

Medical laboratory staff satisfaction and their perspective on the role of health institutions to combat COVID-19 pandemic

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Abstract

Objective: To assess the facilities and challenges encountered in the clinical laboratories, satisfaction of the medical laboratory staff (MLS) toward their profession and their views on the role of related health institutions during the first wave of the Coronavirus Disease 2019 (COVID-19) pandemic in Nepal.

Methods: A web-based cross-sectional study was conducted among registered MLS in Nepal. Data were collected using a structured self-reported questionnaire on the Google Docs platform.

Results: A total of 301 respondents were enrolled in the study; of which 180 were male and 121 were female. Of the 301 respondents, a lack of infrastructure was reported by 241 (80.1%), a lack of skill development training by 204 (67.8%), limited availability of diagnostics kits by 151 (50.2%), overburdened by the workload by 142 (47.2%) and difficulty in sample management by 129 (42.9%). A total of 244 of 301 respondents (81.1%) believed that stakeholder institutions

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should collaborate with the government during the pandemic. The level of satisfaction during the pandemic (130 of 301; 43.19%) was found to have decreased compared with before the pandemic (203 of 301; 67.4%).

Conclusion: MLS were not fully satisfied with the available resources during the pandemic.

Keywords

COVID-19, Nepal, First wave, Facilities, Challenges, Satisfaction, Roles, Laboratory staff

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Background

Coronavirus Disease 2019 (COVID-19), a new respiratory disease caused by Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) was first reported in Wuhan City, China, on December 31 2019.¹ Up to 3 February 2022, the virus has spread to more than 225 countries infecting over 385 million populations worldwide.² Around 5 million deaths have been reported globally during this period.³ The World Health Organization declared this outbreak as a Public Health Emergency of International concern on 30 January 2020.¹ In Nepal, the total infected cases reached to more than 962 000, with recorded deaths of over 11 000 as of 3 February 2022.⁴ The Ministry of Health and Population of Nepal reports ~20% positive cases and 0.26% deaths among the total population tested in Nepal.^{2,5} Nepal experienced two waves of COVID-19 up to the time of preparing this manuscript; the first outbreak in January 2020 and the second in April 2021.^{4,6} During the first wave of infection, a significant increasing trend of newly confirmed, cured and death cases were found. The curve peaked by the end of October 2020 and then followed a downward trend.⁷ The Government of Nepal (GoN) enforced robust mitigative measures from the reporting of the first case in Nepal.⁸

Despite the vigorous efforts of the GoN to control COVID-19, the country experienced a second wave of COVID-19 infection characterized by a dramatic increase in the number of infected cases and deaths.⁹ The number of infections increased continuously for 2 months and then started to fall at the time of writing this manuscript.^{4,9}

Laboratory services, a critical department in healthcare centres, have operated around the clock even during the pandemic. According to a few reports, 70% of clinical decisions depend on laboratory testing in the hospital setting and outside.¹⁰ Furthermore, surveys of evidence-based clinical guidelines show that at least 80% of policies aimed at establishing a diagnosis or managing disease require laboratory testing.¹¹ A chaotic, unstructured and unplanned laboratory produces diagnostic errors and leads to erroneous results that significantly affect the quality of the report.¹² The training gained by laboratory staff, physical and mental satisfaction, knowledge, instrument quality, samples-to-staff ratio, challenges and expectations of laboratory staff directly correlate with the quality of the reports generated from the laboratory.^{12,13}

Amidst the pandemic, Nepal faced a big problem with nucleic acid testing for the diagnosis of COVID-19. This was because of inadequate available testing capacity to

meet the national need. The main reason behind this was the shortage of reagents, infrastructure and skilled human resources. This situation necessitated the GoN for emergency preparedness by establishing molecular testing laboratories and training Medical Laboratory Staff (MLS) for a pandemic response.¹⁴ In the beginning, the GoN set out to establish public laboratories for molecular diagnostic assays. However, when there was a sudden increase in COVID-19 cases around the country, the GoN decided to prepare the public health response with the joint effort of a public-private partnership. Therefore, it allowed private laboratories to conduct COVID-19 polymerase chain reaction (PCR) testing.¹⁵ Interim guidelines were prepared for the establishment of a new PCR laboratory that included basic infrastructure and resources, but it lacked many aspects for a standard molecular biology laboratory.¹⁶ Over time, the number of COVID-19 diagnostic laboratories has increased significantly from an initial 10 to over 75 laboratories currently.^{4,17,18}

