Health services availability and readiness for COVID-19 case surge in hospitals of Nepal

Suraj Bhattarai (surajbpkihs2012@gmail.com)
Global Institute for Interdisciplinary Studies https://orcid.org/0000-0001-6843-6677

Jaya Dhungana
Chitwan Medical College

Tim Ensor
University of Leeds School of Healthcare

Uttam Babu Shrestha
Global Institute for Interdisciplinary Studies

Research article

Keywords: Hospital readiness, infection prevention and control, health services, COVID-19, pandemic response, Nepal

Posted Date: September 28th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-72304/v1

Abstract

Background

As with other coronavirus-affected countries, Nepal's medical community also expressed concerns regarding the government's public health strategies and hospital readiness in response to increasing COVID-19 case surge. To gauge such response, we assessed service availability and readiness status in hospitals situated across seven provinces.

Methods

A web-based observational study was conducted between March 24 and April 07 in 110 hospitals, all of which were later designated as COVID-19 clinics or hospitals by Nepal Government. An electronic survey link was sent out to the clinicians working at the frontline in those hospitals. One response per hospital was analyzed. Hospitals were divided into small, medium, and large based on the total number of beds (small:15 or less; medium:16–50; large:>50), and further categorized into public, private, and mixed based on the ownership.

Results

Out of 110 hospitals, 81% (22/27) of small, 39% (11/28) of medium, and 33% (18/55) of large hospitals had not allocated isolation beds for COVID-19 suspects or cases. Majority of medium (89%; 25/28), and 38% of large hospitals did not have a functional intensive care unit (ICU) at the time of study. Nasopharyngeal (NP)/throat swab kits were available in one-third (35/110), whereas viral transport media (VTM), portable fridge box, and refrigerator were available in one-fifth (20%) of the hospitals. Only one hospital (large/tertiary) had a functional PCR machine. Except for General practitioners, other health cadres—crucial during pandemics, were low in number. On IPC measures, the supplies of simple face mask, gloves and hand sanitizers were adequate in the majority of hospitals, however, N95-respirators and PPE-suits were grossly lacking. Government's COVID-19 support was unevenly distributed across provinces; health facilities in provinces 2, 4, and 5 received fewer resources than others.

Conclusions

Our findings alerted the Nepalese and other governments to act early and proactively during health emergencies and not wait until the disease disrupts their health systems. Other countries with similar economy levels may undertake similar surveys to measure and improve their pandemic response.

Background

The World Health Organization (WHO) declared COVID-19 as Public Health Emergency of International Concern (PHEIC) on 30th January 2020; on 11th March, it was declared a global pandemic.(1) As of 22th August 2020, the disease has spread to 215 countries, areas and territories, infecting 22.8 million people and causing over 795,000 deaths.(2) The increasing trend of new cases and deaths is further worsening COVID-19 situation globally. To minimize the burden, global scientists have advised the governments to take pre-emptive measures to prevent COVID-19 outbreaks among the most vulnerable population of the world living in the vulnerable regions.(3)(4)

In Nepal, the first case of COVID-19 disease was confirmed on 24th January 2020.(5) The second case was detected on 23rd March, after a two-month gap. It was that day the government decided to impose a nationwide lockdown as a measure to contain virus spread.(6) At that time, Nepal Public Health Laboratory (NPHL) Teku was the only authorized

lab that could perform real-time reverse transcription polymerase chain reaction (RT-PCR) tests to detect SARS-CoV2. Even with the gradual expansion of RT-PCR-based testing outside Kathmandu, less than a thousand tests were performed in total, with detection of nine cases and no reported death as of 7th April. The number of cases reached 31,117 on 22nd August with 146 deaths.(6)

The medical community of Nepal expressed concerns regarding country's preparedness and hospital readiness to the potential outbreaks of COVID-19. The clinicians and public health experts were particularly concerned about the government's weak preparation and unclear strategies around molecular testing, contact tracing, medical equipment procurement, resource allocation, infection prevention measures, human resources, training, risk communication, and management of suspected or confirmed cases.(7) The nation's case finding strategy—case-based approach rather than community-based, was heavily criticized by the experts calling it 'sheer undertesting' for a country of 29 million population.(8)

The Government of Nepal designated 25 large (tertiary care) hospitals in the country as COVID-19 Hub hospitals, later expanding the list to 130 plus hospitals (public, private and mixed) as COVID-19 designated hospitals and further categorizing them as 125 COVID-19 clinics (for fever screening), 23 Level 1 hospitals (isolation of asymptomatic cases), 18 Level 2 (management of mild/moderate cases), and seven Level 3 hospitals (management of severe/critical cases), with overlaps in the categories of some hospitals.(6)(9) However, until second week of lockdown (7th April), no stringent guidelines for measuring hospital readiness and response were issued.(6) Even with the decision of the High Level COVID-19 Prevention and Control Coordination Committee (HLCC) (17th March) to add 115 ICU beds and 1,000 isolation beds in Kathmandu, and to set up a total of 120 ICU beds in other provinces, the status of overall preparedness and the capacity of national health systems were unknown.(10)

The WHO released 'Hospital Readiness Checklist for COVID-19'—a useful tool for the assessment of pandemic response practices in the health facilities.(11) Similarly, the United Nations Nepal published 'Preparedness and Response Plan for Nepal' that highlighted key interventions needed to be undertaken by the key players taking into account the projected caseload of 1,500 infected cases and 150,000 collaterally affected population.(12) With the foundation set by these two guidelines, the present study aimed to understand the ground status of COVID-19 services and infection prevention in Nepalese hospitals and how it varied across small, medium, and large facilities. Besides few case reports and opinion pieces found in the literature, this is perhaps the first study that collected COVID-19-related primary data in Nepal, from the clinical-public health point of view.

Method

The list of hospitals in each of the seven provinces was prepared after reviewing the Government of Nepal's Annual Health Report 2017/2018, according to which there are total 2,145 health facilities in the country; 323 public (includes primary health centers) and 1,822 non-public. Province-wise, there are 191 health facilities in Province 1; 214 in Province 2; 1,239 in Bagmati (Province 3); 139 in Gandaki (Province 4); 218 in Province 5; 71 in Karnali (Province 6); and 73 in Sudurpaschim (Province 7).(13) We then categorized hospitals as small, medium or large, based on their bed capacity – small hospital: 15 or less beds (primary health centers, private polyclinics); medium hospital: 15–50 beds (district hospitals, community hospitals public, private or mixed); large hospital: >50 beds (zonal or provincial hospitals, tertiary centers, teaching hospitals).

