways during the course of the pandemic.

- Strengthening situational awareness systems should be a priority for both the near-term COVID-19 response to better inform the actions of the ICS, and longer-term preparedness for future outbreaks. There are several components to this, including (i) improvements to routine surveillance systems to improve data capture; (ii) strengthening epidemic modelling capacity available to the MoHP, NHRC, and academia within country; and (iii) strengthening the mortality surveillance system.

- The health system encountered challenges in ensuring adequate supply of oxygen particularly during the second wave. There is a need to bolster pre-positioned supplies of oxygen as a part of preparation for potential future waves, working with other ministries, development partners and health facilities. Initiatives taken for installation of oxygen plants should be supported and sustained in the future.

- While health workforce shortages cannot reasonably be solved in the short term, there are opportunities to strengthen training for current staff – which has been somewhat ad hoc during the pandemic – and to support lesson learning in terms of best practices for clinical care of COVID-19 based on learning from the first and second waves. There is need for additional attempts in documenting and disseminating the best practices and exchanging skills through practitioners' exchange programmes.

- While the MoHP was successful in aligning development partners' support in priority areas identified, the engagement with the private sector in early phase of pandemic was limited. To support preparedness and particularly surge capacity for future epidemic response, consideration should be given as what incentives could encourage greater and earlier private sector involvement in both clinical care and provision of testing.

- In this report, we have identified a number of cross-cutting areas where further research may be helpful to address knowledge gaps. The NHRC could play an important coordinating role in this

area. Examples of priority areas include (i) detailed evaluation of RCCE approaches deployed during the pandemic so far to understand what worked in changing behaviours, why, and how interventions could be improved; and (ii) building academic capacity in Nepal (and through partner institutions overseas) to generate timely research outputs through, for example, infectious disease modelling to better inform scenario planning.

- Regular meeting of the Knowledge Café initiative will be crucial for timely communication of research findings for evidence informed decision making for addressing the pandemic such as COVID-19.

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Appendices

Appendix 1: Stakeholder mapping

Cluster	Government lead	Agency lead (Co-lead)	Sector members	Purpose
Coordination, Planning, and monitoring	Health Emergency Operation Centre (HEOC) of MoHP and NEOC of MoHA and NDRRMA in collaboration with provincial HEOCs and EOCs, CCMCs	WHO and the UN Resident Coordinator's Office	Humanitarian Country Team	Support in leadership and management of the outbreak
Protection	Ministry of Women, Children and Senior Citizens/Department of Women and Children (federal) and Ministry of Social Development (provincial)	UNICEF and UNFPA	IOM, UNDP, UNHCR, UN Women, WFP, National Child Rights Council, National Senior Citizens Federation (NSCF), Nepal Police, Blue Diamond Society, Care Nepal, CIVICT Nepal, CMC, DCA, Family Planning Association of Nepal (FPAN), FWLD, Humanity and Inclusion, ICRC, Islamic Relief, KOSHISH, Lutheran World Federation, Mercy Corps, Mitini Nepal, National Alliance of Women Human Rights Defenders, National Federation of the Disabled-Nepal, Nepal Red Cross Society, Oxfam, People in Need, Plan Nepal, Relief Trust, Save the Children, Tearfund, Terre des homes, TPO Nepal, VSO, WOREC Nepal, World Vision, ActionAid Nepal, Felm- Nepal	Support in child protection, GBV, psychosocial support, migrant protection, persons of concerns/refugees
Risk communication and community engagement	National Health Education Information and Communication Centre (NHEICC) & Epidemiology and Disease Control Division (EDCD)/ Department of	UNICEF and the Resident Coordinator's Office	FAO, ILO, IOM, UNDP, UNFPA, UNHCR, UNIC, UNICEF, UNOPS, UNV, UNWOMEN, USAID, WFP, WHO, Association of Community radio broadcaster (CIN), BBC Media Action, Care Nepal, Catholic Relief Services, DCA, Felm-Nepal, FINRC, Humanity and Inclusion, Helen Keller International, Housing Recovery and Reconstruction Platform (HRRP) – Nepal, IPAS, Lutheran, Mercy Crops, Nepal Red Cross Society,	To drive a participatory, community-based approach to providing people with necessary, accurate, timely and life-saving information to protect themselves and others.

Cluster	Government lead	Agency lead (Co-lead)	Sector members	Purpose
	Health Services/ Ministry of Health and Population		People in Need, Plan International, Practical Action, PSI, Save the Children, TDH, Tilganga, UMN, USAID's Strengthening Systems for Better Health Activity, VSO International, Winrock International, World Vision, WWF, Yuwalaya	
Health cluster	Epidemiology & Disease Control Division, Department of Health Services, Ministry of Health & Population in collaboration with Provincial Health Directorates, Ministries of Social Development	WHO, UNICEF	IOM (participatory mobility mapping exercise); medical & public health academies & associations; early warning and response system network institutions; national & sub-national epidemic rapid response teams; GIZ, NHSSP and contracted service providers.	Prevention and mitigation of adverse health impacts
Food security cluster	Ministry of Agriculture and Livestock Development	WFP, FAO	NGOs/INGOs: ACF, ActionAid, CARE, Christian Aid, CRS, DCA, FCA, Felm Nepal, GNI, Heifer International, Humanity and Inclusion, IMS Development Partner, Islamic Relief Worldwide, LWF, LWR, NRCS, OXFAM, Plan International, Save the Children, United Mission to Nepal, VSO, Welthungerhilfe, World Vision International, Food Management and Trading Company (government owned public enterprises).	Ensure availability and access to adequate food for people who have lost jobs and income sources due to the prolonged socio-economic effects of the COVID-19 crisis
WASH	Ministry of Water Supply	UNICEF	DWSSM, ACF, CARE, Caritas, CRS, Save the Children, DCA, ENPHO, GIZ, KIRDARC, Mercy Corps, NCV, NEWAH, NRCS, Oxfam, LWF, Plan International, RVWRMP, SNV, WHH, WVI, USAID, Water Aid, Govt of Finland, UN Habitat, UNICEF, WHO, WB	to ensure continuity of WASH services, in addition to those already reflected under the abovementioned pillars
Nutrition cluster	Family Welfare Division of Department of Health Services of Ministry of Health and Population (MoHP)	UNICEF	UNICEF (Nutrition and C4D sections), NPC, NNFSS, MoFAGA, EDCD/MoHP, WFP, WHO, FAO, USAID, WB, DFID, HKI, UN Women, NRCS, Save the Children, Suahaara, ACF, WVI, NRCS, Nepal Paediatric Society, WHO, NTAG, SDPC, Aasman Nepal, GHAN, NYF, HHESS, PHRD	to ensure that critical preventative and curative nutrition interventions for children and pregnant and lactating mothers will continue and, where needed, be augmented