Along with the establishment of new laboratories, there was an increasing demand for skilled MLS to bring the new laboratories into operation. Although significant attempts were made to address all the facilities for the working staff, some associated factors prevented both good laboratory practice and MLS satisfaction toward work during the pandemic. The evidence for assessing the facilities and challenges encountered in COVID-19 diagnostic laboratories in developing countries like Nepal were limited. The satisfaction of MLS about their profession and their perspective on the role of health institutions has a direct relation with the smooth and effective functioning of diagnostic laboratories.¹⁹ This study aimed to assess the facilities and challenges encountered in the clinical laboratories, satisfaction of the MLS toward their profession and their views on the role of

related health institutions during the first wave of the COVID-19 pandemic in Nepal.

Participants and methods

Study design

This cross-sectional survey was undertaken in February 2021 among the registered MLS working in different healthcare centres in Nepal. A structured and self-reported survey questionnaire containing informed consent and other measures was published on the Google Docs platform on 15 February 2021. Data were collected using the same platform between 15 February 2021 and 28 February 2021. The reporting of this study conforms to the Equator guideline: Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.²⁰

Formal ethical approval was granted by the Ethical Review Board of the Nepal Health Research Council (no. 1771) before carrying out this study. Consent from respondents was obtained online before participating in the survey after presenting them with the study's aims, nature and purpose. Respondents that gave their willingness to participate in this survey had to click 'Yes' to answer the question 'Do you want to participate in this survey?', after which only they were administered a set of questions. This study strictly maintained the anonymity and confidentiality of the data.

Study respondents, sample size and sampling

The study population consisted of registered MLS aged ≥ 18 years of all educational levels. All of the enrolled respondents were registered with the Nepal Health Professional Council (NHPC). The NHPC is an autonomous body regulating human resources for laboratory and other allied-health practices in Nepal. According to

the NHPC, the total MLS population in Nepal is around 30 000 that is less than 1% of the total population.^{21,22} Assuming 20% of the MLS population with adequate knowledge and practice behaviour, the sample size was found to be 246 at a 95% confidence interval and 5% margin of error.²³ A total of 350 responses were received during the data collection period of 2 weeks. Duplicate responses from a single individual, incompletely filled responses and responses filled by non-MLS were excluded from the study. In total, 301 completely filled forms were included in this analysis. The MLS with internet access were only considered for this survey. The call for study participants to enrol in this study was made via social media such as Facebook, Messenger, WhatsApp, Viber, WeChat and Emails. The participants were requested to complete the online questionnaire form based on their knowledge. The online-based survey was administered in the two official languages (Nepali and English) in order for MLS to understand the questions clearly. Respondents from all the geopolitical divisions of Nepal were enrolled in this study.

Study questionnaire and measures

After reviewing the literature in this area and several questionnaires used for an online survey, a questionnaire was designed using Google Forms platform, which was prevalidated by three independent reviewers. The questionnaire used in this study was developed for this study and has not been published. The questions were close-ended types that were divided into four different sections as follows; (a) sociodemography of the respondents; (b) facilities and challenges; (c) perception of roles of the organization during COVID-19; and (d) satisfaction. Section A consisted of sociodemographic characteristics of the respondents such as age, sex,

geographical location, level of education, type of institution and years of experience. To understand the facilities provided to MLS and the challenges faced by them during the ongoing pandemic, questions regarding the facilities and challenges were asked in different subheadings. Five questions were asked that related to facilities and eight inquiries related to challenges. The response to those questions was measured using a Yes/No format and only the 'Yes' responses were allocated 1 point. For the evaluation, the total score of 'challenge' was divided into tertiles; the first tertile was considered as minimum, the second as moderate and the third as maximum. The total score of 'facility provided' was divided into the median; less than the median score was considered as poor facilities provided and more than the median score was considered as satisfactory. Likewise, the perception of the MLS towards the role of non-governmental health institutions and professional councils and satisfaction towards their work was measured using Yes/No questions.

