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The Perceived Benefits of Upskilling Medical Technologists in the Bataan Province in regard to Specimen Collection, Handling, and Processing During the COVID-19 Pandemic

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ABSTRACT: The COVID-19 pandemic has greatly impacted the lives of many people in the Philippines, specifically those who work in healthcare. With the sudden rise of COVID-19 cases, many of those working in the medical field had to upskill and undergo training programs to adapt to the new normal, including medical technologists. This study aims to understand whether the training programs were beneficial to the medical technologists in improving their skills in specimen collection, handling, and processing for the pandemic, based on their perceptions. It also seeks to identify the laboratory services most and least affected by the pandemic, as well as the training program deemed most useful. A cross-sectional descriptive research design was employed for this study, and the data collection was done through online Google Forms surveys. Respondents consisted of 132 medical technologists from Bataan Province who have undergone training programs for the COVID-19 pandemic. From their responses, it was discovered that medical technologists found the training programs to be highly beneficial for most skills, and only helpful for some skills. The majority of the respondents underwent online training programs, and this was deemed the most useful. For laboratory services, the least affected service was urinalysis, and the most affected service was microbiology. In the future, further studies should be conducted in wider sample sizes to thoroughly assess the benefits of training programs on medical technologists.

Keywords*: Medical Technologists, Training Programs, Upskilling, COVID-19*

I. INTRODUCTION

The Severe Acute Respiratory Syndrome - Coronavirus 2 (SARS-CoV-2) or COVID-19 was officially announced as a pandemic by the World Health Organization (WHO) in March 2020. The novel coronavirus originated in Wuhan, Hubei, province of China, in November 2019. The viral genome sequence of COVID-19 was identified, and it was found to be transmitted through direct contact from an infected person via respiratory droplets. Thus, laboratory testing using real time reverse transcription polymerase chain reaction (RT-PCR) and serological antibody tests were used to diagnose the disease. Studies have also shown that aerosols on surfaces may be potentially infectious and may spread the virus (Bingliang & Qing, 2020). The first case of COVID-19 in the Philippines was recorded in January of 2020, which originated from a female Wuhan local. In March of 2020, the first local transmission was confirmed (DOH, 2020).

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The nationwide spread of the virus in the Philippines has overwhelmed health systems, as well as caused many disruptions in different ways such as economic recession, political instability and its augmentation, scarcity of supplies, and governments losing hundreds of billions in revenue (Miller, 2006). More so, as the incidence of COVID-19 continues to rapidly rise, the Philippine healthcare system also concurrently adapts to the increasing clinical demands and standards to withstand the effects of the pandemic. With this, healthcare workers are greatly affected by the unprecedented situation, having them work for long hours under extreme conditions with often inadequate resources while accepting inherent dangers in close interactions with suspected or infected patients. Medical technologists, most especially, have been in front and center since the coronavirus emerged — from specimen collection, specimen handling, up to specimen processing, which are all essential and critical to better understand the spread of disease. Similarly, proper personal protective equipment (PPE), handwashing, and personal hygiene have also been crucial in reducing the risk of transmission and infection of the virus in hospitals, more specifically among medical technologists handling specimens inside the laboratory setting (Elhadi, 2020).

Philippine medical technologists are mostly assigned to specimen collection, handling, and processing as needed for the COVID-19 testing such as the RT-PCR test. Such procedures require meticulous work as it is invaluable and necessitates enhanced medical training to provide accurate and reliable results. With several hundreds of infected patients, and a number of them either needing diagnostic testing and/or hospitalization or just merely practicing self-quarantine, the impact on laboratory work may be rapidly saturated, overwhelming or even disrupted (Lippi & Plebani, 2020). With this, some healthcare staff may temporarily be transferred to another laboratory, depending on the need of the virology laboratory personnel. Hands-on training is essential considering that many medical technologists may lack direct experience or skills in virological assays. Retraining of laboratory staff regarding infection, prevention, and control (IPC) programs and clinical management specifically for COVID-19 must be done. Laboratory personnel must also be trained regarding case management strategies, in cases of laboratory test surge situations. Other crucial skills that medical technologists undergo to enhance effective management and handling of patients with the virus include PPE donning and doffing, proper wearing of masks (e.g. N95 respirator), cleaning of medical equipment, and the proper procedure for obtaining nasopharyngeal swabs (CDC, 2020).

Specimen collection is an important step in the laboratory diagnosis of infectious diseases. A specimen that is not collected correctly may lead to erroneous results. Medical technologists are to collect nasopharyngeal or oropharyngeal swab specimens upon recommendation for COVID-19 testing (CDC, 2020).

Following this, correct handling of specimens after collection is essential and these specimens should reach the laboratory as soon as possible. Once the specimen has been transported to the reference laboratory, careful and appropriate biosafety measures must be practiced (WHO, 2020).

Lastly, processing specimens is an occupational health risk to medical technologists. With this, Class 2 Biological Safety Cabinet is recommended for use when it comes to processing

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suspected or confirmed COVID-19 specimens. A thorough risk assessment in all of the areas of the laboratory should be implemented to prevent the possibility of transmitting infectious pathogens (WHO, 2020).