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Cluster	Government lead	Agency lead (Co-lead)	Sector members	Purpose
Education cluster	Ministry of Education, Science and Technology (MoEST) and Centre for Education and Human Resource Development (CEHRD)	UNICEF, Save the Children	Action Aid Nepal, Aasman Nepal, CARE, CBM-Nepal, CMC Nepal, CEPP-PTM, Child Fund Japan Nepal, Child Rescue Nepal, Confederation of Nepalese Teachers, Education Pages , FELM Nepal, Fin Church Aid, GHNA, Global Action, Good Neighbour, HI, Mercy Crops, NCE, NSET, NRCS, PABSON, PIN, Plan International, RBF, Restless Development, Room to Read, Sammunat Nepal, School Management Committee Federation, Seto Gurans, Shanti Volunteers Association, Street Child, Sunrise Education Foundation, UMN Nepal, UNESCO, VSO, World Education, World Vision	to prevent the spread of COVID-19 in education institutions and in local communities through the provision of safe learning environments and by putting in place appropriate prevention measures in schools and awareness activities in ECED/PPE centres, community, institutional and religious schools, and communities.
Camp Coordination and Camp Management (CCCM)/Shelter Cluster	DUDBC, Ministry of Urban Development	IFRC (Shelter), IOM (CCCM)	NRCS, HRRP, Plan International, Save the Children, World Vision, UNICEF, Action Aid, CARE International-Nepal, Mercy Corps, Dan Church Aid, UMN, LWF, People in Need, Lumanti, Welthungerhilfe, UN-HABITAT, CRS, UNOPS, Caritas, OXFAM, ADRA Nepal, Habitat for Humanity	To support the Government of Nepal, in particular the Ministry of Health and Population, the Department of Urban Development and Building Construction and all three tiers of the government to integrate COVID-19 measures in displacement sites that have emerged across the provinces due to landslides and floods, including displacement sites that could emerge during the COVID-19 pandemic in the future
Logistics cluster	Ministry of Home Affairs, NEOC	WFP	MOHP-MD, UNFPA, UNICEF, IOM, UNOPS, Armed Police Force, Nepal Army, Nepal Police, ACF, Action Aid Nepal, AWO International, FPAN, GHSC-PSM, Humanity and Inclusion Nepal, NRCS, Oxfam, People in Need, Plan International, Save the Children, WHH, World Vision International, IPAS Nepal, Mountain Child, United Mission to Nepal.	to provide essential logistics support to the Health Cluster and the Ministry of Health and Population's Management Division (MOHP-MD) to ensure a timely and uninterrupted flow of essential, lifesaving health supplies and equipment to health facilities and clinics across Nepal.

Appendix 2: The epidemiology of COVID-19 in Nepal

This appendix sets out cumulative statistics, presented as raw numbers, for COVID-19 cases and deaths reported in Nepal up to 31 December 2021. It should be noted that for reported cases, these represent absolute case numbers with no adjustment for multiple positive tests (e.g., in individuals who had >1 COVID-19 episode over the period since the beginning of the pandemic). Because of this, and because of variations in the incidence of new cases over the course of the pandemic, data are reported as raw numbers, rather than as rates.

Table 1a: Cumulative COVID-19 positive number up to 31 December 2021

Age group	Province 1 Female	Province 1 Male	Madhesh Female	Madhesh Male	Bagmati Female	Bagmati Male	Gandaki Female	Gandaki Male	Lumbini Female	Lumbini Male	Karnali Female	Karnali Male	Sudurpaschim Female	Sudurpaschim Male	Total Female	Total Male
0-9	1,472	1,860	379	688	4,840	6,425	1,008	1,387	1,060	1,422	243	419	565	865	9,567	13,066
10-19	5,120	5,687	1,073	2,978	13,752	17,062	3,573	4,407	3,420	4,628	974	1,512	1,270	2,449	29,182	38,723
20-29	14,950	16,093	2,989	10,142	47,733	54,513	10,576	11,951	12,057	15,961	2,948	4,836	4,317	9,380	95,570	122,876
30-39	13,799	18,227	2,535	9,033	45,256	63,745	9,768	13,110	11,397	17,524	2,562	4,405	3,118	7,731	88,435	133,775
40-49	9,945	14,528	2,111	5,744	31,260	45,760	7,165	9,877	8,039	12,352	1,383	2,446	1,925	4,264	61,828	94,971
50-59	7,529	10,618	1,689	3,744	24,134	33,516	5,707	7,710	5,771	8,811	938	1,565	1,218	2,447	46,986	68,411
60-69	4,460	5,891	1,015	2,020	14,423	18,583	3,496	4,598	3,465	4,677	533	762	668	1,164	28,060	37,695
70-79	2,537	3,194	390	856	7,977	9,544	1,936	2,342	1,631	2,301	263	321	411	611	15,145	19,169
80+	1,048	1,425	111	228	3,645	4,460	902	1,152	491	859	72	117	145	200	6,414	8,441
Missing age	462	790	70	301	800	1,156	95	161	159	284	19	47	68	151	1,673	2,890
Total	61,322	78,313	379	688	4,840	6,425	1,008	1,387	1,060	1,422	243	419	565	865	9,567	13,066

Notes:
1. Detailed information for 1,763 COVID-19 positive cases is missing from the national line listing and is therefore not included in the table above.
2. Information relating to sex and province/district is not available for 63 cases

Table 1b: Cumulative Number of COVID-19 Deaths up 31 December 2021

Age group	Province 1 Female	Male	Madhesh Female	Male	Bagmati Female	Male	Gandaki Female	Male	Lumbini Female	Male	Karnali Female	Male	Sudurpaschim Female	Male	Total Female	Male
0-9	5	2	3	4	9	8	1	1	6	2		1	1		25	18
10-19	4	6	4	4	8	10	4	2	2	4	3	2	2	3	27	31
20-29	56	41	8	26	42	50	18	17	22	36	6	4	16	16	168	190
30-39	57	85	18	64	111	155	32	72	81	145	19	35	18	42	336	598
40-49	91	164	37	104	178	360	69	119	106	236	30	50	16	69	527	1,102
50-59	114	206	49	111	280	567	93	169	116	301	22	84	27	89	701	1,527
60-69	106	239	41	132	352	700	99	181	141	246	31	57	32	61	802	1,616
70-79	102	208	31	96	409	722	107	176	95	167	32	67	28	45	804	1,481
80+	56	121	14	27	363	585	77	127	30	87	12	21	7	27	559	995
Missing age	1	2		1	4	9	1	3	2	4				1	8	20
Total	592	1,074	205	569	1,756	3,166	501	867	601	1,228	155	321	147	353	3,957	7,578

Notes:
1. *Gender/sex is missing for 14 death cases.*
2. *14 deaths reported in foreign citizens are not captured in this table.*
3. *Information related district/province is missing for 31 cases – these are not included in the table above.*

Table 2: Cumulative COVID-19 deaths by place of death and province, as a proportion of the total number of deaths reported in each province, up to 31 December 2021

Place of death	Province1	Province2	Bagmati	Gandaki	Lumbini	Karnali	Sudurpasc	Other country	Missing district information	Total
Federal hospital	515	383	2,099	623	590	91	134	2	14	4,451
Provincial hospital	219	76	176	82	483	273	228	1	1	1,539
Private hospital	751	271	2,331	598	662	29	111	10	11	4,774
Institutional isolation	8	7	28	9	36	9	13	0	0	110
Home isolation	124	14	254	44	43	47	6	1	1	534
On the way to hospital	12	18	10	4	9	10	6	0	0	69
Missing information	37	5	31	10	7	21	2	0	4	117

Table 3a: Cumulative COVID-19 deaths by comorbidity status and province up to 31 December 2021

Co-morbidity status	Province 1	Madhesh	Bagmati	Gandaki	Lumbini	Karnali	Sudurpasc	Other countries	Total
Without Co-morbidity	1,260	535	3,406	1,102	1,477	407	418	13	23
Co-morbidity with single problem	258	141	865	165	233	55	52	1	6
Co-morbidity with 2 problems/diseases	129	83	523	87	104	18	28	0	2
Co-morbidity with 3 problems/diseases	19	12	129	16	16	0	2	0	0
Co-morbidity with 4 problems/diseases	0	3	6	0	0	0	0	0	0
Total deaths	1,666	774	4,929	1,370	1,830	480	500	14	31

Table 3b: Cumulative COVID-19 deaths by type of comorbidity and province up to 31 December 2021

Co-morbid status	Province 1	Madhesh	Bagmati	Gandaki	Lumbini	Karnali	Sudurpasc	Other countries	Total
Certain infectious and parasitic diseases	7	10	16	6	5	2	3	0	0
Neoplasms	11	4	44	10	5	4	1	0	0
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	8	4	37	2	10	0	1	0	0
Endocrine, nutritional, and metabolic diseases	134	89	576	109	123	20	35	0	2
Mental and behavioural disorders	3	1	13	1	0	3	0	0	0
Diseases of the nervous system	2	4	22	2	5	2	1	1	0
Diseases of the eye and adnexa	0	0	1	1	1	0	0	0	0
Diseases of the circulatory system	235	116	836	145	161	25	33	0	4
Diseases of the respiratory system	106	61	435	47	93	27	17	0	2
Diseases of the digestive system	7	10	47	8	16	1	4	0	2
Diseases of the skin and subcutaneous tissue	0	1	1	0	2	0	0	0	0
Diseases of the musculoskeletal system and connective tissue	1	1	9	0	0	0	0	0	0
Diseases of the genitourinary system	52	48	263	51	59	6	14	0	0

