



## Biosafety During COVID-19 Pandemic: A Study On Knowledge, Attitude And Practice Among Medical Laboratory Technicians.

<sup>1</sup>K.Usha Krishnan, <sup>2</sup>Lavaya T.Kamalasekaran, <sup>3</sup>D. Therese Mary, <sup>4</sup>C.Rajasekaran\*,

<sup>5</sup>M.Suganthi, <sup>6</sup>Thyagarajan Ravinder,

<sup>1,6</sup>Professor, <sup>2,4</sup>Assistant Professor, <sup>3,5</sup>Associate Professor,

Department Of Microbiology,

<sup>1</sup>Govt. Tiruvallur Medical College, Tiruvallur, Tamil Nadu

<sup>2,3,4,5,6</sup>Kilpauk Medical College, Chennai

**\*Corresponding Author:**

**C.Rajasekaran**

Assistant Professor of Microbiology, Kilpauk Medical College, Chennai, Tamil Nadu

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### Abstract

The unprecedented Corona Virus Disease 2019(COVID-19) pandemic placed enormous challenges on all the sections of healthcare system including laboratory departments. Laboratory acquired infection are of public health concern and can be avoided by observing biosafety measures. With this backdrop the present study was conducted to assess lab technicians' knowledge, attitude and practice of biosafety during COVID-19 pandemic. Based upon the national and international Interim Laboratory biosafety guidelines for Handling and Processing Specimens Associated with COVID -19 the questionnaire was prepared with 16 objective type questions. The total score on the scale of 0 to 100 was calculated and classified as good (score > 50), and poor (score < 50). Of the total 52 respondents, 42(81%) were females and 10 (19%) were males. Only 12 (23%) of them had received exclusive training on laboratory biosafety. Pathology technicians had good knowledge (89%) and Microbiology technicians had good attitude (100%) compared with the other departments. In this study the mean knowledge was 5.3 and the mean attitude score was 3.3. Overall, only 77% of study participants had good knowledge, and 83% had good attitude. The overall infection rate of COVID-19 among study participants, calculated by the history given by them was 33%. The study identifies gaps in knowledge, attitude and practice of biosafety among lab technician and conducting safety audit will help in identifying them. The role of structured training is very crucial on the backdrop of pandemic where the knowledge and experience of scientific community is still evolving.

**Keywords:** Biosafety; COVID-19; laboratory acquired infection; Medical Laboratory Technicians; SARS-CoV-2

### Introduction

The unprecedented Corona Virus Disease 2019 (COVID -19) pandemic placed enormous challenges on all the sections of healthcare system and more so on laboratory departments. The COVID-19 outbreak caused by the Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2) was declared as a public health emergency of international concern and subsequently as pandemic on January 30, 2020, by

the World Health Organization (WHO) <sup>1, 2</sup> On this back ground, across the country Molecular biology equipped laboratories with required biosafety level have been set up in a record time to meet out the challenge of laboratory surge capacity required during this pandemic.<sup>3</sup>

Health Care personnel (HCP) are at risk of exposure of occupational infection which is known to transmit different infectious agents in addition to the

possibility of transmission of hitherto unidentified infectious agents. Published case reports were found for a total of 60 pathogens or species including viruses, bacteria, rickettsia, parasite and yeast as a source of occupational infection.<sup>4</sup>

All infections acquired through laboratory or laboratory-related activities are defined as Laboratory-acquired infections (LAIs), or an occupational illness. LAIs are of public health concern, as an infected technician may present a risk of transmission to his colleagues, relatives, family members and general public. Most of these infections caused by occupational exposure can be avoided by observing standard work precautions and laboratory biosafety measures. The fact that HCPs identified as patient facing had a significantly higher odds for SARS-CoV-2 test positivity suggests an increased risk of COVID-19 infection with work exposure.<sup>5</sup> Hence all laboratories need to adapt to the demands of processing COVID-19 related samples with adequate biosafety practices.

As per a review article, in which 99 studies were included, large proportions of HCPs in low and middle income countries, were exposed to biological hazards and various other work place related hazards and it concludes that the implementation of risk reduction strategies was also suboptimal.<sup>6</sup>

Medical Laboratory Technicians (MLTs) in every phase of their work from sample collection, processing, reporting and disposal of biomedical waste work with bio-hazardous material every day. With this backdrop the present study was conducted to assess lab technicians' knowledge, attitude and practice of biosafety during COVID-19 pandemic.

## Materials And Methods

This cross sectional study was conducted among MLTs working in diagnostic laboratories of the departments of the Microbiology, Pathology and Biochemistry in a tertiary care hospital. The study proposal was presented to the Institutional Ethical Committee and approval was obtained. Period of study was 3 months, from October to December 2021.

**Study tool:** The questionnaire was prepared to obtain information on demographics and KAP aspects of participants. After signing the voluntary consent form to participate, they have to answer the

questionnaire. Demographic variables included are age, gender, education, work experience and details of training on biosafety. Inclusion criteria - all the MLTs posted in the processing of suspected Covid-19 samples and who has given consent were included in the study.