Statistical analyses

Data were summarized using Microsoft® Excel® 2019 and analysed using the R statistical package (R version 4.0.3; R Foundation for Statistical Computing, Vienna, Austria). The χ^2 -test was used to investigate the association between independent variables (demographics) and outcome variables (categories of facilities provided and challenges faced). The McNemar test compared the respondents' satisfaction before and after COVID-19 regarding their job. Descriptive analysis was undertaken for the questions related to the perceptions about duties and responsibilities by the stakeholder organizations of the laboratory. All test hypotheses were considered two-sided. A *P*-value <0.05 was considered statistically significant.

Results

A total of 301 respondents were enrolled in the study; of which 180 were male and 121 were female (Table 1). The majority of respondents belonged to the age group of 18–30 years (201 of 301 respondents; 66.8%). Among the study population, the percentage of personnel involved in private organizations was higher than those working in public organizations. Here ‘unemployed’ indicated the MLS that worked for only a few periods during the pandemic and left their job. The majority of the

respondents (120 of 301 respondents; 39.9%) had work experience of 1–5 years. The highest proportion of respondents (127 of 301 respondents; 42.2%) had a bachelor’s degree followed by those with a proficiency certificate in medical laboratory technology, those with a masters and/or above and laboratory assistants.

All of the respondents were provided with personal protective equipment (PPE) for their safety by their respective organizations (Table 2). However, only 17.3% (52 of 301 respondents) of the respondents were

Table 1. Distribution of the study respondents ($n = 301$) according to their sociodemographic characteristics.

Characteristic	Categories	Number of respondents	Percentage of respondents
Working province	Province 1	22	7.3
	Madhesh	21	7.0
	Bagmati	193	64.1
	Gandaki	17	5.6
	Lumbini	26	8.6
	Province 6	7	2.3
	Far west	15	5.0
Sex	Female	121	40.2
	Male	180	59.8
Age	18–30 years	201	66.8
	31–60 years	100	33.2
Educational level ^a	Masters and/or above in medical laboratory technology	47	15.6
	Bachelor’s degree in medical laboratory technology	127	42.2
	Proficiency certificate in medical laboratory technology	102	33.9
	Laboratory assistant	25	8.3
Working place	Government health care institution	104	34.6
	Private clinic/hospital/organization	173	57.5
	Unemployed ^b	24	8.0
Work experience	<1 year	57	18.9
	1–5 years	120	39.9
	6–10 years	63	20.9
	>10 years	61	20.3

^aLaboratory assistant refers to 18 months of training in medical laboratory technology after a basic secondary school education; Proficiency certificate indicates a 3-year course in medical laboratory technology after secondary school education; Bachelor’s degree in medical laboratory technology refers to a standard academic bachelor’s degree; Master and/or above means an academic degree above bachelor’s degree level in medical laboratory technology. ^bUnemployed refers to those medical laboratory staff that left their job during the pandemic.

Table 2. Distribution of study respondents ($n = 301$) according to their responses to questions regarding facilities and challenges.