Table 3b: Cumulative COVID-19 deaths by type of comorbidity and province up to 31 December 2021									
Co-morbid status	Province 1	Madhesh	Bagmati	Gandaki	Lumbini	Karnali	Sudurpasc	Other countries	Total
Pregnancy, childbirth, and the puerperium	1	2	4	0	0	0	0	0	0
Certain conditions originating in the perinatal period	1	0	2	0	0	0	0	0	0
Congenital malformations, deformations, and chromosomal abnormalities	0	0	1	0	0	0	1	0	0
Symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified	1	1	0	1	1	0	2	0	0
Injury, poisoning and certain other consequences of external causes	3	1	5	4	3	1	2	0	0
Factors influencing health status and contact with health services	1	2	10	0	5	0	0	0	0

*One death was reported outside the country

Figure 1: Comparison of new confirmed case per million population in Nepal with the global scenario and India
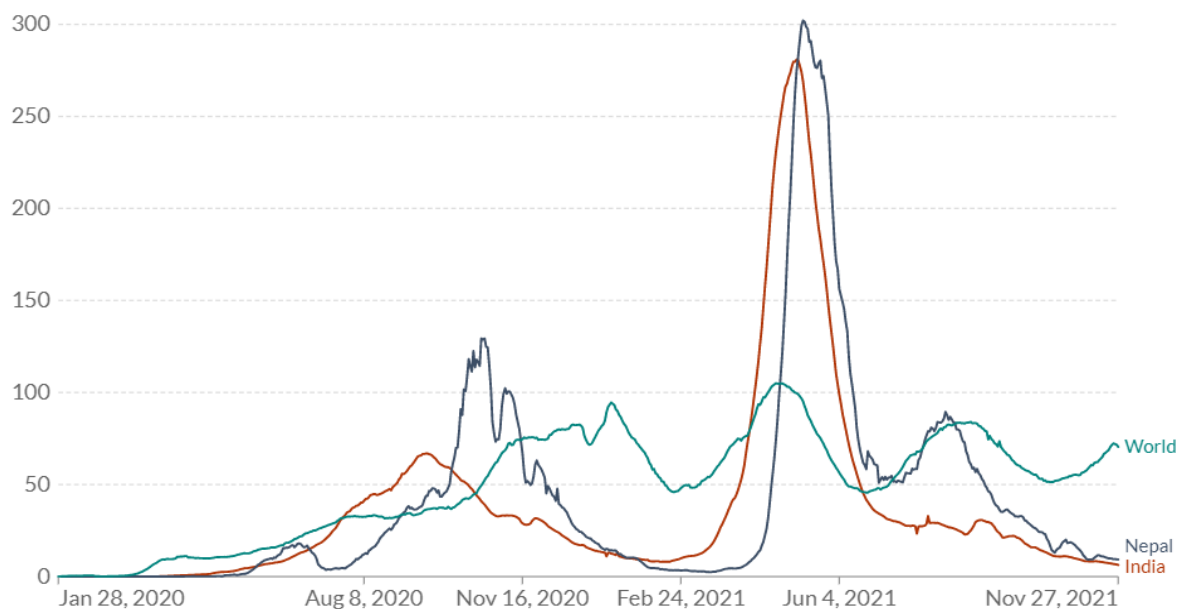