Sample size (hospitals) was calculated by applying Cochrane's formula for a finite population (hospitals in the present study) i.e. $n = N/[1 + N(e)^2]$, where, N is total number of health facilities in Nepal, and e is permissible error taken as 10%. Uneven distribution of health facilities across the provinces (abundant in Bagmati and few in other provinces) were accounted for. Finally, a total of 110 hospitals were selected for the study: 19 in Province 1; ten in Province 2; 33 in Bagmati; 21 in Gandaki; 14 in Province 5; eight in Karnali; five in Sudurpaschim.

In COVID-19 context, all small and most of medium hospitals were designated as COVID-19 clinics to run fever clinics and isolate suspected and/or infected asymptomatic cases, whereas other medium and all large hospitals were involved in managing symptomatic cases. When the study was ongoing, the Government of Nepal categorized 130 plus hospitals, including all under this study, as COVID-19 clinics and Level 1–3 COVID-19 hospitals.(9) Additionally, we included a mixture of public, private, and public-private mix hospitals rather than public hospitals only, because all types of hospitals, regardless of size and ownership, would be needed when there was a massive surge of cases, and therefore, would be expected to be prepared with realistic response plans and measures. Thus, we obtained responses from all types of hospitals in each province to make our samples as representative as possible, retaining only one response per hospital for the analysis.

Potential respondents from the selected hospitals were enlisted using non-probability purposive sampling method. The main author retains an updated contact list (email address) of clinicians working in the health facilities under study, based on a similar study conducted in the past.(14) No incentive was offered to the respondents, and their participation was voluntary. For more than one responses received from the same hospital, the response of the senior-most clinician was analyzed. Seniority of the respondent was determined by his/her qualification, experience, managerial, and leadership role in the hospital.

A structured questionnaire was prepared on the basis of the WHO hospital readiness tool and the IPC guidelines recommended by the Government of Nepal.(11)(12) For data collection, a standard survey link developed using Google forms was sent out to potential respondents by electronic (online) methods. All responses were checked for completeness and quality, then coded. Frequency tables were generated using SPSS 16.0 and prepared maps using ArcGIS.

Results

Respondents and type of hospitals

This study covered 52 out of 77 districts of all seven provinces of Nepal. We received highest response from Kathmandu (15) followed by Kaski (11) and only one response from 31 districts each. Out of 110 respondents from 110 hospitals, 65 (59%) were specialists, 34% were postgraduate trainees, and 7% were medical officers or interns. The respondents worked in small (27), medium (28), and large (55) hospitals across the country, and represented public (65), private (31), and public-private mixed (14) facilities (Fig. 1).

Case surge capacity

The average patient flow per day (pre-lockdown period) was <50 in the majority of small hospitals (17/27), 51-200 in medium (20/28), and >200 in large hospitals (37/55) (Fig. 2A). A significant number of those patients presented with respiratory symptoms (up to 50 per day). Fifteen large hospitals reported >50 patients with COIVID-related symptoms each day, with three hospitals reporting >200 daily (Fig. 2B).

Special health services for COVID-19

Majority (81%) of the small hospitals had not arranged isolation beds for COVID-19 suspects or cases, despite the government's recommendation that all COVID-19 clinics (small to large) should arrange beds. Of 28 medium hospitals, 23 had allocated isolation beds, of which 17 had allocated ten or less. Among 55 large hospitals, 18 (33%) had none, 21 (38%) had <10 beds, ten (18%) had 10-20 beds, and six (11%) had >20 isolation beds (Fig. 3A).

With regards to ICU service, majority of the medium (25/28), and 38% of the large hospitals did not have a functional ICU bed at the time of study. Of 34 large hospitals that had functional ICU beds, 17 (50%) had less than five; ten had 6-15;

four had 16-25; and only three had more than 25 beds that would come into use for severe or critical cases of COVID-19 (Fig. 3B).

Laboratory services

Majority of the small (85%; 23/27) and more than half of the medium (54%; 15/28) hospitals were found to have no capacity to collect patient's respiratory specimens. Four medium hospitals had partially adequate and four had adequate capacity to collect samples (all public facilities). And, among 39 (71%) large hospitals, 24 had inadequate, eight had partially adequate, and seven had adequate laboratory-related capacity (Supplementary table 1).

Nasopharyngeal/throat swab kits were available in one-third (32%; 35/110) of hospitals. As one would expect, large hospitals were found better equipped in this regard. However, viral transport media (VTM) were available in 20% (22/110) of hospitals only. Even the larger hospitals did not have adequate supply of VTM. Likewise, most of the hospitals (82%; 90/110) neither had portable fridge box, nor had the mechanism for specimen transport. Most (80%) of them lacked a refrigerator for storing specimens collected from COVID-19 suspects. Although 26 hospitals had a trained laboratory personnel to process respiratory specimens for viral testing, only one hospital (large/tertiary) in the whole nation had a functional polymerase chain reaction (RT-PCR) machine at the time of this study (Supplementary table 1).

Infection prevention and control (IPC) measures

Simple face masks were in adequate supply in the majority of small (78%; 21/27), medium (86%; 24/28), and large (50/55) hospitals across the country. However, only few hospitals had a supply of N95 respirator masks (5 small; 9 medium; 8 large). Gloves were in adequate supply in the majority (88/110), but there was a scarcity of eye wear or visor (Table 1).

Majority of small (24/27), medium (22/28), and large (49/55) hospitals did not have an arrangement of whole-body personal protective gears (PPEs) for health workers at the time of study. Public facilities had a relatively better availability of PPEs than non-public facilities: small:12% vs. 10%; medium:26% vs. none; large:16% vs. 7% (Table 1).

Table 1. Availability of infection prevention supplies for health workers in small, medium, and large hospitals

Majority of the small, medium, and large hospitals under study had arranged hand sanitizers (21/27, 24/28, 43/55) and handwashing stations for public use (14/27, 22/28, 38/55). Thermal gun was available for temperature check in half of hospitals (small:7/27; medium:18/28; large:29/55; overall 54/110). The availability of thermal gun was relatively higher in public sector than in non-public for small (35% vs. 10%) and medium hospitals (65% vs. 60%), and in non-public sector than in public for larger hospitals (60% vs. 44%) (Table 2).

Only 41% of the facilities had set up 'Health Information Desk' within their premises as a response to COVID-19 pandemic. The information desk would provide IPC-related information, education and communication (IEC) materials to the hospital attendants. One-fourth (24%; 27/110) had adopted disinfection technique (with hypochlorite-based products), and only one-fifth (19%; 21/110) had a proper healthcare waste disposal mechanism (Table 2).

Table 2. Availability of IPC measures in hospitals

Human resource for pandemic response

Majority of small and medium hospitals did not have a laboratory technologist for collecting and processing patient's respiratory specimens (Table 3). Small hospitals did not have qualified human resource for handling COVID-19 as these facilities usually provide primary care service with basic screening of suspected patients. Only one out of 28 medium hospitals had a range of staff available: Infectious disease (ID) physician (private), microbiologist (public), and public

health officer (mixed); five medium hospitals (3 public, 2 private) had an ID-trained nurse. Except for General practitioners (MDGPs)—available in over 50% of facilities (30/55), all other human resource for health were grossly lacking in all hospital types (Table 3).