Protecting healthcare workers from any risk or infections is essential when it comes to defeating COVID-19. Simulation-based training and activities are needed to correct medical practices that may lead to potential harm. In the presence of COVID-19, training and exercises are necessities in identifying the problems and improving the healthcare system (Lababidi, et al., 2020). Additional training allows medical technologists to perform better and increase productivity in facing the pandemic. As COVID-19 is different from other human coronaviruses, it is important to adopt new strategies and enhance the skills of medical technologists in specimen collection, handling, and processing.

The general objective of the study is to assess whether the training programs were beneficial to the medical technologists during the COVID-19 pandemic. The survey questionnaire was distributed using an online platform Google Forms. Then, the collected data was analyzed.

II. METHODOLOGY

Research Design

With the use of a quantitative method for data collection and analysis, the study utilized a cross-sectional survey type of descriptive research as the overall approach. This method aided in the description and interpretation of the responses of medical technologists in Bataan Province regarding their upskilling in terms of specimen collection, handling, and processing during the COVID-19 pandemic. The primary sources or data for this study were obtained through the use of a web-based survey. The participants were approached through a snowball and purposive sampling technique. It was done to best correspond to the objectives of the study while selecting participants that meet the criteria of the research endeavor. The survey form ensured that there would be no manipulation of responses on the part of both the researchers and the participants. In terms of practicality, the only foreseeable obstacle in this study was the possibility of a low response rate. Although, this was managed through effective planning and tracking of resources to ensure that the resources needed for online surveys were implemented effectively.

Sample and Sampling Size

The researchers conducted an online survey throughout April 2021 on the perceived benefits of upskilling medical technologists in the Bataan Province in regard to specimen collection, handling, and processing during the COVID-19 pandemic.

Participants include the medical technologists who are currently working in their designated laboratory institutions. The laboratory services and tests commonly performed include Microbiology, Hematology, Clinical Chemistry, Urinalysis, Blood Bank, Drug Testing, Serology & Immunology, Molecular Biology, and Histology/Cytology. All consenting hospitals and

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laboratory-based registered medical technologists who are of 21 to 60 years of age, residing in Bataan Province, Philippines, and are working or have worked during the COVID-19 pandemic were eligible to participate in this study. Those who did not give consent to take part in the study were excluded. An online cross-sectional survey was conducted using snowball and purposive sampling techniques. 132 eligible medical technologists were invited to participate in this study as respondents. The sample size was calculated using the online Raosoft® sample size calculator, which is specifically suited for population surveys. According to the data from the Philippine Association of Medical Technologists (PAMET), Inc., the population of active medical technologists in Bataan Province was 200, public and private institutions combined. The obtained sample size requirement yielded was 132, with a 95% confidence level and a 5% margin of error.

Instrumentation

The materials for data collection consisted of an informed consent and online survey. The online survey contained six sections with a total of 26 questions: (1) Informed Consent, (2) Demographic Profile, (3) Laboratory Services, (4) Training Programs undergone by the Medical Technologists, (5) Perceived Benefits of Training Program/s on the Most Affected Laboratory Service, and (6) Suggestions. The totality of the survey was adapted from various studies; thus, face and content validity were not conducted. The informed consent form can be viewed in Appendix C, while the complete survey questionnaire tool can be found in Appendix D. The survey underwent pilot testing that was overseen by the researchers. The researchers obtained approximately 25 respondents to accomplish the pilot testing. The respondents for pilot testing consisted of registered medical technologists and other medical practitioners with knowledge on the field of medical technology.

The first section of the survey contained the informed consent form and was designed to aid participants in acknowledging data collection. The succeeding sections of the survey were organized into the following five subsections: (1) Demographic Profile, (2) Laboratory Services, (3) Training Programs undergone by the Medical Technologists, (4) Perceived Benefits of Training Program/s on the Most Affected Laboratory Service, and (5) Suggestions. The second section contained five demographic items including the participant's age, location, name and classification of the hospital the participant is currently working in, and the number of years of experience the participant has had as a Medical Technologist. The third section contained two items adapted from the studies by Preston, L. J., (2008), and Loh, T. P., et. al (2020). The items were related to the laboratory services, which determines the services that are regularly performed in the laboratory and services that would be the least and most affected by the pandemic in terms of collecting, handling, and processing of specimens as a whole. Similarly, the fourth section contained items adapted from studies by Braithwaite, J. et. al (2008) and Yue-lai Chan, et. al (2020) with minor alterations to the questionnaire wording and writing style to best suit the circumstances of the study. The items were related to the training programs undergone by the medical technologists, which were intended to establish the training programs underwent in preparation for dealing with

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possible COVID-19 specimens. For this section, to preserve the respondent's confidentiality and in line with data protection policies, the details of the actual training program undertaken were not collected. Section five was subdivided into three parts: collection, handling, and processing, which contained five items each. Each subdivision listed different skills that could have been improved upon by the chosen training program of the medical technologists. The items in section five were adapted from a study by Al-Mughairi (2018), with minor alterations to the wording and formatting. The different skills were itemized to best fit the perceived benefits in terms of collection, handling, and processing of specimens. The answers for the items under this section were measured with a four-point Likert scale, ranging from not beneficial (1), slightly beneficial (2), beneficial (3), and highly beneficial (4). This section was answered with the medical technologist's chosen most useful training program in mind. The last portion of the survey was section six, which contained an open-ended question inquiring about the improvements to be made for training programs in preparation for a possible outbreak in the future. In total, the survey consists of 26 items, 15 of which are measured on the four-point Likert scale.