Category	Yes		No	
	Number of respondents	Percentage of respondents	Number of respondents	Percentage of respondents
<i>Facilities provided</i>				
Personnel protective equipment set	301	100.0	0	0.0
COVID-19 related laboratory training (sample collections/sample processing/sample handling/guidelines related to COVID-19/ethical concerns)	141	46.8	160	53.2
Special incentives	52	17.3	249	82.7
Health benefits such as insurance	1	0.3	300	99.7
Attain any training/seminar/webinar/e-conference/indirect medical education/conference of COVID-19	92	30.6	209	69.4
<i>Challenges</i>				
Lack of infrastructure and facilities	241	80.1	60	19.9
Lack of skilled human resources	151	50.2	150	49.8
Lack of skill development training	204	67.8	97	32.2
Limited availability of tests	151	50.2	150	49.8
Overburden of testing	142	47.2	159	52.8
Sample management	129	42.9	172	57.1
Equipment maintenance	90	29.9	211	70.1
Administrative issues	146	48.5	155	51.5

provided with special incentives. Nearly half (141 of 301 respondents) of the respondents attended COVID-19-related laboratory training. One participant benefited from health insurance. Of the total of five questions under specific sub-headings asked to assess the facilities provided to the MLS, the median score was 2 points. A high proportion of respondents (210 of 301 respondents; 69.8%) had satisfactory facilities during the COVID-19 pandemic. A χ^2 -test was performed to determine if there was any association between the facilities provided and the different demographic variables demonstrated no significant difference in all the studied variables except for sex (supplementary materials, Table 1). The different views from the respondents concerning the challenges

hindering the performance in the laboratory during the COVID-19 pandemic were analysed. The highest proportion (241 of 301 respondents; 80.1%) of respondents reported that the lack of infrastructure and facilities was a challenge. This was followed by the lack of skill development training. Half of the respondents (50.2%; 151 of 301 respondents) found the limited availability of diagnostics kits to be another challenge. Nearly half of the respondents had to face the overburden of testing (142 of 301 respondents; 47.2%) and sample management (129 of 301 respondents; 42.9%). In addition to these challenges, administrative issues (146 of 301 respondents; 48.5%) were also critical factors hindering the performance of laboratories. Based on the total of eight questions

asked to understand the challenges associated with good laboratory practice, a high number (182 of 301 respondents; 60.5%) of respondents accepted that they had minimum challenges related to their laboratory work. There were no significant associations between the challenges faced and the different demographic variables when tested using χ^2 -test (see supplementary materials, Table 1).

The majority of the respondents had prioritized their collaboration work (244 of 301 respondents; 81.1%) and providing their laboratory manpower (241 of 301 respondents; 80.1%) to the governmental bodies instead of providing financial support or leasing equipment (Table 3). A high proportion of respondents conducted the necessary training seminars (184 of 301 respondents; 61.1%) to support the government in fighting against the pandemic. With regard the roles of professional councils, the majority of the respondents (293 of 301 respondents; 97.3%) believed that the NHPC should conduct the necessary training and webinars focusing on diagnostic approaches and laboratory management strategies to combat the pandemic.

In addition, 174 of 301 respondents (57.8%) expected accommodation and transportation facilities to be provided by the professional council during the pandemic.

The COVID-19 pandemic caused a significant decrease in the satisfaction level of the respondents ($P < 0.001$) (Table 4). The data showed that the majority of respondents (203 of 301 respondents; 67.4%) were satisfied with their work before the COVID-19 pandemic. However, the percentage of respondents satisfied with their work decreased to 43.19% (130 of 301 respondents) after the COVID-19 outbreak.

Multivariate logistic regression analysis was performed to find the association between satisfaction towards work after the COVID-19 pandemic and different study variables such as sociodemographic, facilities provided and challenges faced (Table 5). There were no significant associations between the examined variables and work satisfaction.

Discussion

Diagnostic laboratories have a crucial role to play in the treatment and prevention of

Table 3. Distribution of study respondents ($n = 301$) according to their responses to questions regarding the roles of the health institution.

Category	Yes		No	
	Number of respondents	Percentage of respondents	Number of respondents	Percentage of respondents
<i>Roles of non-governmental health institutions</i>				
Conducting some training seminars	184	61.1	117	38.9
Providing financial support	113	37.5	188	62.5
Collaboration works with government bodies	244	81.1	57	18.9
Providing their laboratory manpower to the place of need	241	80.1	60	19.9
Providing equipment on lease	92	30.6	209	69.4
<i>Roles of professional councils</i>				
Providing training and conduct relevant webinar	293	97.3	8	2.7
Providing accommodation and transportation facilities	174	57.8	127	42.2

Table 4. Satisfaction level before and after the COVID-19 pandemic among the study respondents ($n = 301$).