Table 3. Human resource for health available in hospitals

Stock of (under trial) antiviral medicines

None of the small and medium (except one) hospitals had a stock of Oseltamivir which is an antiviral drug considered effective against influenza-like respiratory illness. Only five (9%) of the large hospitals had this drug available for dispensing. Approximately, half of the hospitals had a stock of Chloroquine/ Hydroxychloroquine (HC) which was popularly used for both therapeutic and research purpose globally during the study period. Remdesivir, an antiviral drug under clinical trials (recently approved by the Food and Drug Administration Authority (FDA), USA for COVID-19 treatment) was available in only one hospital (large, public) (Supplementary table 2).

Government' support and intersectoral engagement

Majority of the hospitals had not received COVID-19 related technical or financial support from the government until the second week of lockdown (7th April), although such support was expected as and when the WHO declared the disease as a global pandemic (i.e. 11th March 2020 onwards) (Table 4).

Small hospitals ran fever clinics, whereas some of medium and almost all large hospitals admitted RT-PCR-confirmed COVID-19 patients for isolation and/or treatment. Depending on case severity, patients were referred from small to medium, then to large hospitals. However, optimization of case reporting and referral mechanism was also poorly performed across the facilities—only two small, five medium, and ten large hospitals supported for case referral; three small and 13 medium, and 15 large hospitals for case reporting.

Although government designated COVID-19 clinics/hospitals included both public and private facilities, the study found that the public hospitals were comparatively better supported than private in terms of COVID-19 IEC materials (35%, 23/65 vs. 26%, 8/31) (Table 4).

Table 4. Provision of Government's pandemic support to hospitals, by hospital type

Province-wise service availability and supplies

By the end of study period, more than half hospitals in each province had allocated at least one isolation bed for COVID-19 suspected or confirmed patient. However, only few hospitals had arranged up to 20 isolation beds: one in provinces 1, Karnali, and Sudurpaschim; two in Province 5; four in Gandaki; and six in Bagmati. Three hospitals in Province 1, two in Bagmati, and one each in Gandaki and Province 5 had arranged more than 20 isolation beds (Fig. 4A).

Majority of the hospitals in each province did not have a functional ICU bed. Only a few hospitals in Province 1 (2/18), Bagmati (3/33), and Gandaki (2/21) had better ICU service with more than 16 beds that could be used for severe/critical COVID-19 cases (Fig. 4B).

Thermal gun for rapid temperature check was available in 68% of facilities in Province 1; 54% in Bagmati; and 60% in Sudurpaschim. Viral transport media (VTM), an important equipment for lodging and transporting respiratory specimens, was lacking in the majority of facilities across the provinces, with Province 2 and 5 reporting its availability in only one hospital. Such scarcity was also reported for personal protective gears (PPEs), as majority (75-91%) of the hospitals across seven provinces reported unavailability of PPE suits (Fig. 5).

Approximately one-third of health facilities in Province 1 and Karnali received government's support for training clinicians and laboratory personnel, whereas few or no facilities in other provinces reported such opportunity. Allocation of resources—equipment, emergency fund, personal protective gears, was relatively better in Province 1, Bagmati, Karnali and Sudurpaschim; on an average, one-fourth of facilities reported the receipt. However, allocation of COVID-19 related IEC materials was evenly poor in all provinces. Province 2 did not receive government's support at all for the optimization of COVID-19 case reporting and referral mechanisms, whereas such support reached up to 20% of health facilities in Province 5, and relatively more facilities (up to one-third) in other provinces (Supplementary table 3).

Discussion

Overall health service availability including respiratory specimen collection and laboratory tests, isolation of COVID-19 suspects/ cases, and ICU beds was found to be inadequate in small, medium, and large (COVID-19 designated; public, private and mixed) hospitals during the transition phase of case surge. Although simple IPC measures such as gloves, simple face masks, hand sanitizers and hand-washing stations were adequately available in the facilities, there was a lack of proper disinfection and waste disposal mechanisms. Medium hospitals had a better supply of N95 masks and whole-body PPE suits than small and large hospitals. Human resource for pandemic was also found inadequate across all provinces, so was the government's COVID-19 support in terms of training, case reporting and referral optimization, resources, and risk communication strategy. Similar constraints were reported in studies conducted by Nepal Health Research Council in government designated COVID-19 clinics and hospitals.(15)(16) The United Nations Development Programme (UNDP) COVID-19 and Human Development Report 2020 also confirmed low preparedness level in Nepal, measured on the basis of national human development index (HDI), HDI inequalities, and health systems capacity.(17) Low preparedness and readiness for COVID-19 case surge was observed in other countries too.(18)(19)(20)

By the time the survey was closed (7th April 2020), i.e. a month after the WHO declaration of global pandemic, a massive number of health facilities in many high-income countries had been affected by daily case surge with high mortality rate. In contrast, Nepal had detected only nine cases with less than 1,000 PCR tests performed in total. Moreover, the government was stumbling through the second week of nationwide lockdown.(6) Despite the given window of opportunity for Nepal in terms of pandemic preparedness, it was tragic to find that the majority of small and over one-third of medium and large hospitals had not allocated isolation beds for COVID-19 suspects. A large proportion of large hospitals (38%) did not have a functional ICU unit. Among those hospitals with ICU facility, 50% had five or less functional beds that could be offered to COVID-19 patients in need. Although the HLCC decided on 17th March to expand isolation and ICU beds throughout the country, the concerned ministries, coordination committees, and health facilities performed poorly in the implementation aspect.(10) In other parts of the globe, the authorities utilized large halls, unused buildings, parks and open spaces to set up new isolation centers and hospitals, but the looming scarcity of ICU beds was haunting everyone regardless of the country's economy.(21)(19)

Prior to and in the first two weeks of lockdown, the majority of the hospitals were already seeing a number of patients with respiratory (COVID-like) symptoms; some large hospitals reporting over 200 COVID-19 suspected patients per day. Four out of five hospitals did not have VTM supply and just one large hospital had a functional PCR machine throughout the country. The majority of small and medium hospitals did not have a laboratory technologist to collect and process human specimens. At the present context, PCR-based testing has been expanded to all seven provinces, altogether 40 molecular laboratories, however, there are fresh media reports of the scarcity of VTM and test reagents.(9)(22)

Simple face masks and gloves were in adequate supply in the majority of hospitals. However, there was a gross lack of N95 respirators, eye wears, and whole-body PPE suits for frontline workers. Despite the IPC guidance issued by Nepal Medical Council and the Ministry's Health Emergency Operations Center (HEOC), the clinicians expressed constant fears and concerns in the social media regarding potential exposure to infection.(23)(24) Thermal guns that measure patient's

temperature were better available in non-public hospitals than in public; one reason could be relatively quicker procurement process in non-public hospitals as compared to sluggish procurement in government facilities even during the emergencies. The highest number of facilities with Thermal gun was in Province 1 (68%) and Sudurpaschim (60%), and the lowest in Gandaki (33%). This geographical difference could be explained by the close proximity of former two provinces to India with an easy cross-border import.