Data Gathering Procedure

Prior to data gathering, the study was subjected to the approval of the Ethics Review Board of a university. Following approval, data gathering was conducted in April 2021. The respondents of the study were determined using the purposive and snowballing sampling techniques. In this probability method, research participants were recruited based on the researcher's judgment on their ability to correspond to the objectiveness of the study. Data collection was done directly through the web-based platform, Google Forms, through the initiation of a cross-sectional survey. Prior to the deployment of the online cross-sectional survey, 22 registered medical technologists (RMT) residing in the 11 municipalities in Bataan, specifically 2 RMTs from each municipality were personally contacted by the researchers to discuss specific instructions on the distribution of the survey to other possible respondents. The participation of the RMTs strictly remained anonymous and confidential. Instructions included the purpose and objectives of the study, corresponding mode of delivery in the distribution and deployment of survey links to other RMTs who also fit the inclusion criteria for the study, guide for the completion and submission of the survey, as well as the 2-week target date for completion. Hence, the application of snowball sampling technique. The cross-sectional survey through Google Forms consisted of an attached consent form and statement of the objectives of the study, along with the procedure, responsibilities, compensation, benefits & risks, voluntariness, confidentiality, and requirements to participate in the study. Furthermore, the survey was carefully developed and completed by the researchers alone through the careful analysis of the perceived benefits of medical technologists regarding specimen collection, handling, and processing during the COVID-19 pandemic. Subsequently, the survey had undergone an extensive process of review and given ethical approval by the Review Ethics Committee Team before deploying to the participants. The survey contained a total of 26 questions of which were a combination of open and closed-ended response items. The daily total number of retrieved survey forms were monitored. Following the selected end date for

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accessing the survey, all started and completed surveys were submitted to the delegated researcher handling data management. Participants were given a maximum of two weeks to subject the survey for completion. Upon the end of the 2-week target date, the provided link to the actual survey was set automatically as inaccessible to ensure data confidentiality and prevent data tampering. As indicated, the general purpose of the study is to assess whether or not medical technologists in the Philippines, particularly in the Province of Bataan, found these training programs beneficial to their upskilling following the rise of the COVID-19 pandemic. Participation in this survey benefits both parties by gaining knowledge of the matter. Additionally, the collated data could be of use to future studies and references concerning the skills of medical technologists and the COVID-19 pandemic. After collecting the data, it was then subjected to statistical treatment with the use of SPSS and further analysis.

Ethical Consideration

This study was subjected to the approval of the Review Ethics Committee Team of a university. Following approval, the survey was then deployed to the respondents in a specific time frame in April 2021. The contents of the questionnaire focused on the perceived benefits of training programs on the upskilling of medical technologists and did not contain statements or languages that may be offensive to the participants. Any form of incentive or monetary compensation was not given to avoid any conflict of interest. The principles of autonomy, beneficence, justice, informed consent, confidentiality, data protection, and integrity were considered in conducting this study. All invited participants of the study had the freedom to participate or not. Even with the consent form, withdrawal from the study was allowed even without giving a reason. Beneficence minimized the risks to participants and maximized the benefits not only to the participants but also to society. In the principle of justice, no group bore any burden from the study. An informed consent form was attached in the first section of the survey, included to properly communicate with the participants to permit us to conduct the study. Included here were the details of the study such as the objectives, procedure, responsibilities, compensation, benefits & risks, voluntariness, confidentiality, and requirements to participate. The participants were given the option to consent or not, and were responsible for answering the survey as accurately and honestly as possible. Participants were given a maximum of two weeks to subject the survey for completion. Upon the end of the 2-week target date, the provided link to the actual survey was automatically set to be inaccessible to ensure data confidentiality and prevent data tampering. Accessibility of the data was strictly granted only to the researchers and statisticians involved, and was only accessible with a secured email through Google Sheets. While raw data tables are included in Appendix F, confidentiality was preserved and the datasheet in its entirety is not visible to the public. After treatment, the raw datasheet was kept offline and is to be stored indefinitely.

The integrity of the study assures that standards were met and no falsification of data or any other forms of unacceptable practice was done.