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Figure 2: Comparison of daily deaths per million populations in Nepal with the global scenario and India
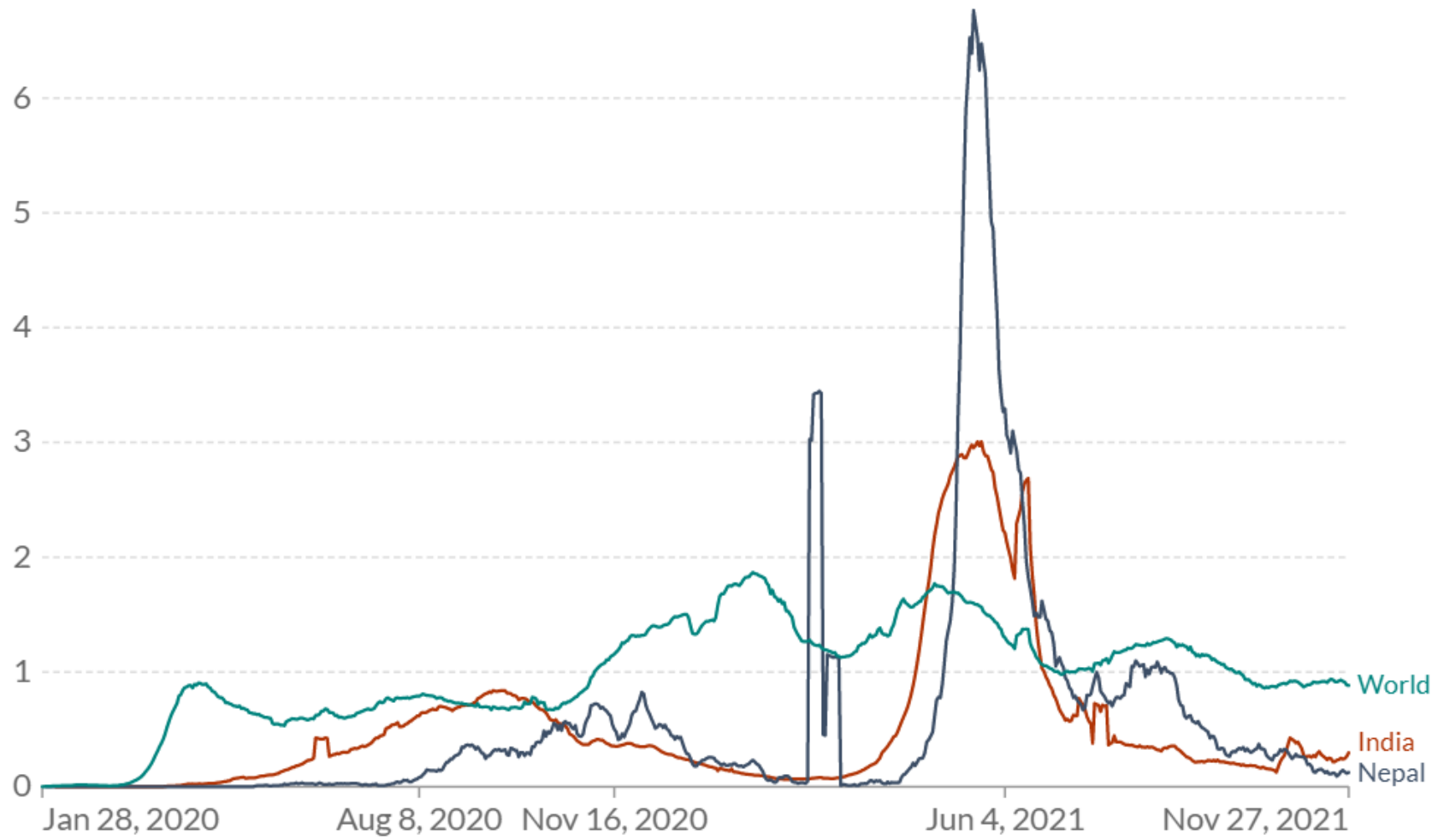
Figure 3: Alignment of public health and social measures (PHSM) severity with trend of COVID-19 cases in Nepal
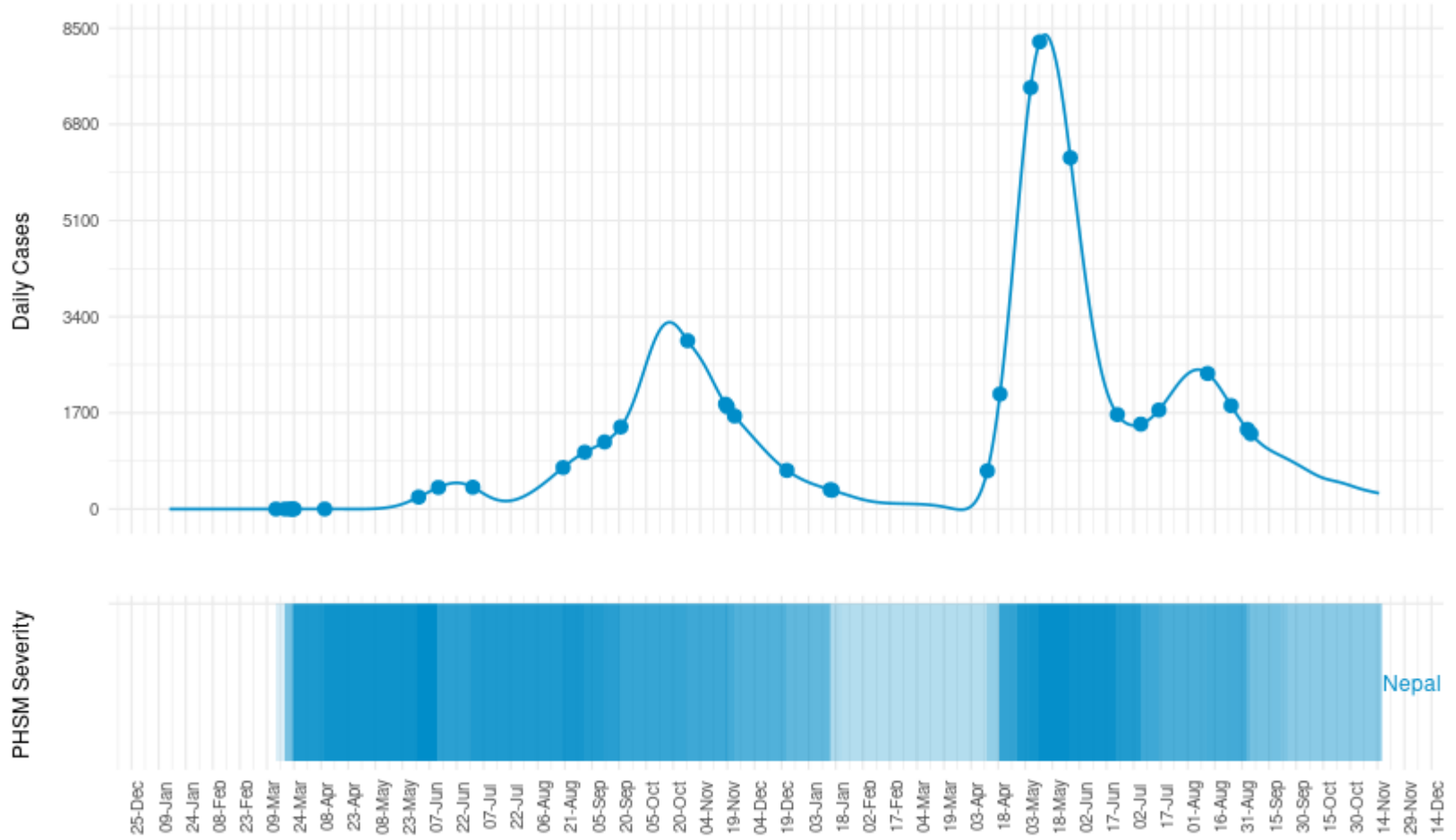
Figure 4: Alignment of public health and social measures (PHSM) severity with trend of COVID-19 deaths in Nepal
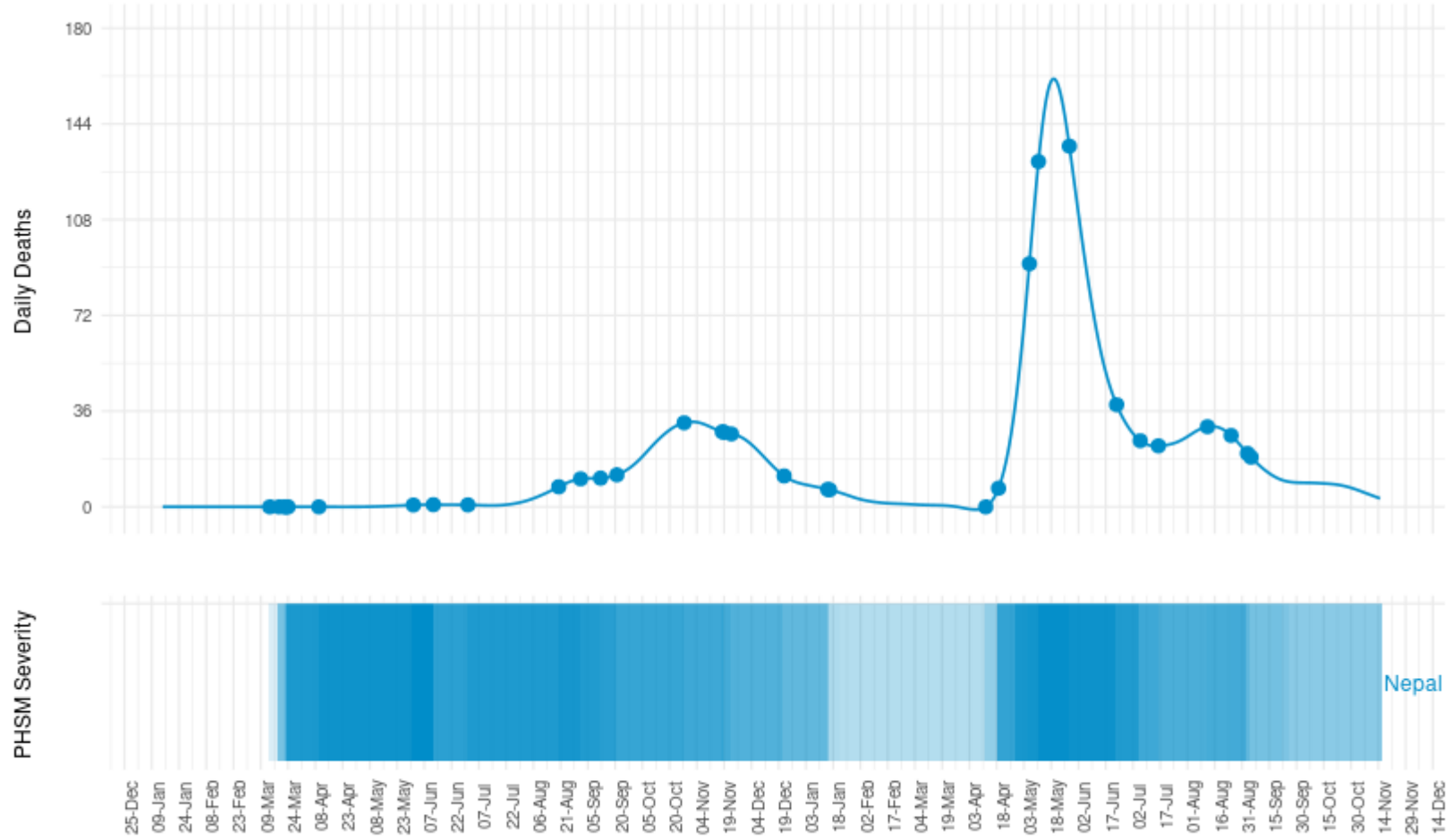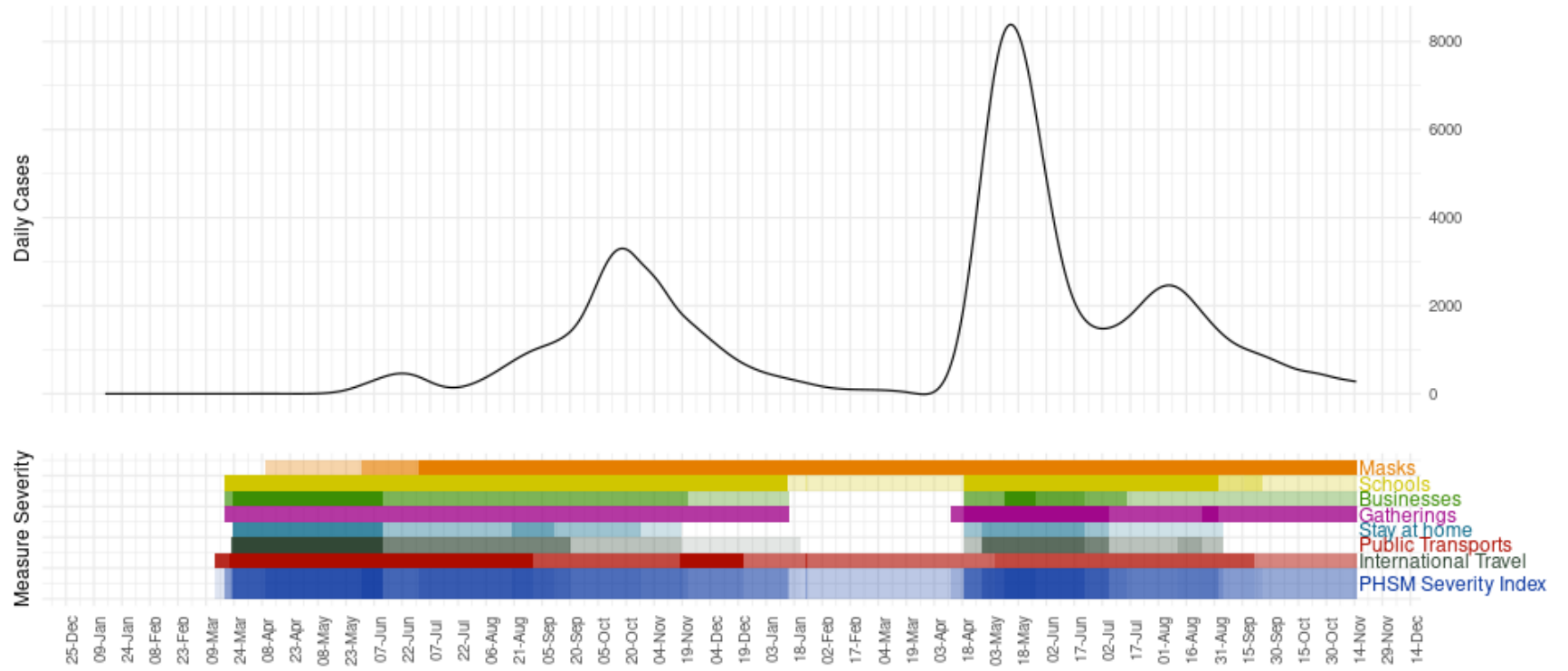
Figure 5: Alignment of public health and social measures (PHSM) severity with trend of COVID-19 cases in Nepal (breakdown of individual measures)