According to the Center for Disease Control and Prevention (CDC, USA), the planning, preparedness and response to a pandemic is a team work.(25) It involves clinicians, public health professionals, researchers, politicians, private sector, community, and individual experts working together to solve a common problem. In this study, human resource for COVID-19 response was found inadequate across the range of facilities. Although a qualified General practitioner was on service in more than half of medium and large hospitals, other health cadres crucial during pandemic response—physicians and nurses trained in infectious disease, lab technologists, microbiologists, public health officers and epidemiologists, were on board in less than 20% of hospitals. According to the UNDP report, Nepal's health system capacity—measured on the basis of human resource for health, is very low with the availability of just three hospital beds, six physicians, and 27 nurses per 100,000 people.(17) As Nepal continues to tackle community spread of the virus and expects similar disease outbreaks in the foreseeable future, it is important for both public and private sectors to invest more on human resource should they want to contribute for a quality patient care and an improved national health indicators.

The government's pandemic support to the health facilities was unevenly and inadequately distributed to the provinces. Needful resources such as laboratory equipment and test kits, technical personnel, personal protective gears, IEC materials, and emergency fund were absent in all small hospitals, patchy in medium, and negligible in large hospitals. Provinces 2 and 5 received less support than other provinces in terms of laboratory/ technical resources and case reporting/ referral optimization; and the deficit was reflected by a rapid case surge (96 cases in Province 2 and 70 cases in Province 5) compared to other provinces.(6) Much needed epidemic drill was also lacking throughout provinces, except Bagmati (six drills conducted) and Gandaki (five drills conducted). Other special services such as isolation beds for COVID-19 suspects, functional ICU beds for critically ill patients, sample collection and testing capacity, infection prevention and control measures were overall poor in all provinces. Our findings are supported by the field studies conducted by the National Disaster Risk Reduction Center during the transition phase of case surge.(26)

To mitigate pandemic-borne workload for human resource and managerial confusion within health service divisions of the Ministry of Health, the central government (that led the whole COVID-19 preparedness and response tasks) could have leveraged full authority to the provincial and municipal governments, coupled with stringent action plans and guided by the priorities. Equipment production, procurement and supplies (testing kits, PPEs), staff recruitment and training, expansion of laboratories, restoration of hospital units (isolation, ICU), contact tracing, and case reporting could have been eased and fast-tracked through proactive bureaucracy, as China did but what India failed to do.(21) On the other hand, the healthcare facilities, small to large and public or private, could have proactively activated their 'emergency preparedness plan' to ease the operational processes, way before the disease dismantled local health systems. Utilizing the relatively larger window of preparedness opportunity compared to hard-hit countries, these facilities could have adopted full preparation gears early on, indeed adhering to the relevant national guidelines and service standards, for example, Hospital Management Strengthening Program (HMSP)—Minimum Service Standards (MSS) checklist for hospitals, Nepal Health Infrastructure Development Standards (HIDS).(27)(28)

This study has a few limitations. First, it was conducted using web-based survey, considering the government's strict orders against travel and social mingling. A field-based observational study would better reflect the scenario of services and IPC measures adopted by the hospitals. Second, the study did not cover all hospitals of the country; only a few-select hospitals were included. Third, the study took the perspectives of frontline physicians only, excluding other cadres of

health workforce (nurses, paramedics, hospital administrators) who would have better knowledge about COVID-19 response plans and readiness in the health facilities.

Conclusions And Recommendations

Our study found inadequacy in several aspects of health services and IPC measures in hospitals that define country readiness in the context of COVID-19 case surge. It was also found that the government's pandemic support was unevenly distributed across the provinces and health facilities of Nepal. While pandemic teaches an important lesson for all governments—to act early and proactively during health emergencies and not wait until the disease disrupts health systems, our findings can provide further guidance to the governments in formulating strategic emergency preparedness and response plans. Further, to know the actual preparedness at each service level province-wise, to understand the exact scenario of case surge and patient management in hospitals, and to evaluate the nationwide surveillance and reporting mechanisms, there is an urgent need of large-scale studies coordinated either by the government's monitoring and evaluation divisions or by the non-government research institutions. From global health point of view, other countries at the similar level of economic development could learn from our findings and conduct similar assessments in order to gauge their pandemic response.

Abbreviations

IEC
information, education, communication
IPC
infection prevention and control
NPHL
Nepal Public Health Laboratory
RT-PCR
reverse transcription polymerase chain reaction
PPE
personal protective equipment
VTM
viral transport medium

Declarations

Ethics approval and consent to participate

Ethical approval to conduct this study was obtained from Nepal Health Research Council *(Ref: NHRC-ERB Reg. No. 267/2020P).* Informed consent was obtained from each study participant on the digital/electronic format. They were asked to provide information about their working district and hospital type; however, to maintain the privacy and confidentiality throughout the study, they were not obliged to provide the hospital name and other personal information. All personal identifiers were removed during data analysis and report writing.

Consent for publication

Not applicable.

Availability of data and materials

The dataset used or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

None.

Authors' contributions

SB and JD were responsible for study concept, design, and data collection. SB and UBS analyzed the data and prepared the first draft of manuscript. SB, JD, TE, and UBS provided critical feedback to the manuscript drafts and later approved the submitted version.

Acknowledgement

We would like to acknowledge the health facilities and clinicians who participated in this survey, and independent anonymous reviewers who provided critical feedback. Uttam Babu Shrestha is supported by National Geographic Society Grant (NGS-62058R-19).

Author's information

SB and UBS are research fellows at the Global Institute for Interdisciplinary Studies, Kathmandu, that conducts and promotes interdisciplinary research in Nepal and elsewhere. SB leads the global health unit. SB and UBS are also the members of the Global Young Academy, which is a group of 200+ young scientists from all over the world and gives them voice and platform to engage with and promote science and research globally. SB is also a member of Friends of Nepal Ambulance Service (FONAS), a UK-based charity that supports COVID-19 response in Nepal through its collaboration with Nepal Ambulance Service (NAS).