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Data Analysis

The questionnaire was administered through Google Forms to obtain data for the study. Upon gathering data from the respondents, it was then entered into Microsoft® Excel for Mac (Microsoft 365 Subscription 2020 Version 16.41) and simultaneously quality-checked by the researchers to ensure data accuracy and consistency. For the statistical treatment, IBM SPSS Statistics Version 22.0 was used to tally the data according to the number of responses under each question. This software was utilized to calculate the frequencies and percentages to identify which of the laboratory services provided by medical technologists were the least and most affected by the COVID-19 pandemic in terms of collecting, handling, and processing of specimens as a whole and to identify the kinds of training programs underwent by medical technologists and which was the most useful in preparation for dealing with possible COVID-19 specimens. Assuming that the data are of normal distribution, the mean and standard deviation will be calculated to assess whether the training program/s have been beneficial in developing the skills needed by the medical technologists in the most affected areas of the laboratory in terms of the collection, handling, and processing of specimens. If data is not of normal distribution, the median and interquartile range will be calculated instead. To statistically test for the significant difference between the public and private classification of hospital/ laboratory when it comes to the perceived benefits of training programs in terms of handling and processing, the Mann-Whitney U test was utilized since there were only two categorical variables. Meanwhile, the significant difference between the years of experience and the kind of training program when it comes to the perceived benefits of training programs in terms of handling and processing was determined through the use of Kruskal-Wallis Test since there were more than three categorical variables involved.

III. RESULTS AND DISCUSSIONS

Introduction

The data was collected on April 7, 2021 to April 27, 2021 via an online Google Forms survey from 132 medical technologists living in Bataan. The purpose of this study was to determine the perceived benefits of training programs for medical technologists in terms of specimen collection, handling, and processing. The data was subjected to statistical treatment, and the following sections are dedicated to discussing the statistical analyses and interpreting the findings.

Section I: Respondent Demographics

The demographic characteristics of the total study sample are presented in Tables 2 through 3.

Respondents Ranging from Ages 23 to 32

Table 2. Demographic Profile in Terms of Age

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	N	Mean	Std. Deviation
Age	132	26.69	1.808
Valid N (listwise)	132		

Table 2 shows the demographic profile of the respondents in terms of age. Of the one hundred thirty-two (132) respondents, it shows that the mean age of the respondents was 26.69 ($std.dev. = 1.808$).

Classification of Hospital/Laboratory and Years of Experience

Table 3. Demographic Profile in Terms of Classification of Hospital / Laboratory and Years of Service

	Frequency	Percent
Classification of Hospital / Laboratory		
Private	123	93.2
Public	9	6.8
Total	132	100.0
Years of Experience		
Less than 1 year	8	6.1
1 to 3 years	82	62.1
3 years to 5 years	34	25.8
5 to 10 years	8	6.1
Total	132	100.0

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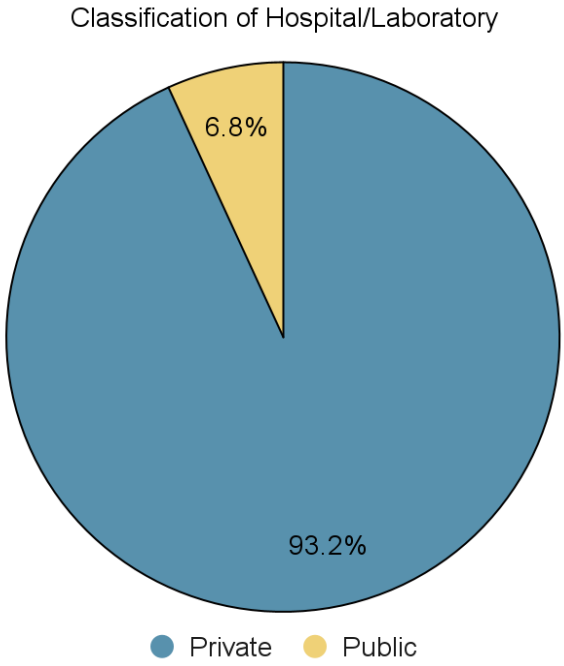

Figure 3. Pie Chart Representation of the Respondents in Terms of Classification of Hospital/Laboratory.