Appendix 3: Active COVID-19 testing laboratories in Nepal

NO	Name of designated COVID-19 Lab/Institution	Province	Government/ Private	Established Date* (M/D/Y) BS	AD
1	National Public Health laboratory (NPHL), Kathmandu	Bagmati	Government	10/13/2076	1/27/2020
2	Koshi Hospital, Morang	Province 1	Government	12/28/2076	4/10/2020
3	Provincial Public Health Laboratory 1, Biratnagar	Province 1	Government	4/26/2077	8/10/2020
4	Mechi Hospital, Jhapa	Province 1	Government	1/19/2077	5/1/2020
5	Kankai COVID Lab, Jhapa	Province 1	Government	5/19/2077	9/4/2020
6	Birat Medical College and Teaching Hospital, Biratnagar	Province 1	Private	6/11/2077	9/27/2020
7	Neurocardio and Multispecialty Hospital, Biratnagar	Province 1	Private	6/11/2077	9/27/2020
8	Nobel Medical college and Teaching Hospital, Biratnagar	Province 1	Private	6/11/2077	9/27/2020
9	Provincial Public Health Laboratory 2, Dhanusha	Madhesh	Government	12/21/2076	12/21/2076
10	Narayani Hospital, Birgunj	Madhesh	Government	1/23/2077	5/5/2020
11	Gajendra Narayan Singh Sagarmatha Zonal Hospital, Rajbiraj, Saptari	Madhesh	Government	2/30/2077	2/30/2077
12	Bardibas Hospital, Mohattari	Madhesh	Government	5/11/2077	8/27/2020
13	Gaur Hospital, Rautahat	Madhesh	Government	6/2/2077	9/18/2020
14	BP Koirala Institute of Health Science, Dharan	Province 1	Government	5/21/2077	9/6/2020
15	Sukra Raj Tropical and Infectious Disease Hospital, Kathmandu	Bagmati	Government	12/23/2077	12/23/2077
16	Kathmandu University School of Medical Sciences, Dhulikhel	Bagmati	Private	1/11/2077	4/23/2020
17	Bharatpur COVID-19 Diagnostic Lab, Chitwan	Bagmati	Government	12/22/2076	12/22/2076
18	Patan Academy of Health Sciences (PAHS), Lalitpur	Bagmati	Government	1/11/2077	4/23/2020
19	Bir Hospital, Kathmandu	Bagmati	Government	12/28/2077	12/28/2077
20	Vector Borne Disease Research and Training Center (VBDRTC), Hetauda	Bagmati	Government	12/23/2077	12/23/2077
21	Tribhuvan University and Teaching Hospital (TUTH)	Bagmati	Government	2/12/2077	5/25/2020
22	Nepal Police Hospital Laboratory, Kathmandu	Bagmati	Government	3/18/2077	7/2/2020

NO	Name of designated COVID-19 Lab/Institution	Province	Government/ Private	Established Date* (M/D/Y)	
				BS	AD
23	Nepal Armed Police Force Hospital (APF), Kathmandu	Bagmati	Government	5/21/2077	9/6/2020
24	Prasuti Griha (Paropakar Maternity and Women's Hospital) Kathmandu	Bagmati	Government	4/31/2077	4/31/2077
25	Leprosy mission Nepal, Anandaban, Lele, Lalitpur	Bagmati	Private	4/16/2077	7/31/2020
26	Nepal Korea Friendship Hospital, Kathmandu	Bagmati	Government	3/8/2077	6/22/2020
27	Birendra Army Hospital	Bagmati	Government	4/4/2077	7/19/2020
28	Central Diagnostics Laboratory and Research Center	Bagmati	Private	4/16/2077	7/31/2020
29	Bidh Laboratory, Lalitpur	Bagmati	Private	4/13/2077	7/28/2020
31	Kathmandu Medical College	Bagmati	Private	3/14/2077	6/28/2020
32	Star Hospital, Kathmandu	Bagmati	Private	3/14/2077	6/28/2020
33	B & B Hospital, Lalitpur	Bagmati	Private	4/21/2077	8/5/2020
34	Nepal Medicity Hospital	Bagmati	Private	4/26/2077	8/10/2020
35	Chitwan Medical College, Bharatpur	Bagmati	Private	4/30/2077	8/14/2020
36	Intrepid Nepal, Kathmandu	Bagmati	Private	5/2/2077	8/18/2020
38	HAMS hospital, Dhumbarahi, Kathmandu	Bagmati	Private	4/6/2077	7/21/2020
39	Kirtipur Municipality TU Biotech Corona Lab	Bagmati	Government	6/2/2077	9/18/2020
40	BP Koirala Memorial Cancer Hospital, Bharatpur	Bagmati	Government	5/21/2077	9/6/2020
41	Pokhara Academy of Health Science (WR Hospital)	Gandaki	Government	12/17/2077	12/17/2077
42	Provincial Tuberculosis Center, Pokhara	Gandaki	Government	3/1/2077	6/15/2020
43	Provincial Public Health Laboratory 5, Bhairahawa	Province 5	Government	1/10/2077	4/22/2020
44	Bheri Hospital, Nepalgunj	Province 5	Government	1/6/2077	4/18/2020
45	Nepalgunj Medical College, Kohalpur	Province 5	Private	6/1/2077	9/17/2020
46	Gulmi COVID-19 Lab	Province 5	Government	6/7/2077	9/23/2020
47	Rapti Academy of Health Sciences	Province 5	Government	2/13/2077	5/26/2020
48	Lumbini Provincial Hospital, Butwal	Province 5	Government	4/19/2077	8/3/2020
49	Bageshwori Diagnostic and Polyclinic, Banke	Province 5	Private	3/24/2077	7/8/2020
50	National Path Lab and Research Center, Rupandehi	Province 5	Private	3/24/2077	7/8/2020