References

1. World Health Organization. WHO Timeline - COVID-19 [Internet]. 2020 [cited 2020 Mar 22]. Available from: https://www.who.int/news-room/detail/27-04-2020-who-timeline—covid-19
2. World Health. WHO Coronavirus Disease (COVID-19) Dashboard [Internet]. 2020 [cited 2020 May 9]. Available from: https://covid19.who.int/
3. Berger ZD, Evans NG, Phelan AL, Silverman RD. Covid-19: Control measures must be equitable and inclusive. The BMJ. 2020.
4. Wang J, Xu C, Wong YK, He Y, Adegnika AA, Kremsner PG, et al. Preparedness is essential for malaria-endemic regions during the COVID-19 pandemic. The Lancet. 2020.
5. Bastola A, Sah R, Rodriguez-Morales AJ, Lal BK, Jha R, Ojha HC, et al. The first 2019 novel coronavirus case in Nepal. The Lancet Infectious Diseases. 2020.
6. Government of Nepal Ministry of Health and Population. Coronavirus Disease (COVID-19) Outbreak Updates [Internet]. [cited 2020 Mar 22]. Available from: https://heoc.mohp.gov.np/
7. Shrestha R, Shrestha S, Khanal P, Bhuvan KC. Nepal's First Case of COVID-19 and public health response. J Travel Med. 2020.

8. The Himalayan Times. Proper testing to contain COVID-19. 2020 Apr 7; Available from: https://thehimalayantimes.com/opinion/proper-testing-to-contain-covid-19/
9. Government of Nepal Ministry of Health and Population. Health Emergency Operation Center (HEOC). Coronavirus disease (COVID-19) outbreak updates and resource materials [Internet]. 2020 [cited 2020 Jun 23]. Available from: https://heoc.mohp.gov.np/update-on-novel-corona-virus-covid-19/
10. Republica. Government to set up 235 ICU beds amid coronavirus fears. 2020 Mar 17; Available from: https://myrepublica.nagariknetwork.com/news/90596/
11. World Health Organization. Hospital Readiness Checklist for COVID-19 [Internet]. 2020. Available from: http://www.euro.who.int/__data/assets/pdf_file/0004/78988/E93006.pdf
12. United Nations Nepal. COVID-19 Nepal: Preparedness and Response Plan (NPRP) [Internet]. 2020. Available from: https://www.who.int/docs/default-source/nepal-documents/novel-coronavirus/covid-19-nepal-preparedness-and-response-plan-(nprp)-draft-april-9.pdf
13. Department of Health Services; Ministry of Heatlh and Population. Annual Report 2017/2018 [Internet]. 2018. Available from: https://dohs.gov.np/annual-report-2074-75/
14. Shah MT, Bhattarai S, Lamichhane N, Joshi A, Labarre P, Joshipura M, et al. Assessment of the availability of technology for trauma care in Nepal. Injury. 2015.
15. Nepal Health Research Council. Preparedness and Readiness of Government of Nepal Designated Hospitals Running COVID Clinics- Fact sheet [Internet]. 2020. Available from: http://nhrc.gov.np/wp-content/uploads/2020/06/Fact-sheet-Preparedness-and-Readiness-of-Government-of-Nepal-Designated-Hospital-running-COVID-Clinics.pdf
16. Nepal Health Research Council. Preparedness and Readiness of Government of Nepal Designated COVID Hospitals-Fact sheet [Internet]. 2020. Available from: http://nhrc.gov.np/wp-content/uploads/2020/06/Fact-sheet-Preparedness-and-Readiness-of-Government-of-Nepal-Designated-COVID-Hospitals.pdf
17. UNDP. COVID-19 and Human Development: Global Preparedness and Vulnerability Dashboard [Internet]. 2020. Available from: http://hdr.undp.org/
18. Garg S, Basu S, Rustagi R, Borle A. Primary Health Care Facility Preparedness for Outpatient Service Provision During the COVID-19 Pandemic in India: Cross-Sectional Study. JMIR Public Heal Surveill. 2020.
19. Barasa EW, Ouma PO, Okiro EA. Assessing the hospital surge capacity of the Kenyan health system in the face of the COVID-19 pandemic. PLoS One. 2020.
20. Tran BX, Hoang MT, Pham HQ, Hoang CL, Le HT, Latkin CA, et al. The operational readiness capacities of the grassroots health system in responses to epidemics: Implications for COVID-19 control in Vietnam. J Glob Health. 2020.
21. Baru R V. Health systems preparedness during COVID-19 pandemic: China and India. Indian journal of public health. 2020.
22. The Himalayan Times. Shortage of kits to transport virus samples. 2020 Apr 19; Available from: https://thehimalayantimes.com/nepal/shortage-of-kits-to-transport-virus-samples/
23. Nepal Medical Council. Interim Guidance for Infection Prevention and Control When COVID-19 is Suspected [Internet]. 2020. Available from: https://heoc.mohp.gov.np/update-on-novel-corona-virus-covid-19/
24. MOHP HEOC. Key Actions to be taken for COVID-19 infection [Internet]. 2020. Available from: https://heoc.mohp.gov.np/
25. Center for Disease Control and Prevention (CDC). Pandemic Influenza: Planning and Preparedness Resources [Internet]. 2020 [cited 2020 Mar 22]. Available from: https://www.cdc.gov/flu/pandemic-resources/planning-preparedness/index.html

26. Gautam D. Nepal's Readiness and Response to COVID-19: Key Initiatives, Emerging Challenges, and Way Forward. 2020.
27. Government of Nepal Ministry of Health and Population. Hospital Management Strengthening Program (HMSP) 2019 - Checklist to Identify the Gaps in Minimum Service Standards (MSS) of District Hospitals [Internet]. 2019. Available from: https://www.mohp.gov.np/downloads/HMSP_MSS_print_version.pdf
28. Government of Nepal Ministry of Health and Population. Health Infrastructure Development Standards (HIDS) [Internet]. 2017. Available from: https://dohs.gov.np/nepal-health-infrastructure-development-standards-2017/

Tables

Table 1. Availability of infection prevention supplies for health workers in small, medium, and large hospitals

	Type of Hospital (N=110)								
	Small (n=27)			Medium (n=28)			Large (n=55)		
	Public	Private	Mixed	Public	Private	Mixed	Public	Private	Mixed
Simple face mask	11 (64.7%)	7 (100%)	3 (100%)	19 (82.6%)	3 (100%)	2 (100%)	22 (88.0%)	20 (95.2%)	8 (88.9%)
N95 mask	3 (17.6%)	1 (14.3%)	1 (33.3%)	8 (34.8%)	1 (33.3%)	0	3 (12.0%)	3 (14.3%)	2 (22.2%)
Gloves	14 (82.4%)	6 (85.7%)	3 (100%)	21 (91.3%)	2 (66.7%)	2 (100%)	16 (64.0%)	16 (76.2%)	8 (88.9%)
Eye wear or visor	4 (23.5%)	0	1 (33.3%)	8 (34.8%)	1 (33.3%)	0	5 (20.0%)	5 (23.8%)	1 (11.1%)
PPE whole body suit	2 (11.8%)	0	1 (33.3%)	6 (26.1%)	0	0	4 (16.0%)	2 (9.5%)	0