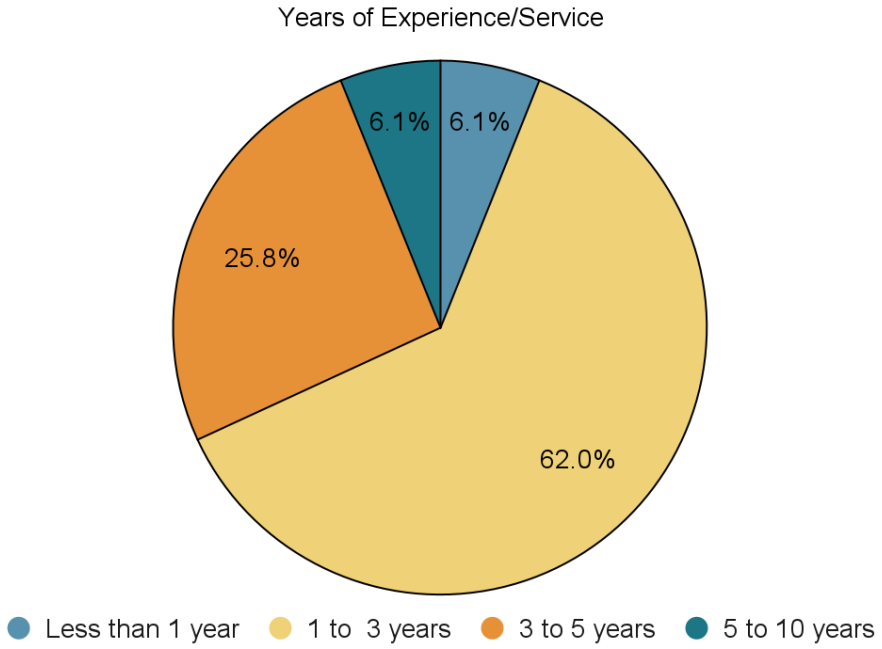

Figure 4. Pie Chart Representation of the Respondents in Terms of Years of Experience

Table 3 shows the demographic profile of the respondents in terms of the classification of hospital/laboratory where they were working (also see Figure 3).

For the classification of hospital/laboratory, a vast majority were working in a *Private Hospital/Laboratory* with a percentage of 93.2% ($n = 123$). The years of experience ranged from

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less than 1 year to 5 to 10 years (Figure 4). Of the one hundred thirty-two (132) respondents, the majority had been working for *1 to 3 years* only with a percentage of 62.1% ($n = 82$) while very few had either *less than 1 year* of experience or had been working for *5 to 10 years*, having a percentage of 6.1% ($n = 8$).

Section II: Laboratory Services

Regularly Performed Laboratory Services

Table 4. Regularly Performed[a] Laboratory Services

	Responses	
Laboratory Services	**N**	**Percent**
Microbiology	98	74.2%
Hematology	117	88.6%
Clinical Chemistry	106	80.3%
Urinalysis	118	89. 4%
Blood Bank	93	70.5%
Drug Testing	77	58.3%
Serology and Immunology	99	75.0%
Molecular Biology	34	25.8%
Histology / Cytology	27	20.5%

a. Dichotomy group tabulated at value 1.

Table 4 shows the laboratory services that were regularly performed by the respondents. *Urinalysis* with a total number of one hundred eighteen (118) and having a percentage of 89.4% was found to be the laboratory service that was the most regularly performed while *Histology/Cytology* with a total number of twenty seven (27) and having a percentage of 20.5% was the laboratory service that was least regularly performed.

Most Affected Laboratory Service

Table 5. Laboratory Services Mostly Affected by COVID-19 pandemic

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Laboratory Services	Frequency	Percent
Microbiology	55	41.7
Clinical Chemistry	8	6.1
Blood Bank	1	0.8
Serology and Immunology	52	39.4
Molecular Biology	16	12.1
Total	132	100.0

Table 5 shows the laboratory services believed to be the most affected by COVID-19 pandemic by the respondents. It shows that *Microbiology* with a total number of fifty five (55) and having a percentage of 41.7% as the laboratory service that was mostly affected by COVID-19 pandemic. The COVID-19 pandemic had significantly affected clinical microbiology laboratories. A study by Tang et. al (2020) provided an analysis that covered recent concerns and difficulties in these laboratory sections. In the preanalytical stage, proper collection of patient samples and time is essential for accurate diagnosis of COVID-19. Safety measures were crucial to protect medical technologists and other lab staff while producing test results. In the analytical stage, RT-PCR testing remained as the gold standard for the diagnosis of SARS-CoV-2. Meanwhile, antibody-based methods were utilized as supplemental tools. In the post-analytical stage, results were interpreted carefully using findings from both molecular and serological. According to Posteraro et. al (2020), diagnostic paraphernalia of clinical microbiology laboratories were ideally asked to be refined to maximize direct detection of SARS-CoV-2 samples of patients. Many routine laboratories found it difficult to adjust to daily activities due to the virus. Posteraro' study supported the concept that clinical microbiology laboratories was the section most responsive to this emergency pandemic.

Least Affected Laboratory Service

Table 6. Laboratory Services Least Affected by COVID-19 pandemic

Laboratory Services	Frequency	Percent
Clinical Chemistry	4	3.0
Urinalysis	90	68.2
Drug Testing	28	21.2
Histology / Cytology	10	7.6

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Total	132	100.0

Table 6 shows the laboratory services believed to be the least affected by the COVID-19 pandemic. It shows that *Urinalysis* with a total number of ninety (90) and having a percentage of 68.2% as the laboratory service that was least affected by COVID-19 pandemic. From another study by Nomoto et. al (2020), the findings supported that SARS-CoV-2 RNA is possibly secreted in the urine. The presence depends on the severity of COVID 19, but the area is still vague.

Section III: Training Programs

Training Program Undergone by Medical Technologists

Table 7.Training Programs Undergone by Medical Technologists in Preparation for COVID-19 Pandemic

	Responses	
Training Programs	**N**	**Percent**
Course	2	1.5%
Seminar or Lecture	45	34.1%
Trained by Colleague	25	18.9%
Online (Web-based)	111	84.1%

Table 7 shows the training programs undergone by the medical technologists in preparation for COVID-19 pandemic. Of the respondents, it shows that the majority (84.1%) had undergone *Online (Web-based)* trainings ($n = 111$) while very few (1.5%) had undergone *Course* as a training program ($n = 2$). According to Gamage et. al. (2020), online learning became necessary as a means of alternative teaching method due to the suspension of traditional training methods to prevent community transmission of COVID-19.