NO	Name of designated COVID-19 Lab/Institution	Province	Government/ Private	Established Date* (M/D/Y) BS	AD
51	Province Hospital Surkhet	Karnali	Government	1/15/2077	4/27/2020
52	Chaurjahari Municipality PCR laboratory, Rukum (West)	Karnali	Government	12/4/2076	3/17/2020
53	Karnali Academy of Health Sciences	Karnali	Government	12/20/2076	12/20/2076
54	COVID-19 Testing Laboratory, Dailekh	Karnali	Government	12/7/2076	3/20/2020
55	Seti Provincial Hospital, Dhangadhi	Sudur Paschim	Government	12/29/2076	4/11/2020
56	Veterinary Lab Research Center, Surkhet	Sudur Paschim	Government	1/15/2077	4/27/2020
57	Dadeldhura Hospital Laboratory, Dadeldhura	Sudur Paschim	Government	12/7/2076	3/20/2020
58	Doti Hospital, Doti	Sudur Paschim	Government	5/2/2077	8/18/2020
59	Baitadi Hospital Laboratory	Sudur Paschim	Government	5/31/2077	9/16/2020
60	Bajhang Hospital Laboratory	Sudur Paschim	Government	1/6/2077	4/18/2020
61	International Organization for Migration Nepal (IOM)	Bagmati	Private	5/21/2077	9/6/2020
62	Nepal Medical College, Attarkhel	Bagmati	Private	6/22/2077	10/8/2020
63	Manmohan Memorial Medical College and Teaching Hospital, Swayambhu	Bagmati	Private	6/22/2077	10/8/2020
64	Life Care Diagnostics, Pokhara	Gandaki	Private	6/26/2077	10/12/2020
65	Alka Hospital, Lalitpur	Bagmati	Private	7/6/2077	10/22/2020
66	Modern Diagnostic, Kathmandu	Bagmati	Private	7/3/2077	10/19/2020
67	Alfa Health Care & Diagnostic Center, Kathmandu	Bagmati	Private	7/3/2077	10/19/2020
68	Siddhi Poly Path Lab, Kathmandu	Bagmati	Private	7/6/2077	10/22/2020
69	Kantipur Hospital, Kathmandu	Bagmati	Private	7/19/2077	11/4/2020
70	B-Sure Diagnostic Center, Biratnagar	Province 1	Private	7/5/2077	10/21/2020
71	Universal College of Medical Science, Bhairahawa	Province 5	Private	7/4/2077	10/20/2020
72	Janamaitri Hospital	Bagmati	Private	7/4/2077	10/20/2020
73	Palpa Hospital COVID-19 Lab	Province 5	Government	6/21/2077	10/7/2020
74	Lumbini Medical College	Province 5	Private	7/3/2077	10/19/2020
75	Trishuli Hospital	Bagmati	Government		
76	National Medical College, Molecular Lab Birgunj	Province 2	Private	6/16/2077	10/2/2020

NO	Name of designated COVID-19 Lab/Institution	Province	Government/ Private	Established Date* (M/D/Y)	
				BS	AD
77	Bhaktapur Hospital, Bhaktapur	Bagmati	Government	7/6/2077	10/22/2020
78	Kantipur General and Dental Hospital Teaching Hospital and Research Center	Bagmati	Private	7/27/2077	11/12/2020
79	Civil Service Hospital	Bagmati	Government	8/4/2077	11/19/2020
80	Sindhuli Hospital	Bagmati		8/7/2077	11/22/2020
81	PPHL 3	Bagmati	Government	5/21/2077	9/6/2020
82	Kamalbazar Municipality PCR lab, Achham	Sudur Paschim	Government	6/18/2077	10/4/2020
83	Hetauda Hospital, Makwanpur	Bagmati	Government	10/8/2077	1/21/2021
84	Shaheed Gangalal National Heart Centre	Bagmati	Government	10/8/2077	1/21/2021
85	Bara District Hospital, Kalaiya	Province 2	Government	1/21/2078	5/4/2021
86	Madhyabindu District Hospital, Nawalpur	Gandaki	Government	1/21/2078	5/4/2021
87	Dhaulagiri Hospital, Baglung	Gandaki	Government	1/5/2078	4/18/2021
88	Decode genomes and research center, Bagbazar,	Bagmati	Private	1/21/2078	5/4/2021
89	Molecular Laboratory District Hospital, Dhankuta	Province 1	Government	12/16/2077	3/29/2021
90	Crystal Diagnostic Pvt. Ltd.	Bagmati	Private	11/20/2077	3/4/2021
91	Charikot Hospital PCR Lab	Province 3	Government	1/26/2078	5/9/2021
92	Grande International Hospital, Kathmandu	Bagmati	Private	2/4/2078	5/18/2021
93	Nepal Cancer Hospital and Research Center (NCHRC) Pvt. Ltd, Lalitpur	Bagmati	Private	2/10/2078	5/24/2021
94	Sumeru Hospital Pvt. Ltd., Lalitpur	Bagmati	Private		
95	Mahendra Narayan Nidhi Memorial Hospital, Kathmandu	Bagmati	Private		
96	NPL, Kathmandu	Bagmati	Private		
97	Green City Hospital, Kathmandu	Bagmati	Private		

Appendix 4: Stock Status of COVID-19 Key Commodities

Table 4 (a): Stock status on *20th October 2020*

SN	Particulars	Available Stock / Province								
		Central Store *	Province 1	Madhesh	Bagmati *	Gandaki	Province 5	Karnali	Sudurpashchim	Total
A	**Testing**									
1	RT-PCR Kits	162,236	10,680	11,400	1,200	30,268	2,048	12,400	13,172	2,43404
2	Viral Transport Medium (VTM)	145,742	20,745	20,613	21,044	26,538	45,703	7,765	21,723	309,873
3	RNA extraction Kit	194,304	7,200	11,760	5,500	61,760	10,716	7,400	3,904	302,544
B	**Personal protective equipment**									
4	PPE Set	0	3,033	8,525	7,213	4,062	11,379	528	6,982	41,722
5	Mask-N95	63,632	8,242	13,906	19,631	24,254	14,748	5,618	10,170	160,201
6	Surgical Mask	256,620	301,877	255,451	511,399	451,908	496,770	192,066	249,713	271,5804
7	Gown	101,641	53,132	73,539	137,242	55,016	82,207	13,606	47,416	563,799
8	Face Shield	799	4,586	3,694	10,536	5,840	5,094	869	1,279	32,697
9	Shoe Cover	19,624	21,891	28,282	75,509	26,102	40,783	3,435	20,278	235,904
10	Surgical Gloves	4	10,048	27,721	33,345	19,804	50,336	12,844	67,060	221,162

SN	Particulars	Available Stock / Province								
		Central Store *	Province 1	Madhesh	Bagmati *	Gandaki	Province 5	Karnali	Sudurpashchim	Total
11	Head Cap	45	4,318	2,229	12,998	7,639	8,,535	1271	8,453	45,488
12	Goggles Polycarbonate	200	3,279	4,517	6,924	2,941	5,203	795	2,588	26,447
13	Safety Goggles	27,920	6,808	6,146	12,238	9,417	9,699	3,573	3,539	79,340

Note: N95 includes N95 Mask and KN95 Mask; Surgical Mask includes Mask and Surgical Mask; Gown include Disposable Gown and Gown for reusable and Head cap includes Head Cap and Surgical Cap

* Central store includes NPHL and Bagmati province excludes Central store.