Table 2. Availability of IPC measures in hospitals

	Type of Hospital (N=110)								
	Small (n=27)			Medium (n=28)			Large (n=55)		
	Public	Private	Mixed	Public	Private	Mixed	Public	Private	Mixed
Hand sanitizers	13 (76.5%)	5 (71.4%)	3 (100%)	20 (87.0%)	2 (66.7%)	2 (100%)	20 (80.0%)	15 (71.4%)	8 (88.9%)
Handwashing stations	9 (52.9%)	2 (28.6%)	3 (100%)	18 (78.3%)	2 (66.7%)	2 (100%)	17 (68.0%)	15 (71.4%)	6 (66.7%)
Thermal Gun	6 (35.3%)	0	1 (33.3%)	15 (65.2%)	2 (66.7%)	1 (50.0%)	11 (44.0%)	14 (66.7%)	4 (44.4%)
Health Information desk for IEC	7 (41.2%)	0	2 (66.7%)	12 (52.2%)	1 (33.3%)	1 (50.0%)	10 (40.0%)	6 (28.6%)	6 (66.7%)
Disinfection technique (hypochlorite)	4 (23.5%)	2 (28.6%)	0	3 (13.0%)	0	1 (50.0%)	7 (28.0%)	7 (33.3%)	3 (33.3%)
Waste disposal system	3 (17.6%)	1 (14.3%)	1 (33.3%)	5 (21.7%)	0	2 (100%)	4 (16.0%)	3 (14.3%)	2 (22.2%)

Table 3. Human resource for health available in hospitals

	Type of Hospital (N=110)								
	Small (n=27)			Medium (n=28)			Large (n=55)		
	Public	Private	Mixed	Public	Private	Mixed	Public	Private	Mixed
Infectious disease physician	0	0	0	0	1 (33.3%)	0	5 (20.0%)	3 (14.3%)	2 (22.2%)
General practitioner (MDGP)	0	2 (28.6%)	2 (66.7%)	16 (69.6%)	3 (100%)	2 (100%)	12 (48.0%)	13 (61.9%)	5 (55.6%)
Nurse trained on Infectious disease	0	0	0	3 (13.0%)	2 (66.7%)	0	3 (12.0%)	4 (19.0%)	3 (33.3%)
Laboratory technologist	1 (5.9%)	0	0	1 (4.3%)	0	1 (50.0%)	5 (20.0%)	7 (33.3%)	4 (44.4%)
Microbiologist	0	0	0	1 (4.3%)	0	0	0	2(9.5%)	1 (11.1%)
Public health officer	0	0	0	0	0	1 (50.0%)	5 (20.0%)	1 (4.8%)	3 (33.3%)

Table 4. Provision of Government's pandemic support to hospitals, by hospital type

	Type of Hospital (N=110)								
	Small (n=27)			Medium (n=28)			Large (n=55)		
	Public	Private	Mixed	Public	Private	Mixed	Public	Private	Mixed
Training for clinical staff	1 (5.9%)	0	1 (33.3%)	2 (8.7%)	0	0	8 (32.0%)	2 (9.5%)	2 (22.2%)
Training for laboratory staff	0	0	0	10 (43.5%)	0	0	6 (24.0%)	2 (9.5%)	0
Epidemic drill	1 (5.9%)	1 (14.3%)	1 (33.3%)	2 (8.7%)	0	0	1 (4.0%)	3 (14.3%)	2 (22.2%)
Resource allocation (equipment, funding, etc)	0	0	0	10 (43.5%)	0	1 (50.0%)	5 (20.0%)	3 (14.3%)	0
Case referral mechanism	0	2 (28.6%)	0	4 (17.4%)	1 (33.3%)	0	2 (8.0%)	7 (33.3%)	1 (11.1%)
Case reporting mechanism	2 (11.8%)	1 (14.3%)	0	11 (47.8%)	1 (33.3%)	1 (50.0%)	9 (36.0%)	5 (23.8%)	1 (11.1%)
COVID-19 IEC materials	4 (23.5%)	1 (14.3%)	0	10 (43.5%)	1 (33.3%)	1 (50.0%)	9 (36.0%)	6 (28.6%)	3 (33.3%)
No pandemic support at all	12 (70.6%)	5 (71.4%)	2 (66.7%)	7 (30.4%)	2 (66.7%)	1 (50.0%)	5 (20.0%)	8 (38.1%)	3 (33.3%)