Most Useful Training Program

Table 8. Most Useful Training Program in COVID-19 Pandemic

Training Programs	**Frequency**	**Percent**
Seminar or Lecture	25	18.9
Trained by Colleague	19	14.4

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Online (Web-based)	86	65.2
Workshop	2	1.5
Total	132	100.0

Table 8 shows the training programs in COVID-19 pandemic perceived to be most useful by the respondents. Of the one hundred thirty-two (132) respondents, it shows that the respondents considered *Online (Web-based)* training as the most useful training program with a percentage of 65.2% ($n = 86$) while very few considered *Workshop* as the most useful, with only a percentage of 1.5% ($n = 2$). Online (web-based) learning platforms enhance safety precautions that assure effective learning outcomes among healthcare workers as established by the DOH in collaboration with USAID. Aside from this, it is the most flexible, accessible, and cost-effective compared to other traditional training programs. In contrast, according to Gamage et. al. (2020), laboratory classes performed in real laboratory setups are impractical during a pandemic. Laboratory classes performed in real laboratory setups or environments are examples done in workshop training programs as discussed by Doyle & Robson (2002).

Section IV: Perceived Benefits

Perceived Benefits of Training Programs on Specimen Collection

Table 9. Perceived Benefits of Training Program/s on Collection Service

	Mean	Std. Deviation	Description
General specimen collection methods	3.67	0.473	Highly beneficial
Donning/Doffing of PPE	3.83	0.374	Highly beneficial
Specimen labelling	3.33	0.673	Highly beneficial
Patient identification and communication	3.41	0.665	Highly beneficial

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Specimen preparation (appropriate use of anticoagulant, amount of sample, specimen site, etc.)	3.13	0.735	Beneficial
Mean	3.47	0.46	Highly beneficial

*Legend:

1.00 – 1.74	Not beneficial
1.75 – 2.49	Slightly beneficial
2.50 – 3.24	Beneficial
3.25 – 4.00	Highly beneficial

Table 8 shows the perceived benefits of the training program/s in terms of collection services. The respondents considered the training program/s under collection services as *highly beneficial* as their mean fell between 3.25 to 4.00, except for *specimen preparation* with a mean of 3.13 (SD=0.735), which was only considered as *beneficial*. Generally, the training programs were perceived to be *highly beneficial* with a total mean of 3.47 (SD=0.46) under the *collection services*. In Taiwan, as a part of the cytopathology biosafety strategy of laboratories against the COVID-19 infection, the WHO recommended the laboratory director to provide the laboratorians with proper employee training and adequate PPE supplies, among other things (Chen & Chi, 2020). In turn, there were no reported biohazard events in relation to COVID-19 in the medical laboratories found in Taiwan as of the publication of the article in May 2020.

Perceived Benefits of Training Programs on Specimen Handling

Table 10. Perceived Benefits of Training Program/s on Handling Service

	Mean	Std. Deviation	Description
General specimen handling methods	3.80	0.405	Highly beneficial
Handling infectious specimens	3.63	0.500	Highly beneficial
Donning / Doffing of PPE	3.89	0.319	Highly beneficial
Specimen transportation	3.23	0.708	Beneficial

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Specimen storage methods	3.14	0.773	Beneficial
Mean	3.54	0.405	Highly beneficial

*Legend:
1.00 – 1.74 Not beneficial
1.75 – 2.49 Slightly beneficial
2.50 – 3.24 Beneficial
3.25 – 4.00 Highly beneficial

Table 10 shows the perceived benefits of the training program/s in terms of handling services. The respondents considered the training program/s under handling services were *highly beneficial* as their mean fell between 3.25 to 4.00, except for *specimen transportation* with a mean of 3.23 (SD=0.708) and *specimen storage methods* with a mean of 3.14 (SD=0.773) were only considered *beneficial*. Generally, the training programs were perceived to be *highly beneficial* with a total mean of 3.54 (SD=0.405) under the *handling services*. According to an article by UPLB (2020), the deployment of an online training program aided its training participants in properly handling infectious materials such as COVID-19 specimens, in order to lessen their exposure to these pathogens.