	Satisfaction after COVID-19		Total	McNemar χ^2 -test	P-value
	No	Yes			
Satisfaction 51.33 before COVID-19					
No	84 (27.91)	14 (4.65)	98 (32.56)	51.33	$P < 0.001$
Yes	87 (28.90)	116 (38.54)	203 (67.44)		
Total	171 (56.81)	130 (43.19)	301 (100.00)		

Data presented as n of respondents (%).

Table 5. Multivariate logistic regression analysis of the association between the level of satisfaction after the COVID-19 pandemic and study variables among the study respondents ($n = 301$).

Variable	Category	Satisfaction		
		Total cohort $n = 301$	No $n = 171$	Yes $n = 130$
Age	15–30 years	201 (66.78)	117 (68.42)	84 (64.62)
	31–60 years	100 (33.22)	54 (31.58)	46 (35.38)
Sex	Male	180 (59.80)	96 (56.14)	84 (64.62)
	Female	121 (40.20)	75 (43.86)	46 (35.38)
Educational level	Bachelor's degree and higher	174 (57.81)	104 (60.82)	70 (53.85)
	Laboratory assistant and proficiency certificate	127 (42.19)	67 (39.18)	60 (46.15)
Years of work experience	<5 years	177 (58.80)	100 (58.48)	77 (59.23)
	≥5 years	124 (41.20)	71 (41.52)	53 (40.77)
Working province	Bagmati	193 (64.12)	111 (64.91)	82 (63.08)
	Others	108 (35.88)	60 (35.09)	48 (36.92)
Working place	Government hospital	104 (34.55)	59 (34.50)	45 (34.62)
	Private hospital/clinic/unemployed ^a	197 (65.45)	112 (65.50)	85 (65.38)
Facility provided	Poor	91 (30.23)	52 (30.41)	39 (30.00)
	Satisfactory	210 (69.77)	119 (69.59)	91 (70.00)
Perceived challenges	Minimum	182 (60.47)	102 (59.65)	80 (61.54)
	Moderate	67 (22.26)	41 (23.98)	26 (20.00)
	High	52 (17.28)	28 (16.37)	24 (18.46)

Data presented as n of respondents (%).

No significant associations ($P \geq 0.05$).

^aUnemployed refers to respondents that were working in a private institution and left their job during the pandemic.

COVID-19 during the pandemic. The knowledge, practical skills, enthusiasm and motivation possessed by the human resources working inside a laboratory are critical elements determining the generation of reliable and accurate laboratory test

results.^{24,25} In addition, the generation of quality laboratory reports is also directly related to the quality of the laboratory systems that are managed by the human resources involved in the process.¹⁹ The testing capacity of a diagnostic laboratory

further depends on the availability of resources. This current survey explored the facilities and challenges associated with working in diagnostic laboratories that had been used to diagnose COVID-19 during the pandemic; including analysing the potential role of the professional councils and the satisfaction that MLS had toward their profession before and after the pandemic. The findings of this current study might help MLS to participate actively in controlling future pandemics. The laboratory workers had an increased risk of infection because they were directly involved in handling infectious specimens. Frequent reports of illness and the deaths of healthcare workers from around the world raised an important question concerning their medical safety.²⁶ This situation can have a negative impact on their levels of satisfaction toward their profession and their attitude toward their umbrella professional council and association for their influential role in combating the pandemic. Furthermore, a previous study showed that a significant number of healthcare workers (88.5%) considered financial incentives as a critical motivation.²⁷ Under such circumstances, standard facilities provided to them could be beneficial in the potential long-term battle against COVID-19 and could be a crucial factor in their willingness and motivation to continue engaging in COVID-19-related work.