Based upon the national and international Interim Laboratory biosafety guidelines for Handling and Processing Specimens Associated with COVID -19 the questionnaire was prepared<sup>7-10</sup> with 16 objective type questions. The components of the questionnaire was, 9 questions on knowledge, 4 on attitude and 3 on practice. The knowledge questions were prepared to include pre analytical, analytical and post analytical aspects. The questionnaire was validated for clarity and consistency by all the authors of the study and pretested with 10 MLTs and the results of which is not included in the analysis. The questionnaire was distributed in person to the respondents and collected back the next day by the second author. The infection rate was calculated by the participant's response of having suffered by the laboratory confirmed COVID-19 infection during the previous year.

One point was assigned for correct answer and an incorrect/unknown answer was assigned 0 points. The total score on 0 to 100 scale was calculated for knowledge and attitude domains and classified as good (score > 50), and poor (score < 50). Qualitative variables were presented as number and percentage and quantitative variable presented as mean and Standard deviation.

## Results

The total number of respondents included in this study was 52, of which 42(81%) were females and 10 (19%) were males. Regarding age, maximum age of a respondent was 57 years and minimum was 20 years, 56% of respondents were in the age group 21- 35 years. About 4 participants were qualified up to undergraduate and 48 (92%) of MLTs were diploma qualified. Among the participants, 2 had the maximum work experience of 31 years and 4 participants had minimum of 1 year experience. The average work experience was 13 years. Out of 52 participants, 12 (23%) of them had received training exclusively on laboratory biosafety. **Table 1** depicts the distribution of study participants among the departments of microbiology, pathology and

biochemistry. In **Table 2** number of correct response given by participants for each question is discussed. Status of Knowledge, Attitude and Practice among study participants is elaborated in **Table 3**. Pathology

technicians had good knowledge (89%) and Microbiology technicians had good attitude (100%) compared with the other departments.

**Table 1: Distribution of study participants**

Department	Male	Female	Total
Microbiology	3	18	21
Pathology	3	15	18
Biochemistry	4	9	13
Total	10	42	52

**Table 2: Questionnaire with number of correct response**

Sl.no	Questions on knowledge	Correct response(%)
1	Activity specific risk assessment	44(85)
2	Nitrite gloves	43(83)
3	Handling of duly filled requisition forms	19(36)
4	PPE recommendation while collection of nasopharyngeal swab on a dead patient,	11(21)
5	Automated instruments and analyzers for all routine hematology and clinical biochemistry tests	50(96)
6	Procedures to be performed in BSC-Class 2	36(69)
7	Procedure to reuse the face shield	25(48)
8	Choices of disinfectants recommended to wipe down the surfaces before & after diagnostic procedure	12(23)
9	Handling of laboratory waste from testing suspected or confirmed COVID-19 patient specimens	39(75)
Questions on Attitude		
10	Lab personnel are responsible for cleaning the surfaces in the laboratory and sample reception area	50(96)
11	Scenarios to apply Standard Safety guidelines	46(88)
12	Can any face covering worn inside the lab be subsequently worn	35(67)

	outside the lab area also	
13	Self-quarantine after close contact history with a laboratory confirmed COVID-19 patient.	43(83)
Questions on Practice		
14	Have you ever tested Positive for COVID-19 in the previous year?	17(33)
15	If “Yes” what could be the probable source of infection? Work place was suggested as probable source of infection by 13 participants.	13(25)
16	Was any of your family members diagnosed with COVID-19 during the same time period ?	19(36)

**Table 3: Status of Knowledge, Attitude and Practice among study participants.**

Department (No of MLTs)	Knowledge		Attitude		Practice		Probable source of infection- work place
	Good (%)	Poor (%)	Good (%)	Poor (%)	No.of MLTs not Infected(%)	No.of MLTs Infected(%)	
Microbiology( 21)	14(66)	7(33)	21(100)	0	16(31)	5(24)	5
Pathology(18)	16(89)	2(11)	14(78)	4(22)	12(23)	6(33)	2
Biochemistry( 13)	10(77)	3(23)	8(62)	5(38)	7(13)	6(46)	6
Total(52)	40(77)	12(23)	43(83)	9(17)	35(67)	17(33)	13

## Discussion

Various governing bodies have been regularly issuing biosafety guidelines for laboratories during the present COVID-19 pandemic. Routine laboratory precautions and biosafety guidance insists that all procedures must be performed based on risk stratification and only by trained personnel as per the relevant standard operating procedures at all times. Safe handling of laboratory samples, appropriate use of Personal Protective Equipment (PPE) and proper biomedical waste disposal can reduce the risk of transmitting COVID-19 to the laboratory personnel.