Figures

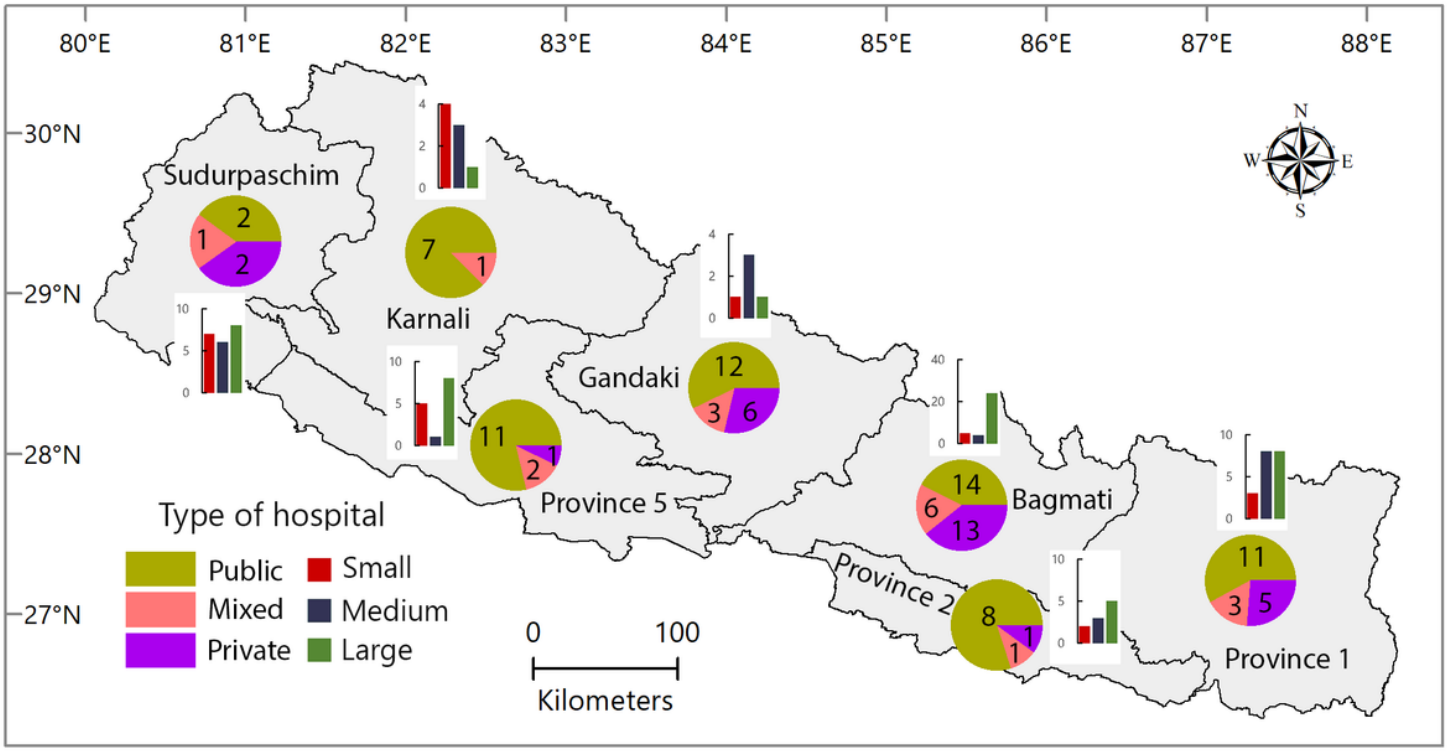

Figure 1

Number of hospitals under study, by province and hospital type (N=110). Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

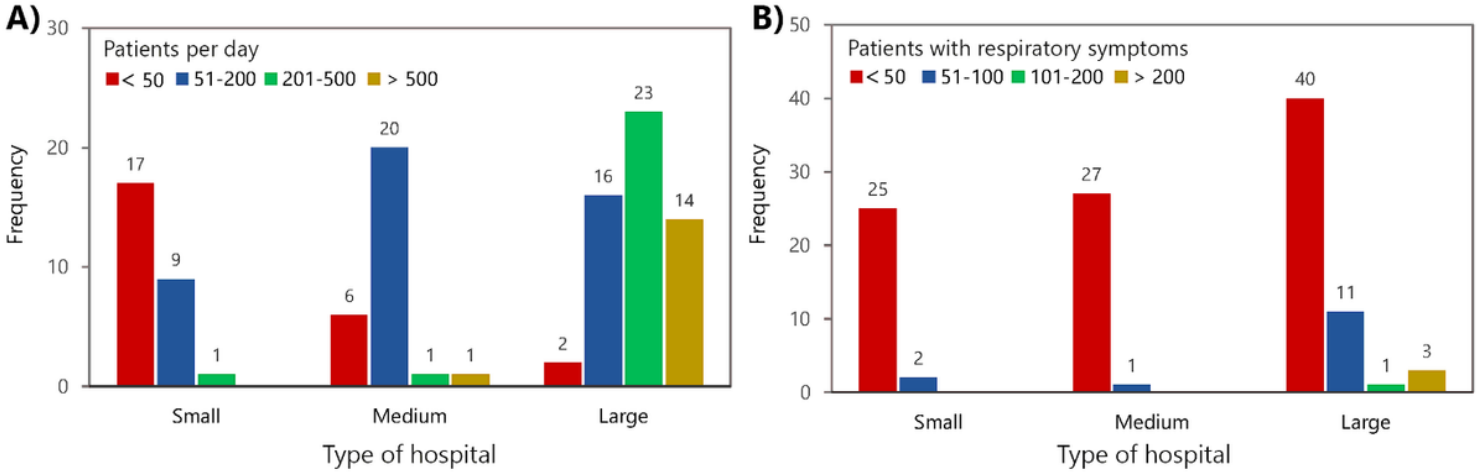

Figure 2

Average patient flow (A) and patients with respiratory (COVID-like) symptoms (B) attending small, medium, and large hospitals per day (N=110)

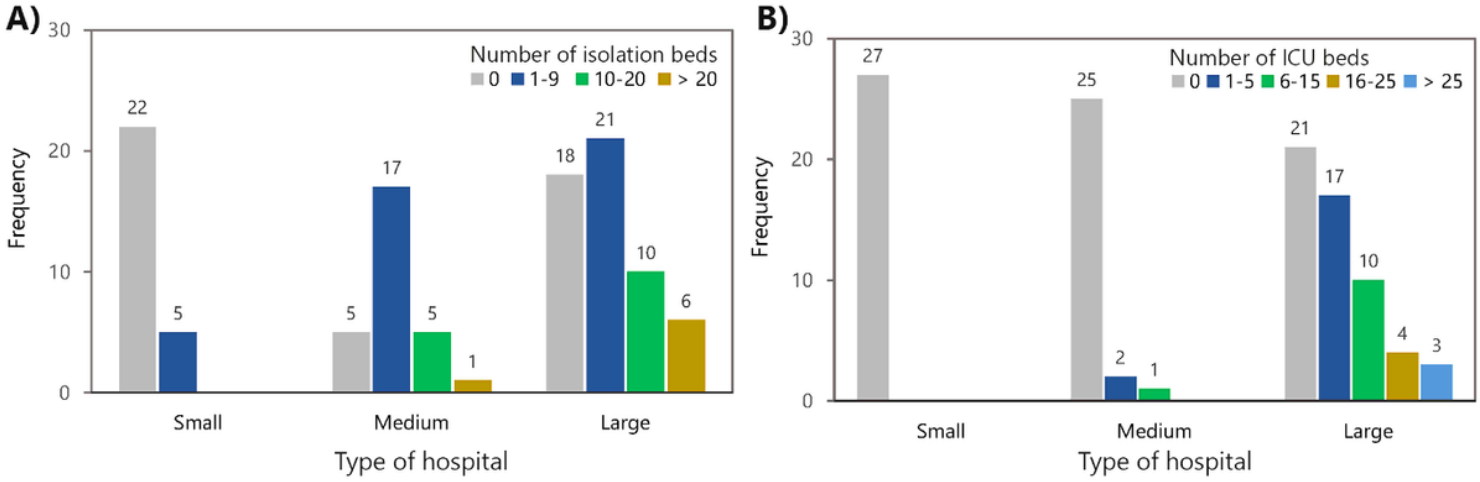

Figure 3

Number of isolation beds (A) and ICU beds (B) available for COVID-suspected cases in small, medium, and large hospitals (N=110)