This current study demonstrated that the COVID-19 pandemic caused reduced satisfaction among Nepalese MLS. Occupational dissatisfaction and willingness to leave jobs have been recently reported in nurses, in a wide range of healthcare workers and medical staff.^{28–30} However, a study in clinical biochemistry staff obtained contrary findings compared to this current study.³¹ Furthermore, this current study demonstrated no significant association between the facilities and challenges faced by the MLS in the laboratory

with their level of satisfaction before and after the pandemic. These current findings suggest that the decreased level of satisfaction toward work among MLS during the pandemic might have been due to psychological distress arising due to the increased risk of infection to themselves and their family members.

Numerous challenges are faced in diagnostic laboratories in resource-limited settings.³² Many of them have been addressed elegantly in a recent report.³³ The chaotic situation created by the COVID-19 pandemic resulted in clinical laboratories facing unprecedented challenges.^{34–37} Collecting proper samples and a prompt and accurate molecular diagnosis was essential to produce reliable results. However, in many testing centres, large volumes of clinical samples were collected and MLS often faced high workloads and difficulties in processing samples on time. As a consequence, they might have needed to store samples at a pre-analytical stage for a long time. Sample storage is a big problem in resource-limited countries like Nepal. Therefore, the quality of the data generated by laboratories has been questioned. In this current study, a lack of adequate infrastructure and skill development training were the significant challenges facing MLS in Nepalese molecular diagnostic laboratories, which was similar to the findings of a survey in Ethiopia.²⁵

Special safety protocols must be followed during the handling specimens from COVID-19 patients.²⁹ The processing of samples from suspected cases of COVID-19 poses a high risk to the laboratory workers as research suggested that the SARS-CoV-2 virus can survive on non-living surfaces at 22–25 °C and 40–50% relative humidity for up to 5 days.^{34,38,39} Laboratory staff becoming infected from handling samples was reported from Asian countries such as Singapore and Taiwan.⁴⁰ These current data demonstrated that

100% of the respondents were provided with enough PPE, which is much higher in comparison with other studies from Latin America and Nigeria.^{41,42} However, the provision of health insurance to MLS was poor with only one respondent reporting that they received health insurance.

This current study had several limitations. First, as this was a social-media and email-based survey, non-responsiveness by MLS was due to the lack of availability or inadequate network/internet facilities at their homes or workplaces. Secondly, the lack of in-depth face-to-face interviews prevented the researchers from gaining valuable information on the nuances of the responses provided by the respondents. Thirdly, the majority of the responses were from the MLS from Bagmati province. Therefore, the limited participation from other regions might not reflect the actual situation in those provinces. Finally, no pretesting of the questionnaire was undertaken before conducting this research.

In conclusion, the COVID-19 pandemic was and still is especially challenging for clinical laboratories tasked with rapid and reliable testing of a significantly increased number of samples. Demand above surge capacity readily clogged up the standard infrastructure. According to this study, limited facilities and maximum challenges were prevalent in Nepalese diagnostic laboratories. In addition, the satisfaction toward their profession has fallen during the pandemic (first wave of COVID-19), which has indirectly impacted on the enthusiasm of MLS toward their jobs. These findings provide an understanding of the role of health-care facilities in tackling the COVID-19 pandemic or similar health emergencies in the future. Based on the findings of this current survey, we recommend stakeholders and related authorities establish laboratories with systems focusing on quality assurance and staff recognition in order to uplift

the level of MLS satisfaction. The findings could also be helpful in developing strategies for human resource management in clinical laboratories of a resource-limited country like Nepal to bring improvements in the perception of a laboratory-based profession in the future.

Author contributions

All of the authors made substantial contributions to this work. B.B.B. and D.S. drafted the proposal. B.B.B., D.S., R.P., A.M., R.K., G.C. S. and S.K.M. collected data. T.B.B. and R.P. helped in the statistical analysis of the data. B.B. B., R.P. and D.S. wrote the manuscript and were guided by S.K.M. and T.B.B. All of the authors approved the final version of the manuscript.

Declaration of conflicting interest

The authors declare that there are no conflicts of interest.

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Supplemental material

Supplemental material for this article is available online.

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