In this study, though all the participants had attended the 3 hours training along with other cadre of health care personnel on biomedical waste management,

usage of PPE and other infection control practices in the early phase of the pandemic, only 12 (23%) of them had received a prior training exclusively on laboratory biosafety within last 2 years. No biosafety manual was given at that time and none of the laboratory was accredited. In a study conducted at Yemen, 32% of lab technicians from public laboratories had received training on biosafety.<sup>11</sup> Formal biosafety training had not been given to 84.2% of the respondents in Pakistan as per a study by Sadia Nasim et al.<sup>12</sup>

In this study though 84% of participants were aware of 1% Sodium hypochlorite as work bench disinfectant, only 12 (23%) were aware of choices of other disinfectants effective against SARS-CoV-2, recommended to wipe down the surfaces before and

after diagnostic procedure. Only 21% were aware of PPE recommendation while collection of nasopharyngeal swab on a dead patient. PPE is an important part of safety to prevent SARS-CoV-2 transmission, in this pandemic, but several limitations in adherence to biosafety guidelines have been found, including the shortage of PPE, frequent changes and ambiguity of the recommendations.<sup>13</sup>

Among the participants of this study, about 25(48%) MLTs had known about the proper procedure to reuse the face shield. In a study conducted in Clinical Laboratories of Karachi, Pakistan, the practice of using safety glasses or similar protective equipment in biosafety 2 laboratory was found to be 0.8% only.<sup>14</sup>

Out of 52 MLTs of this study, 33 (63%) were on the opinion that duly filled requisition forms should be wrapped around the samples so that it will not get missed. Regarding the procedures to be performed in BSC-Class 2, 69% of respondents were well aware. Proper handling of laboratory waste generated from testing suspected or confirmed COVID-19 patient specimens was exhibited by 39(75%) technicians of this study. This is similar to a study in which laboratory technicians answered better and 88.8% gave correct response to knowledge questions on biomedical waste management<sup>15</sup>

As the transmission mechanisms of COVID-19 are through respiratory droplets, aerosolized particles, and contact, knowledge and proper use of automated instruments will reduce the risk of contracting the infection. Correct concept on activity specific risk assessment and nitrile glove was exhibited by 85% and 83% of MLTs. Over all 50(96%) participants knew about usage of automated instruments and analyzers for all routine hematology and clinical biochemistry tests.

Correct attitude regarding scenarios to apply safety guidelines was exhibited by 46 (88%) of participants of this study. Nearly 50 (96%) respondents were displaying good attitude on responsibility of cleaning the work bench surfaces in the laboratory and also in the sample reception area. This is in contrast to a study that showed only about 60% of lab personnel disinfect their working tables regularly.<sup>16</sup>

Good attitude was portrayed by 43(83%) participants of this study on self-quarantine after close contact

history with a laboratory confirmed COVID-19 patient. Nearly 35(67%) had a correct attitude that any face covering worn inside the lab should not be subsequently worn outside the lab area, meaning 33% of participants move out of lab with the same face mask they wear during laboratory work. This is similar to a cross-sectional KAP study of donning and doffing of PPE, without removing gloves and N-95, 3.5% of HCWs move out of the doffing area, which requires serious correction in their practice.<sup>17</sup>

In this study the mean knowledge was 5.3 with standard deviation 1.29, and the mean attitude score was 3.3 with Standard deviation 0.81. Overall, only 77% of study respondents had good knowledge of biosafety, 23% had poor knowledge and 83% had good attitude and 17% had poor attitude. In a study conducted at Srilanka majority of MLTs 72.2%-98.8% have correctly answered for the questions on biosafety.<sup>18</sup>

Among study participants microbiology MLTs 66% had good knowledge and 100% had good attitude. This is similar to a study by Jyotsana V Wadar in which, 100% of microbiology had good scores on attitude.<sup>19</sup> Pathology and biochemistry MLTs 89% and 77% had good knowledge, 78% and 62% had good attitude respectively.

The overall infection rate of COVID-19, calculated by history given by the participants, was 33%. Infection rate among microbiology technicians was 24% and other than Microbiology technicians was 39%. Among the 17 infected during the previous one year period, 13 persons (76%) reported that the probable source of infection was from work place, which is similar to a study by Anita D et al in which over 70% of HCPs were reporting exposure to COVID-19 at work place, as the probable source and exposure to a family member with COVID-19 was reported in 28% of participants.<sup>5</sup> The confirmation of source of infection either from work place or by a family member is out of the scope of this study.

The difference of knowledge and attitude among various laboratory departments reflects their safety work culture and their common mindset that the risk of infection is more with Microbiology laboratory work.

## Conclusion

The study identifies gaps in knowledge, attitude and practice of biosafety among MLTs during COVID-19 pandemic. All the MLTs working in the laboratories involved in the diagnosis of COVID-19, should be well trained in the implementation of appropriate biosafety measures.

The role of structured training is very crucial on the backdrop of pandemic where the knowledge and experience of scientific community is still evolving. The updates and modifications in biosafety mandates need to be communicated to the MLTs without delay, which requires an ongoing training culture. Periodical assessment of the laboratory safety practices can be a valuable tool in making long-term improvements. Conducting safety culture survey and safety audit will help in identifying the gaps in knowledge, attitude and practice results.

### Declarations

### Authors Contribution –

All the authors listed have made a substantial, direct and intellectual contribution to the work and approved it for the publication.

### Ethics Statement –

The study was approved by Institutional Ethical committee of Kilpauk Medical College, Tamilnadu, Chennai, India.

### Availability Of Data-

All the data collected and analysed during the study are included in the manuscript.

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