Perceived Benefits of Training Programs on Specimen Processing

Table 11. Perceived Benefits of Training Program/s on Processing Service

	Mean	Std. Deviation	Description
General specimen processing methods	3.77	0.421	Highly beneficial
Donning / doffing of PPE	3.86	0.344	Highly beneficial
Awareness of appropriate turn-around times	3.25	0.714	Highly beneficial
Meticulous use of laboratory equipment	3.09	0.786	Beneficial
Machine calibration	2.94	0.798	Beneficial

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Mean	3.38	0.476	Highly beneficial

*Legend:

1.00 – 1.74	Not beneficial
1.75 – 2.49	Slightly beneficial
2.50 – 3.24	Beneficial
3.25 – 4.00	Highly beneficial

Table 11 shows the perceived benefits of the training program/s in terms of processing services. The respondents considered the training program/s under processing services were *highly beneficial* as their mean fell between 3.25 to 4.00, except for *meticulous use of laboratory equipment* with a mean of 3.09 (SD=0.786) and *machine calibration* with a mean of 2.94 (SD=0.798), which were only considered *beneficial*. Generally, the training programs were perceived to be *highly beneficial* with a total mean of 3.38 (SD=0.476) under the *processing services*. Regular training sessions and staff forums are held for healthcare workers in Hong Kong to increase their alertness during the COVID-19 pandemic (Cheng et al., 2020). A communication kit was compiled as a training material, and then uploaded to an electronic platform that was easily accessible to all the staff. Similarly, the Hong Kong healthcare workers were also provided with timely education during the community outbreak of influenza A in 2009. This was a vital parameter in having achieved zero nosocomial outbreak of the influenza A virus.

Relationships between Perceived Benefits and other Variables

Table 12. Comparison of Perceived Benefits According to Classification of Hospital / Laboratory, Years of Experience, and Kind of Training Program

	Collection		Handling		Processing	
	Mean	**Description**	**Mean**	**Description**	**Mean**	**Description**
Classification of Hospital / Laboratory						
Private	3.4780	Highly beneficial	3.5350	Highly beneficial	3.3789	Highly beneficial
Public	3.4222	Highly beneficial	3.5778	Highly beneficial	3.4444	Highly beneficial
Years of Experience						

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Less than 1 year	3.6500	Highly beneficial	3.7750	Highly beneficial	3.6750	Highly beneficial
1 to 3 years	3.4659	Highly beneficial	3.5268	Highly beneficial	3.3732	Highly beneficial
More than 3 years to 5 years	3.4706	Highly beneficial	3.5294	Highly beneficial	3.3588	Highly beneficial
5 to 10 years	3.4000	Highly beneficial	3.4500	Highly beneficial	3.3000	Highly beneficial
Kind of Training Program						
Seminar or Lecture	3.5600	Highly beneficial	3.6400	Highly beneficial	3.5200	Highly beneficial
Trained by Colleague	3.5053	Highly beneficial	3.5895	Highly beneficial	3.4105	Highly beneficial
Online (Web-based)	3.4302	Highly beneficial	3.4860	Highly beneficial	3.3233	Highly beneficial
Workshop	4.0000	Highly beneficial	4.0000	Highly beneficial	4.0000	Highly beneficial

*Legend:

1.00 – 1.74	Not beneficial
1.75 – 2.49	Slightly beneficial
2.50 – 3.24	Beneficial
3.25 – 4.00	Highly beneficial

Table 12 shows the comparison of the perceived benefits of the training program when the respondents were grouped according to classification of hospital/laboratory, years of experience, and the kind of training programs they underwent.

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For classification of hospitals, the perceived benefits of the training programs were both *highly beneficial* in the private and public classifications in terms of collection, handling, and processing.

For years of experience, the perceived benefits of the training programs were all *highly beneficial* in the different categories in terms of collection, handling, and processing.

For the kind of training programs, the perceived benefits of the training programs were all *highly beneficial* in terms of collection, handling, and processing.

Table 13. Statistical Test for Significant Difference

	Sig.	Decision
Classification of Hospital / Laboratory		
Collection	0.833*	Retain the null hypothesis
Handling	0.743*	Retain the null hypothesis
Processing	0.611*	Retain the null hypothesis
Years of Experience		
Collection	0.609**	Retain the null hypothesis
Handling	0.347**	Retain the null hypothesis
Processing	0.371**	Retain the null hypothesis
Kind of Training Program		
Collection	0.148**	Retain the null hypothesis
Handling	0.072**	Retain the null hypothesis
Processing	0.090**	Retain the null hypothesis

**Mann-Whitney U Test 0.05 level of significance*
***Kruskal-Wallis Test 0.05 level of significance*

Table 13 shows the results of the statistical test for the significant difference in the respondents' perceived benefits of the training programs in terms of collection, handling, and processing when they were grouped according to classification of hospital/laboratory, years of experience, and the kind of training programs they had undergone.

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When grouped according to classification of hospital/laboratory, all of the significant values were greater than 0.05. This means that there was no significant difference in the respondents' perception on the benefits of the training program.

When grouped according to the years of experience, all of the significant values were greater than 0.05. This means that there was no significant difference in the respondents' perception on the benefits of the training program.

When grouped according to the kind of training program, all of the significant values were greater than 0.05. This means that there was no significant difference in the respondents' perception on the benefits of the training program.