Source: eLMIS Report, data extracted on 20th October 2020 at 10:00 PM

Table 4 (b): Stock status on *11th May 2021*

SN	Particulars	Available Stock								
		*Central Stores	Province 1	Province 2	*Bagmati	Gandaki	Lumbini	Karnali	Sudurpaschim	Total
A	Laboratory and Vaccine commodities									
1	SARS-COV-2 Vaccine (Vero Cell) Inactivated	476,704	300	-	30,039	-	-	-	1,200	508,243

SN	Particulars	Available Stock								
		*Central Stores	Province 1	Province 2	*Bagmati	Gandaki	Lumbini	Karnali	Sudurpaschim	Total
2	COVISHIELD 10 Dose	1,677	3,311	11,769	9,461	6,344	11,281	4,862	7,367	56,072
3	RT-PCR Kits	117,996	7,660	56,156	15,350	30,740	11,600	10,351	22,736	272,589
4	Viral Transport Medium (VTM)	95,413	21,625	55,565	56,672	40,648	41,700	14,184	42,972	368,779
5	RNA Extraction Kit	103,544	8,124	32,806	19,900	59,692	15,250	14,206	26,350	279,872
B	Personal Protective Equipment									
1	PPE Set	1,660	4,740	5,936	12,113	5,761	10,299	3,527	9,174	53,210
2	Mask-N95	76,699	19,943	20,750	26,641	30,295	20,265	11,642	33,702	239,937
3	Surgical Mask	1,039,052	497,048	480,971	1,041,542	558,731	910,475	338,415	875,413	5,741,647
4	Gown	5,219	37,538	68,109	45,814	29,553	43,319	22,760	41,962	294,274

SN	Particulars	Available Stock								
		*Central Stores	Province 1	Province 2	*Bagmati	Gandaki	Lumbini	Karnali	Sudurpaschim	Total
5	Face Shield	25,631	7,408	4,083	76,513	15,614	29,269	1,247	3,206	162,971
6	Shoe Cover	5,300	17,603	31,780	25,860	24,479	24,690	9,109	20,191	159,012
7	Surgical Gloves	13,752	22,914	28,659	38,399	20,969	88,471	15,350	55,920	284,434
8	Head Cap	2,890	49,739	2,147	9,714	6,204	16,906	6,266	6,396	100,262
9	Goggles Polycarbonate	1,922	2,836	3,520	3,763	2,665	2,174	1,396	2,538	20,814
10	Safety Goggles	39,689	9,351	8,899	15,653	11,573	12,537	5,338	3,159	106,199
C	Others									
1	Dead Body Bag	-	407	132	193	96	111	97	91	1,127

Note: N95 includes N95 Mask and KN95 Mask; Surgical Mask includes Mask and Surgical Mask; Gown include Disposable Gown and Gown for reusable and Head cap includes Head Cap and Surgical Cap

| SN	Particulars	Available Stock								
		*Central Stores	Province 1	Province 2	*Bagmati	Gandaki	Lumbini	Karnali	Sudurpaschim	Total

Central store includes all central stores as well as NPHL, Teku and Bagmati province excludes Central stores.

**Source: eLMIS Report, data extracted on 11th May 2021 at 6:00 PM**

Table 4 (c): Stock status on *24th December 2021*

SN	Particulars	Available Stock								
		*Central Stores	Province 1	Madhesh	*Bagmati	Gandaki	Lumbini	Karnali	Sudurpaschim	Total
A	Laboratory and Vaccine commodities									
1	Janssen COVID-19 Vaccine 5 Dose	435,338	3,666	15,253	8,095	4,194	6,684	4,323	2,166	4,79719
2	AstraZeneca 10 Dose	0	6,316	9,656	7,163	0	12,537	2,362	2,422	40,456
3	SARS-COV-2 Vaccine (Vero Cell) Inactivated	153,004	428,501	438,712	235,497	201,340	139,512	37,515	154,780	1,788,861
4	COVISHIELD 10 Dose	304,593	5,940	90,027	5,738	2,658	19,061	2,466	,1971	432,454
5	Real Time RT-PCR Kits	173,556	18,966	0	89,408	18,740	13,364	1,000	18,810	333,844
6	Viral Transport Medium (VTM)	321,342	14,255	16,706	27,809	44,412	37,453	5,200	24,045	491,222
7	RNA Extraction Kit	309,744	26	1,008	91,200	0	3,884	2,000	2,400	410,262
B	Personal Protective Equipment									
1	PPE Set	7,509	5,172	5,141	10,941	13,253	19,455	6,002	12,333	79,806
2	KN95 Mask	1,362,9811	286,7559	273,2244	335,9243	345,3899	4E+06	829,569	254,1419	3,321,4396

SN	Particulars	Available Stock								
		*Central Stores	Province 1	Madhesh	*Bagmati	Gandaki	Lumbini	Karnali	Sudurpaschim	Total
3	Surgical Mask	25,795	449,906	777,134	1,228,252	334,015	927,175	368,410	586,112	4,696,799
4	Gown	18,526	2,781	4,615	2,714	2,946	6,125	143	3,768	41,618
5	Face Shield	161,757	125,097	70,378	161,165	78,089	146,169	32,430	70,887	845,972
6	Shoe Cover	23,344	23,740	26,410	40,478	113,880	38,123	8,503	21,373	295,851
7	Surgical Gloves	1,102	24,582	19,161	42,447	175,492	56,335	13,255	37,200	369,574
8	Head Cap	2,605	39,417	2,020	5,879	5,855	5,825	1,550	1,220	64,371
9	Goggles Polycarbonate	639	2,325	2,195	3,843	1,951	1,846	856	1,784	15,439
10	Safety Goggles	96,407	40,478	43,793	179,945	48,614	71,234	15,597	4,2200	538,268
C	Others									
1	Dead Body Bag	3,473	964	1,058	4,158	1,842	1,053	392	1,512	1,4452

Note: N95 includes N95 Mask and KN95 Mask; Surgical Mask includes Mask and Surgical Mask; Gown include Disposable Gown and Gown for reusable and Head cap includes Head Cap and Surgical Cap

- *Central store includes central stores as well as NPHL, Teku and Bagmati province excludes Central stores.*

Source: eLMIS Report

SN	Particulars	Available Stock								
		*Central Stores	Province 1	Madhesh	*Bagmati	Gandaki	Lumbini	Karnali	Sudurpaschim	Total
**Data not available from 24 Dec, 2021*										