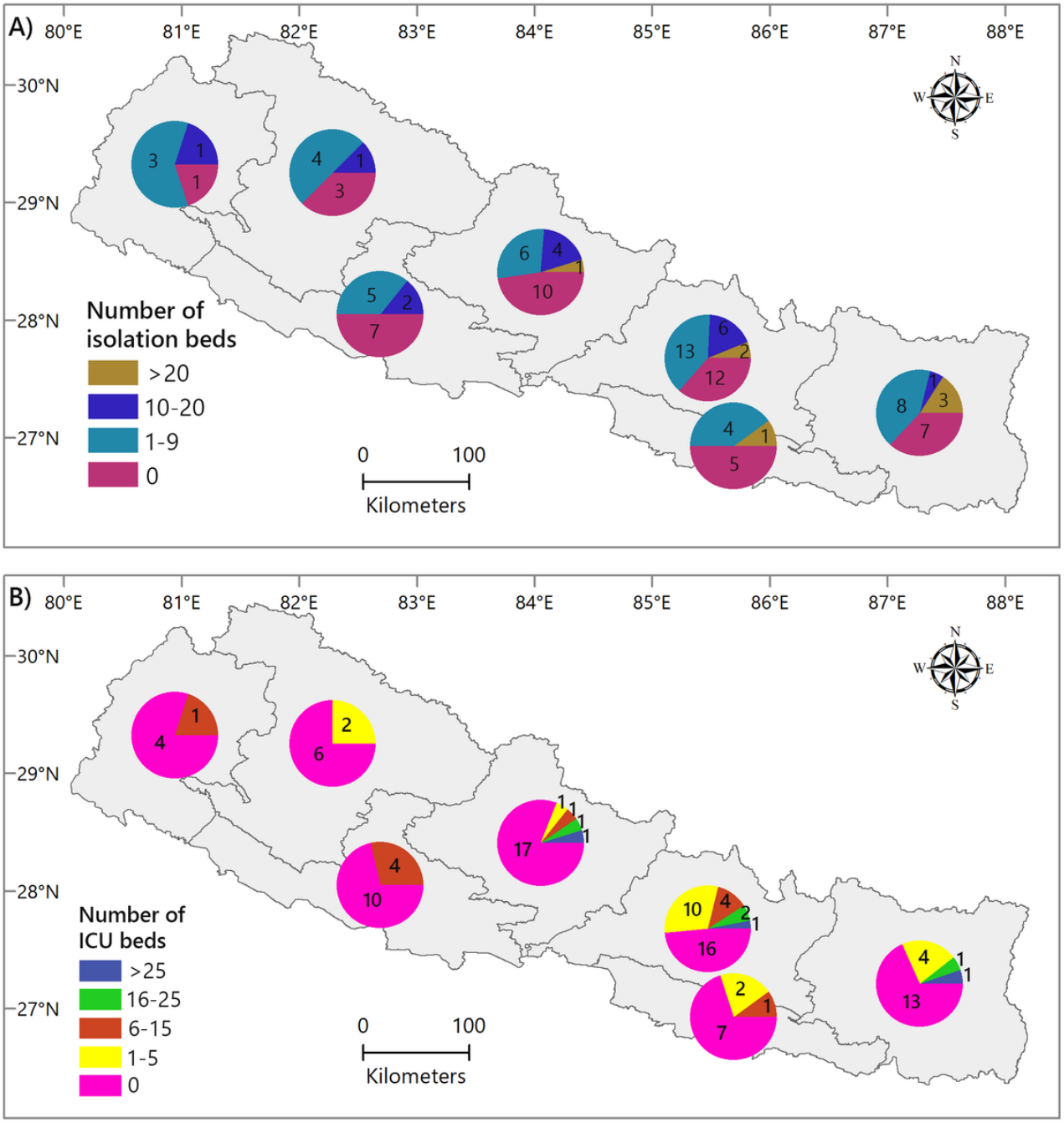

Figure 4

Availability of isolation beds (A) and functional ICU beds (B) for COVID-19 suspected patients in hospitals, by province. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

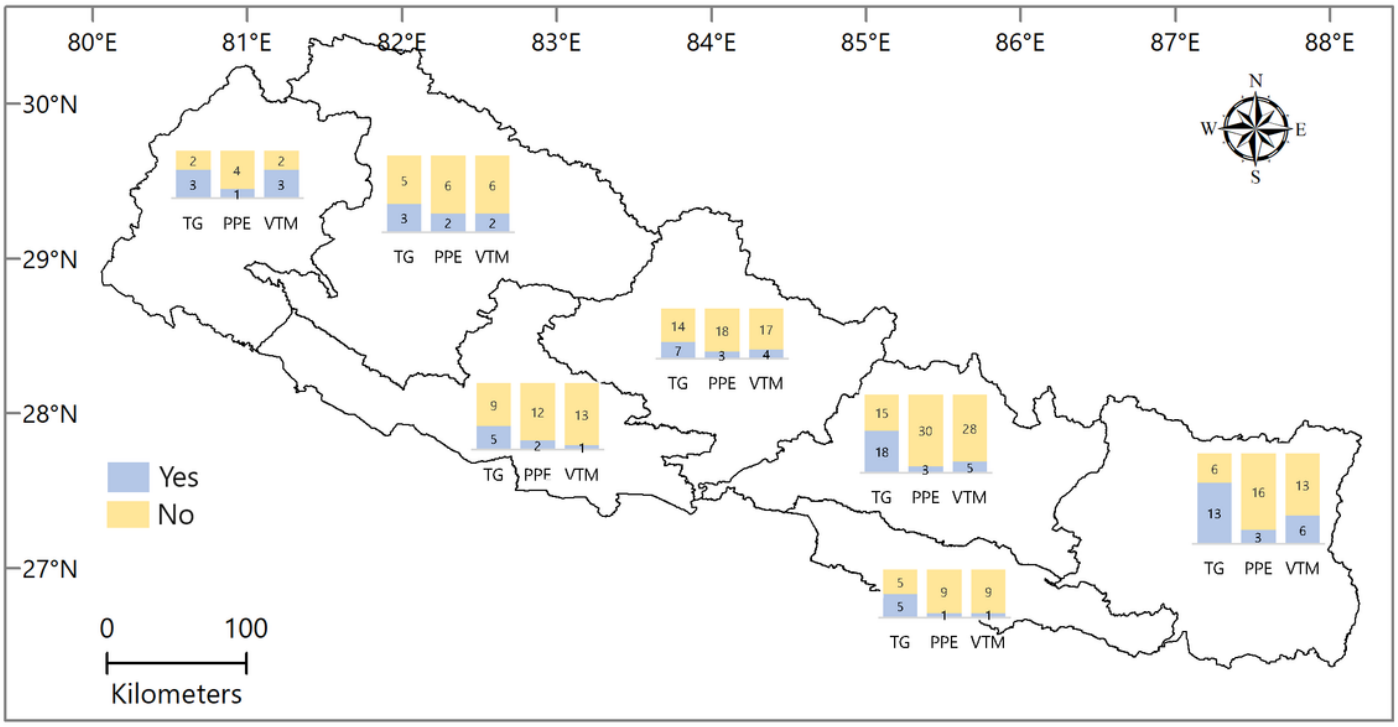

Figure 5

Availability of thermal gun, personal protective equipment, and viral transport media in hospitals, by province Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Supplementaryfilehealthservicescovid19nepBMC.docx