Suggestions

The Suggestions portion of the questionnaire was set as optional, and only a few of the respondents answered. 14 of the 132 respondents filled out the suggestion box at the end of the survey questionnaire, and their responses were relatively similar in thought and idea. To summarize, the suggestions consisted of requests for training specific to medical technologists, more learning materials and in-house training, not just through online means, and the involvement of the hospitals or government to ensure practical, hands-on training with experts instead of simply co-workers training other co-workers. One respondent mentioned the provisions of more PPE, and another mentioned that training should be affordable or even free to encourage the participation of medical technologists with minimal risk. One stated that, "Trainings shouldn't be a one time thing." Another respondent suggested, "implement stricter protocols" for training programs. Gleaning from this, while not all answered the suggestions portions of the survey, coming from the medical technologists themselves, it is clear that there are many aspects that can be improved in the future training programs. To better prepare for future outbreaks similar to COVID-19, training programs need to evolve and provide better resources for their trainees.

4. CONCLUSION AND RECOMMENDATIONS

Summary

The statistical analysis was done on 132 responses from the select medical technologists in Bataan. For demographics, the data showed that the respondents had a mean age of 26.69 years old, the majority had 1-3 years of experience (62.1%), as well as worked in private hospitals/laboratories (93.2%). In terms of laboratory services, *Urinalysis* was found to be the most regularly performed service (89.4%), the most affected service due to the pandemic was *Microbiology* (41.7%), and the least affected was *Urinalysis* (68.2%). For training programs, the majority of the respondents underwent *Online or web-based training* (84.1%), which was similarly chosen as the most useful training program during the pandemic. Generally, the medical technologists found the training programs to be *highly beneficial* in terms of upskilling in specimen collection, handling, and processing, with a mean falling between 3.25 and 4.00. In addition, the perceived benefits of the training programs were also compared according to the classification of

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hospital/laboratory, years of experience, and the kind of training program. The training programs were perceived to be *highly beneficial* in both the private and public classifications of hospitals/laboratories in terms of specimen collection, handling, and processing. Similarly, these were also perceived to be *highly beneficial* by the medical technologists with varying years of experience with regard to specimen collection, handling, and processing. The perceived benefits of all the kinds of training programs were also *highly beneficial* in terms of specimen collection, handling, and processing. It was found that there was no significant difference in the respondents' perception of the benefits of the training programs when grouped according to the classification of hospital/laboratory, years of experience, and the kind of training programs. Despite this, several suggestions were also made regarding the improvement of programs in the event of a future outbreak. These suggestions included requests for more specific or practical training, more learning materials and resources, and further involvement of the government.

IV. CONCLUSION AND RECOMMENDATIONS

Conclusion

The least affected laboratory service during the COVID-19 pandemic was *Urinalysis*. Medical technologists should still take precautionary measures when handling urine samples especially from patients with moderate to severe COVID-19. It is supported by the fact that the coronavirus is transmitted through respiratory droplets, and there are still no studies on whether the coronavirus can be transmitted through urine. Safety measures are crucial to protect medical technologists and other lab staff while producing test results. Meanwhile, *Microbiology* was the most affected laboratory service as it handles microorganisms such as bacteria and viruses. The majority of the medical technologists underwent an *Online (web-based) training program* as it became the most common alternative teaching method during the pandemic. Aside from this, some medical technologists also attended courses, seminars or lectures, or were trained by a colleague. *Online (web-based) training* was deemed to be most useful as it was the most flexible, accessible, cost-effective, and safest compared to other traditional training programs. It also ensured effective learning outcomes among healthcare workers during this time of the pandemic. However, its credibility to assess the medical technologists when it comes to practical knowledge is still debatable as some medical technologists suggested more skill-based practical training. Furthermore, online training for medical technologists has not yet been established since only limited research was found. Thus, further studies should be conducted. A majority of the medical technologists found the training programs to be *highly beneficial* and some to be only *beneficial* in terms of the collection, handling, and processing of specimens during the COVID-19 pandemic. When compared according to the classification of hospital/laboratory, years of experience, and the kind of training programs underwent, the perceived benefits of the training programs were all *highly beneficial* regarding specimen collection, handling, and processing, and there was no significant difference in the perceived benefits of training programs.

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Recommendations

For prospective researchers that are interested in exploring a similar study, the researchers recommend the following:

1. The study should cover a wider region by getting respondents from throughout the Philippines. In turn, this will lead to the study having a bigger sample size. Covering a wider region may thoroughly assess and understand which training programs are beneficial to medical technologists.
2. Hospital classification (primary, secondary, tertiary) may be appended in future studies as a factor for extended discussion. This will provide adequate inferences on the similarities and differences of the laboratory services and types of training programs undergone by medical technologists.
3. The data collection period should be extended to one to two months to obtain more responses. This will also be advantageous for studies with bigger sample sizes.
4. The assessment of the perceived benefits of the training programs should be rated by respondents who were able to receive various training programs to better determine which training program was the most effective. This is because a number of the respondents from this study had undergone only one or two training programs, making their choices limited.
5. Additional studies on online-based training may be carried out to establish its credibility as a training program for medical technologists.
6. Future research papers on upskilling medical technologists through training programs should have a more in-depth discussion by comparing the perceived upskilling of those who underwent training programs against those who did not.
7. Respondents can be required to include details of the training programs undergone to qualify the training received. Since no specific details of the actual training programs undertaken were collected, actual training qualifications were lacking.

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