Appendix 5: IMU related decisions

Formation of Different Teams with dedicated members and their TOR to operationalize different functions of IMU as per concept note (Secretary level decision:2077-5-23)
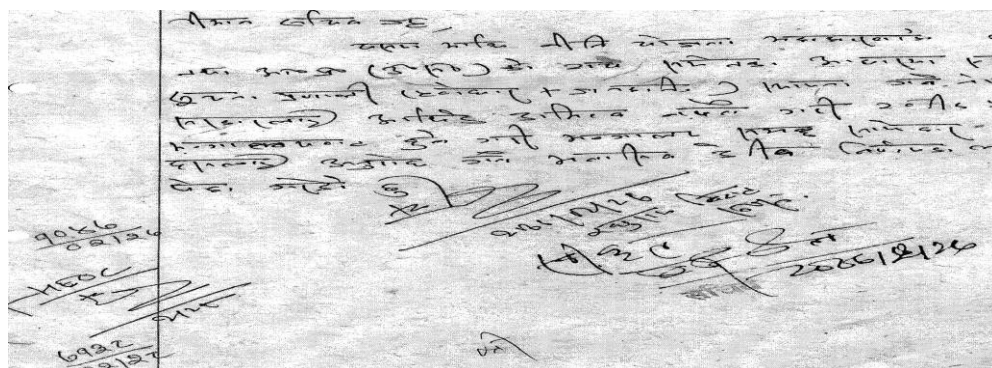
Shifting IMU to IHIMS assigning the chief of IHIMS as Chief of IMU too: additional scope of work to manage Covid vaccination reports (Secretary level decision:2077-12-31)
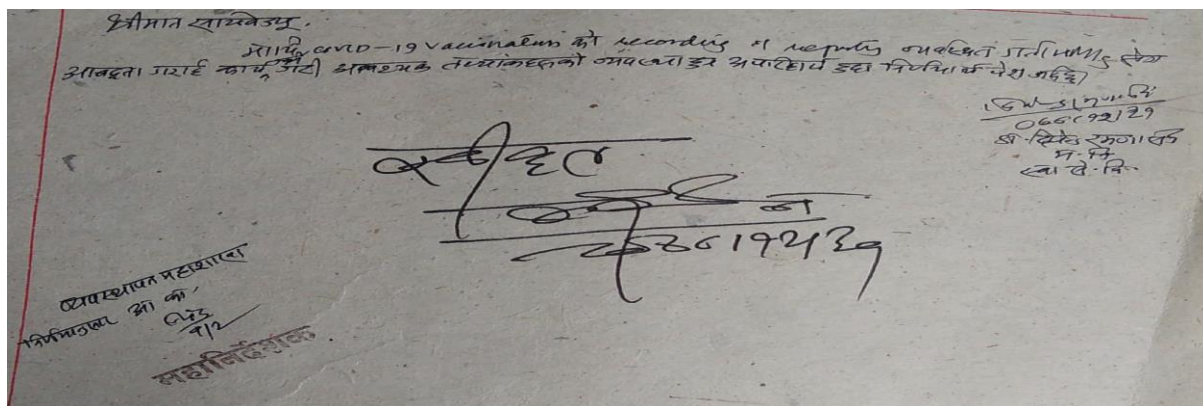
Establishment of IMU under ICS/HEOC & management of necessary Resources to operationalize (Secretary level decision:2077-2-27)

नेपाल सरकार
स्वास्थ्य तथा जनसंख्या मन्त्रालय
नीति योजना तथा अनुगमन महाशाखा
रामशाहपथ, काठमाडौं

पत्र संख्या :२०७७/७८

च. नं. ९३४५०

मिति : २०७८/२/१३

बिषय: COVID 19 सम्बन्धि तथ्यांक एकद्वार प्रणाली बाट अद्यावधिक गर्ने सम्बन्धमा ।

श्री प्रादेशिक स्वास्थ्य आपतकालीन कार्यसंचालन केन्द्र (PHEOC)

सबै (७ वटै) ....प्रदेश

उपरोक्त सम्बन्धमा नेपाल सरकार, स्वास्थ्य तथा जनसंख्या मन्त्रालयको मिति २०७८/२/३ को सचिवस्तरीय निर्णय अनुसार "हाल चलिरहेको COVID 19 सम्बन्धि तथ्यांक संकलन विभिन्न निकायहरु EDCD, HEOC, NPHL, HMIS,IMU आदि बाट हुने गरेकोमा यसरि विभिन्न निकाय बाट तथ्यांक संकलन गर्दा झन्झटिलो तथा दुबिधा हुने देखिएकोले COVID 19 सम्बन्धि सबै किसिमका तथ्यांक को संकलन एकद्वार प्रणाली IHIMS/IMU मार्फत उपलब्ध गराउने तथा साबिक EDCD तथा HEOC ले गर्ने गरेका COVID 19 सम्बन्धि तथ्यांक संकलनका क्रियाकलाप हरु IHIMS/IMU मार्फत एकद्वार प्रणाली बाट गर्ने" भन्ने निर्णय भएको र सो निर्णय सबै प्रदेश का सम्बन्धित निकायहरु तथा सबै PHEOC हरु लाइ पठाई सकेको व्यहोरा अनुरोध गर्दै सोहि निर्णय अनुसार COVID 19 सम्बन्धि सम्पूर्ण तथ्यांकहरु तथा खोप सम्बन्धि तथ्यांक सम्बन्धित सबै स्वास्थ्य संस्था हरुले IHIMS/IMU मा इन्ट्री गर्ने र सबै सातै प्रदेशका स्वास्थ्य निर्देशनालय तथा PHEOC हरु बाट सबै तथ्यांक एक द्वार प्रणाली IHIMS/IMU system मा अनिबार्य इन्ट्री गर्ने/ गर्न लगाउने ब्यवस्थाको लागि सबैमा अनुरोध गरिन्छ ।

(डा. गुणराज लोहनी)
प्रमुख
नीति योजना तथा अनुगमन महाशाखा
स्वास्थ्य तथा जनसंख्या मन्त्रालय

बोधार्थ
१) श्री महानिर्देशक ज्यू
   स्वास्थ्य सेवा विभाग
२) EDCD
३) NPHL
४) सबै प्रदेश स्वास्थ्य निर्देशनालय - ७७ वटै स्वास्थ्य कार्यलय सँग समन्वय गरिदिनु हुन
५) HEOC
६) सबै प्रदेश ल्याबहरु

MoHP & CCMC decision: one door COVID-19 data management through IMU

Decision (ICS level) to form information, statistics, and monitoring team with clear ToR of CoVID-19 data analysis (2077-1-25) and sharing to higher authority in daily basis using template as instructed by the secretary.

नेपाल सरकार
स्वास्थ्य तथा जनसंख्या मन्त्रालय
स्वास्थ्य आपतकालीन तथा विपद व्यवस्थापन इकाई
Health Emergency and Disaster Management Unit (HEDMU)
स्वास्थ्य आपतकालीन कार्यसंचालन केन्द्र
Health Emergency Operation Center (HEOC)

फोन ०१-४२५०६५५
फ्याक्स ०१-४२५०६५३

पत्र संख्या: ०७६/७७
च.नं. ८९८

मिति २०७७/१/१५

डा. अमृत पोखरेल
श्री शिव शर्मा
श्री प्रदीप पौडेल

विषय: स्वास्थ्य आपतकालिन संचालन केन्द्रको "इन्सीडेन्ट कमाण्ड सिस्टम सम्बन्धमा "।

उपरोक्त विषय सम्बन्धमा कोभिड १९ को स्वास्थ्य क्षेत्रको तयारी तथा प्रतिक्रियालाई यस मन्त्रालयको स्वास्थ्य आपतकालिन संचालन केन्द्रमा एक एकीकृत कमाण्ड तयार गरी "इन्सीडेन्ट कमाण्ड सिस्टम" मार्फत सम्पूर्ण कार्यको प्रभावकारी कार्यान्वयनको लागि नेपाल सरकार श्रीमान् सचिवज्यूको कमाण्ड अन्तर्गतको इन्सीडेन्ट कमाण्ड सिस्टममा तपाईलाई सूचना तथ्याङ्क अनुगमन कमिटिको सदस्यको रुपमा तोकिएको व्यहोरा अनुरोध छ । कार्यविवरण यसै साथ संलग्न छ ।

बोधार्थ :
श्रीमान सचिवज्यू(यादव प्रसाद कोइराला, स्वास्थ्य तथा जनसंख्या मन्त्रालय ।
श्रीमान प्रमुख विशेषज्ञज्यु, डा. श्री रोशन पोखरेल, स्वास्थ्य तथा जनसंख्या मन्त्रालय ।
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....
डा.गुणराज लोहनी
ICS Coordinator

अनुसूची २

Information Management

- Provide standard guidelines for recording and reporting of the COVID related information
- Coordinate with provincial HEOC and standardise information
- Collect, collate, analyse and synthesize COVID-19 information (all types of data) from Local. Province and Federal level

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Supported by: