Level of Awareness on Quality Indicators in the Pre-Analytic Phase among Registered Medical Technologist in the Private Hospital in Bacoor, Cavite

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***Abstract*--- Total Quality Management is an important concept in the clinical laboratory management that aims to produce an accurate, reliable, and timely results. The implementation of the quality management is a sustained strategy based on the indicators of total testing processes. These key processes in the laboratory (pre-analytical, analytical and post-analytical) are important areas to address for any improvement based on what is called quality indicators. It is defined as measurable, objective, quantitative measures that evaluate total testing processes. The purpose of this study is to assess level of awareness on quality indicators among Medical Technologists in the private hospital of Bacoor, Cavite. This study was a descriptive design utilizing pre-tested 35 item questionnaire to determine level of awareness among medical technologist in the private hospitals. 37 Medical Technologist from 5 private hospitals in Bacoor, Cavite participated in the study. The findings suggest that the level of awareness on sample management and sample integrity as quality indicators was at the risk of developing pre-analytical errors with most systems rated low by the respondents. The conclusions of this research that these quality indicators were consistently low in terms of level of awareness among Medical Technologist. The recommendation is to support laboratory staff with post-graduate studies to improve the perceptions on these quality indicators.**

***Key Words*---Quality indicators, Total Quality Management, Total Testing Processes.**

I. INTRODUCTION

Quality management system in the clinical laboratory is the key in attaining an effective laboratory service mandated to produce accurate, reliable, and timely results. But as the laboratory continues to modernize in terms of accuracy and precision, it is still susceptible to various random and systematic errors. These errors are encountered in the total testing processes in the clinical laboratory classified as pre-analytical, analytical and post-analytical. Most of the researches in the laboratory are aimed at the analytical phase which analyses the sample. The pre-analytical process has the most number of errors with 70% in the total testing process [1] Pre-analytic phase starts from the time physician ordered test for the patient until the sample is ready for analysis. Any errors from these areas particularly at the pre-analytical can affect the total testing process and can seriously lead to patient misdiagnosis.

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Misidentification of patient, wrong containers or clotted samples and hemolyzed specimens are some of the commonly reported errors from the clinical laboratory. Human mistakes from these errors are clear indications of low level of awareness among laboratory staff on quality management system.

Sustained improvement is an important process to maintain laboratory quality. It is a part of the different processes of total quality management. Quality indicators is a tool used in this procedures that measures and monitors laboratory errors. Quality indicators is defined as an assessment of critical domains in the laboratory outlined by the Institute of Medicine (patient safety, effectiveness, equity, patient-centeredness, timeliness and efficiency)[2] This definition accurately measures the objectives of quality indicators as tool for continuous improvement in the laboratory. ISO 15189[4.12.4] states that the laboratory shall implement quality indicators to systematically monitor and evaluate the laboratory's contribution to patient care. World Health Organization (WHO) stated from their handbook in laboratory management, the purpose of the quality indicator is to give information about the performance of a process and to highlight potential quality concerns.

Awareness as defined is a knowledge that is already existing or understanding of a concept based on information or experience. Medical Technologist awareness is one key component to assure and sustain the effectiveness of any laboratory quality improvement. This is an important step of plans to improve the laboratory to achieve its goals that is to release an accurate, reliable and timely result.

II. OBJECTIVES OF THE STUDY

In general, this research assessed level of awareness of medical technologist in the private hospitals of Bacoor City, Cavite, Philippines. The study aimed to determine the demographic profiles of the respondents, to identify the level of awareness of Medical Technologist regarding quality indicators in the pre-analytical phase and to find out differences of perception as to the demographic profiles and hospitals

III. REVIEW OF RELATED LITERATURE

Total Quality Management is an important concept in the clinical laboratory management that aims to produce an accurate, reliable and timely result. Every step in the key processes in the laboratory (pre-analytical, analytical, and post analytical is accurately performed. But as the laboratory is

inclined to embrace modern technology, random and systematic errors in the key areas is unavoidable and is affecting patient correct diagnosis. To measure and monitor these errors, quality indicators are utilized to achieve the objectives of quality management which is a sustained improvement in all key processes. Developing these indicators is an important step in the evaluation of laboratory standards by comparing it against a standardized criterion. Important areas defined by the Institute of Medicine (IOM) (patient safety, effectiveness, equity, patient-centeredness, timeliness and efficiency) are evaluated by these indicators. [3].

The focus of the research in the clinical laboratory now shifted to the pre-analytical phase because of the increasing number of errors. Most commonly encountered pre-analytic errors are: missing specimen or request, hemolysed or clotted blood for EDTA, insufficient blood volume, misidentification of patient and inappropriate transport of sample and storage. In research conducted for five years, total pre-analytic errors rate was13.54%. The errors monitored was inadequate container (0.08%), insufficient sample (0.35%) and hemolysed sample (8.76%)[4] The impact of pre-analytical errors was huge due to the fact it will affect the entire testing process because there will no sample to be analyzed and no results that will be generated. But, greatly affected here is the patient diagnosis.

According to point 4.12.4 of ISO 15189"Medical Laboratories-particular requirements for quality competence", it is suggested that laboratories should implement quality indicators for systematic and evaluation of laboratory's effectiveness in delivering healthcare [5] The purpose of these quality indicators given by the World Health Organization (WHO) are: to identify areas that need further study and investigation, highlight potential quality concerns and determine quality of services.[6]. It was suggested that laboratories must have its own quality indicators for measuring the performance. Mark Graham Brown, an expert on performance measurement, gave several guidelines in selecting quality indicators. Some of these guidelines are as follows:

1. Evaluation should cover all areas of the laboratory and should include management from the highest to the lowest position. 2. Adopt quality indicators according to the needs of the areas for better performance. 3. Indicators to be implemented should be based on patient needs and other stakeholders of the hospitals. WHO outlined the characteristics of good quality indicators. It should be measurable, achievable, interpretable, actionable, balanced and engaging. The International Federation of Clinical Chemistry and Laboratory Medicine in 2008, organized a working group named

"Laboratory Errors and Patient Safety" (WG-LEPS), their mission is to identify and evaluate QIs to cover all areas of the total testing process. There are 16 QIs developed by the group for the pre-analytical phase. QI-1 to QI-2-Appropriateness of Test Request, QI-3 to QI-4 Examination Requisition, QI5 to QI- 6 Identification, QI-7 Test Request, and QI-8 to QI-16 Samples. These quality indicators were used as a basis of this research to assess level of awareness of Medical Technologist on these indicators.

Laboratory staff awareness on quality management system is an important component to attain an effective laboratory service which is to deliver accurate, reliable, and timely results. Pre-analytical phase activities involved more human handling and any errors from these areas are caused by human mistakes [6] Improving this area of testing process involves training and education of laboratory personnel and other healthcare professional. In the book published by the Institute of Medicine titled, "Improving Diagnosis in Health Care", an accurate diagnosis of the patient depends on healthcare professional's trainings and education. Their recommendations is "to address performance in the diagnostic process, including areas such as clinical reasoning; teamwork; communication with patients, their families and other health care professionals; appropriate use of diagnostic tests and application of these result on subsequent decision making and use of health information technology" Another point of consideration, healthcare workers awareness should be assessed in terms of the pre-analytical variables and issues that need improvement. Accreditation and certification of healthcare professionals on trainings related to quality improvement will enhance the laboratory quality system [7]

IV. CONCEPTUAL FRAMEWORK

The concept of this study is based on total quality management framework for managing quality in health care laboratory. This is a continuous process that guarantees the patient of accurate, reliable, and timely results. The quality indicators are a tool for sustained improvement in the laboratory and are part of the TQM framework under quality improvement. Other components of this framework are quality planning, quality laboratory process, quality control, quality assessment, Inside this framework are the goals, objectives, and quality requirements.

V. METHODS

The study was conducted in the private hospitals in Bacoor, Cavite from September to October, 2016. A total of 5 hospitals participated in the study. Respondents of this study are the registered Medical Technologist working full-time in the hospitals. 37 RMTs from 51 participated in the study. The retrieval rate of this study was 73%.

The determination of the level of awareness among this medical technologist on quality indicators in the pre-analytic phase was a descriptive design and the survey method was used to produce the necessary information for the study. This study utilized a standardized questionnaire. This questionnaire was composed of two parts. The first gathered the demographic profile of the respondents which included age, gender, position, highest educational qualifications, years of experience as medical technologist and trainings certificate attended. The second part was composed of 35 questions regarding conditions, situation and practice that reflect the level of awareness of the Medical technologist based on the quality indicators in the pre-analytic phase developed by the IFCC. In this part, the respondents were instructed to indicate

their level of awareness on the quality indicators by encircling on the appropriate column.

The researcher personally administered the questionnaire to the Medical Technologist. A brief instruction was done before the respondent's started answering the question.

Data Analysis

For valid and reliable analysis and interpretation of the data, frequency counts, percentages, means and standard deviations was utilized.

A 5-point scale was used to determine the perception of the respondents regarding the quality indicators.

Unit Weight	Weighted Mean	Verbal Interpretation
5	4.20-5.00	Strongly Agree
4	3.40-4.19	Agree
3	2.60-3.9	Uncertain
2	1.80-2.59	Disagree
1	1.00-1.79	Strongly Disagree

VI. RESULTS AND DISCUSSION

TABLE I. SUMMARY OF THE DEMOGRAPHIC PROFILE OF RESPONDENTS

Profile		Frequency	Percentage (%)
Gender :	Male	10	27
	Female	27	73
Age:	20-30 years	26	70.3
	31-40 years	7	18.9
	41-50 years	4	10.8
Post:	JMT	15	40.5
	SMT	10	27
	CMT	5	13.5
	Others	5	13.5
Years:	0-4	26	70.3
	5-9	4	10.8
	10-14	4	10.8
	15-20	3	8.1
HEA:	BSMT	34	91.9
	With MT	3	8.1
TC:	LMT	17	45.9
	QCT	6	16.2
	Others	14	37.8

Table I shows the summary of the demographic profile of the respondents in terms of gender, age, position, years of experience, highest educational attainment and training certificate attended. Findings revealed that most of the respondents were females, 20-40 years old and 0-4 years of experience. Moreover, respondents are bachelor's degree with no post-graduate studies. In addition to this, 37.8% of the respondents attended trainings not related to laboratory management which is important in the implementation of the improvements.

As to age, the 4 respondent in the 41-50 (10.8%) are the Chief Medical Technologist working in those particular hospitals. But, these supervisors of the laboratory as revealed in the demographic profile sheet, some of them have no post-graduate studies or masteral units. Furthermore, some of the respondents occupying the said position are in 31-40 years old bracket. As to the highest educational attainment, most of the respondents are with Bachelors degree (91.9%). These findings indicate that most of the medical technologist working does not have post-graduates studies. These results were supported with age and years of experience findings. In the Philippines, only few Medical Technologist pursued post-graduate studies like Masters Degree because of the graduates of this program continued their study in the medicine program. Education or trainings are important element in the implementation of quality control program. As to the position, most of the respondents occupied the Junior Medical Technologist which correlates with the rest of the demographic profiles. This position of Junior Medical Technologist and Senior Medical Technologist based on Philippine setting is applied only in the private hospitals. In the government hospitals, the term of position is Laboratory Technologist 1 up to Medical Technologist 3 which is more standardized in terms of salary.

TABLE II. EXTENT OF THE LEVEL OF AWARENESS IN TERMS OF THE APPROPRIATENESS OF TEST REQUEST

Quality Indicators	Mean	SD	Verbal Interpretation
1.It is important that the Initial diagnosis of the patient be provided by the requesting physician	4.73	.51	Strongly Agree
2.The specimen should be rejected or refuse to collect specimen if the initial diagnosis of the patient is not provided	2.41	.93	Uncertain
3.The Medical Technologist can ask the requesting physician about test ordered if it is not clear or incomplete with regards to patient initial diagnosis.	4.14	.89	Agree
4. It is a concern to be addressed in the laboratory of an increased incident of misidentified request of patient	4.19	1.15	Agree
5. The laboratory should have a clear policy of carrying out "add-on-tests and be included in the laboratory manual	3.86	1.18	Agree
6. The medical technologist can select the most appropriate test based on the clinical diagnosis of patient	2.84	1.3	Uncertain
OVERALL AVERAGE	3.69	4.3	Agree

Table II presents the level of awareness in terms of the appropriateness of test request. This indicator is at the start of the pre-analytical phase where the physician will select appropriate test to support the clinical diagnosis of the patient. In line with this, to augment the needs of a laboratory in reducing laboratory errors, the International Organization for Standardization (ISO) formulated an international standard for clinical laboratories, entitled the ISO 15189:2003 "Medical laboratories particular requirements for quality and competence" quality improvement was applied in the total testing process dividing each process into phases (pre-analytical, analytical and post-analytical). This standard outlines the activities in the whole testing process. In the pre-analytical phase, it is further subdivided into two parts, pre-pre analytical and conventional pre-analytical phase. In the pre-pre analytical area involves the determination of the physician working diagnosis for the patient and selection of appropriate test that will support the diagnosis. In compliance with the laboratory standard, the ISO stressed that laboratory "the right test and the right order to the right patient, for the right question, at the right time" In this line, that aside from the usual information provided in the request form, the physician must indicate the clinical diagnosis of the patient. In the study conducted by Marin (2014), 44.03% are associated

to the physician mistakes in formulating patient analytical request. Table II showed that respondents are uncertain or not sure if such information should be provided by the physician (x=2.41). Plebani(2004), cited this entire provisions in his article published in the International Federation of Clinical Chemistry and Laboratory. He further mentioned that medical technologist can even select the most appropriate test in which some respondents doesn't know of such laboratory protocols (x=2.84). But, it can be noted also from Table II that respondents strongly agree (x=4.73) that it is important that clinical diagnosis of the patient should be indicated in the laboratory diagnosis. This perception was in contrast to their idea if they will accept specimen without clinical diagnosis. This clearly indicates that protocol regarding clinical diagnosis is not followed or observed in the laboratory. Table II also revealed that respondents have a moderate level of awareness on the following: if the Medical Technologist can ask the physician about the test ordered (x=4.14), if it is a concern to be addressed in the laboratory about misidentified request (x=4.19) and about the "add-on "test. Add-on testing is a procedure when the physician ordered for another test from a previously analyzed sample. Though this is an additional income to the laboratory but one can see this as an inefficiency in the pre-pre analytical phase and to be considered an error in the phase. According to Melanson (2006) it is an inefficient process that occurs frequently in the laboratory. Nelson (2015) corroborated the results of Melanson that add-on testing can be a result of a disorganized ordering process. Overall, respondents have a moderate level of awareness in appropriateness of test (x=3.69)

TABLE III. EXTENT OF LEVEL OF AWARENESS IN TERMS OF EXAMINATION REQUISITION AND IDENTIFICATION

Quality Indicators	Mean	SD	Verbal Interpretation
1.It is important that a detailed test requisition form should be provided by the laboratory to the physicians.	4.19	1.1	Agree
2. It is essential that complete and accurate information of the patient and physician be provided prior collecting and receiving of specimen	4.70	.52	Strongly Agree
3. The requisition form should indicate the complete information of the requesting physician including the contact number and clinic address if out-patient	3.81	1.02	Agree
4. Specimen should be rejected and refuse to collect specimen if information provided is not clear which include patient identification	4.22	1.25	Strongly Agree
5. Specimen should be rejected and refuse to collect specimen if there is no physician signature and there is no date when signed.	2.92	1.23	Uncertain
6. It is a requirement in the identification of patient to have a two or more identifier of the patient	3.38	1.36	Uncertain
7. The request form should include the date of birth of the patient	4.38	1.04	Strongly Agree
8. The laboratory should have a clear policy on test request and patient identification. These policies should be included in the manual and be strictly enforce as part of quality management in the laboratory.	4.84	.44	Strongly Agree
OVERALL AVERAGE	4.05	.47	Agree

Examination Requisition and Identification includes important indicators that are critical in the total testing process. Any mistakes committed in one of the indicators greatly affect the safety of the patient. The quality indicators included in the examination requisition are identification of the patient, test ordered and identification of the physician. Misidentification of the patient is the second mostly encountered errors in the pre-analytic phase after hemolysed blood. According to Rana (2012), in the patient identification and preparation that only 12% technicians labeled the test tubes prior to drawing of blood samples. In another research, Hawkins (2012)), 46-68% pre-analytical errors encountered in the pre-pre analytical phase, included in the encountered mistakes is the misidentification of patient. Table III shows the awareness of the medical technologist on examination requisition and identification. Respondents were not aware of the indicator that prior to extraction, it is recommended to follow protocol in the identification of patient which should be two or more identifier. Another indicator were the respondents is low in terms of awareness is the physician signature in the test request. But the result also revealed strong level of awareness on the following quality indicators: (2) it is essential that complete and accurate information of the patient and physician be provided before collecting and receiving of specimen (4) specimen should be rejected and refuse to collect specimen if the information provided is not clear (7) the request form should include the date of birth of the patient.(8) policies on the patient identification and test request and should be strictly enforced. Specifically, one of the concerns in the findings is the protocol that in the laboratory, every medical technologist should know the laboratory standard of identifying the patient properly. It is a must that they follow a two or more identifier which is the advocacy of the World Health Organization in their released manual in patient identification; The respondents awareness on this indicator has a mean of 3.38. Another low level of awareness from the patient is the requirement of the ISO 15189 as part of the identification of the physician is to sign in the test request. The respondent got an average mean of 2.92.

The moderate level of awareness of the respondent comes from the indicators that matters the test requisition. The test requisition is an important paper in the laboratory. It contains essential information that will support the laboratory quality of the results. Rana (2012) concluded that to improve patient safety in the testing process, all healthcare workers should assess the pre-analytic procedures and improve the area with a more quality system.

The awareness in this particular indicator because if the mistakes is encountered the test request is always assessed if it is properly addressed or not.

The overall awareness of this indicator is 4.05 with a verbal interpretation of "agree", it indicates the moderate level of awareness of the respondents.

Sample management is an important process in the pre-analytical phase. Essential indicators are included here like specimen collection, labeling of containers, correct containers and transport of specimen. Mistakes committed during specimen collection affects greatly the total testing processs. In the research of Rana (2012), the sample collection,

inappropriate container comprise the 46-68% laboratory errors. Marin (2014) reported that 8.76% corresponds to hemolysed samples. Also in the research of Rana, she mentioned of the most common laboratory errors which include handling of specimens,

TABLE IV. EXTENT OF LEVEL OF AWARENESS IN TERMS OF SAMPLE MANAGEMENT

Quality Indicators	Mean	SD	Verbal Interpretation
1. It is essential for the laboratory to have a policy on the maximum hours for the specimen to be received in the laboratory	4.32	0.94	Strongly Agree
2. Specimen should be rejected if the sample container is wrong or the sample collected is not appropriate in the test ordered.	4.81	0.46	Strongly Agree
3. Specimen should be rejected if the sample is insufficient to the test ordered.	4.38	0.79	Strongly Agree
4. Sample inappropriate to the test ordered should be rejected and advises for recollection of sample.	3.35	1.3	Uncertain
5, Specimen can still be accepted even it is insufficient to the test ordered provided the phlebotomist will collect new sample.	4.65	.59	Strongly Agree
6. Sample that is hemolysed can still be used for test that is not affected by the conditions.	3.65	.98	Agree
7.Sample collected insufficient is still valid provided that an additional blood should be collected to augment the desired volume ratio	2.70	1.31	Uncertain
8. Transportation of specimen should be included in the SOP manual that any violation is a reason for rejection of sample	4.41	.96	Strongly Agree
9. Labeling of test tube should be done before the collection for the purpose of precise identification of patients.	2.46	1.30	Disagree
10. The proper labeling of test tube should include patient name, test ordered, date and time of collection and name of phlebotomist	3.78	1.36	Agree
11. Unlabeled sample container can still be accepted beside you can always ask the phlebotomist for labeling of test tubes	1.97	1.19	Disagree
12. Pre-analytic activities should include separation and aliqouting of specimen	3.59	1.21	Agree
13.Pre-analytic errors is a common error in the laboratory and should be addressed immediately	4.84	.37	Strongly agree
14. Pre-analytic errors can cause the laboratory an additional cost and can result of a longer turnaround time for the result.	4.59	.50	Strongly Agree
OVERALL AVERAGE	3.82	.35	Agree

Table IV presents the results of sample management awareness of the respondents. In this cluster of indicators, the following are negative questions which respondents are expected to disagree: (5) specimen can still be accepted even if it is insufficient to the test ordered (6) sample that is hemolysed can still be used for the test (7) sample collected insufficient is still valid provided an additional blood should be collected (9) Labeling of test tube should be done before the collection (11) unlabeled sample container can still be accepted. Findings revealed, respondents did not fully "disagree" on the indicators stated above. This means laboratory staffs are still receiving specimens that is insufficient and hemolysed. The indicators that respondent disagree are question 9 and 11. The table also revealed the indicators that respondents have a strong level of awareness. It can be noted also in the findings that transportation of specimen should be included in the standard operating procedure in the laboratory (x=4.41) which is important to assess the sample. Overall this indicator got a mean of 3.82 with verbal interpretation of " agree" which indicates some indicators are not clear to the respondents.

TABLE V. EXTENT OF LEVEL OF AWARENESS IN TERMS OF SAMPLE INTEGRITY

Quality Indicators	Mean	SD	Verbal Interpretation
1. Extracting blood from small, fragile veins and exploring for veins with needle can cause hemolysis	3.73	1.22	Agree
2. Traumatized veins can still be a good site for blood collection provided an appropriate needle should be used	2.70	1.15	Uncertain
3. If the vein of the patient is fragile, large volume tubes should be used to increase blood flow	2.38	.98	Disagree
4. Alcohol used in phlebotomy can caused hemolysis for not allowing it to dry prior to extraction	3.68	1.29	Agree
5. Needle-size to be used in extraction is not important. The needle size available in the extraction room can be used provided the technique of the phlebotomist is precise	2.43	1.30	Disagree
6. Frothing of specimen can result to hemolysis	3.40	1.04	Agree
7. Underfilled tube is not caused of hemolysis	3.73	1.04	Agree
OVERALL AVERAGE	3.06	.51	Uncertain

Sample integrity is about proper collection of specimen. The most commonly reported pre-analytic error is hemolysed blood which described as ruptured RBC that gave a reddish color in the serum. It is known fact in the laboratory that hemolysed sample can never be used for analysis because it will affect the result of the patient. In this Sample Integrity, 4 are negative question to assess the respondent perceptions on the indicators included in sample integrity. Of these 4 indicators, 2 showed a strong level of awareness while 2 revealed negative perceptions. In (7) , it can be noted that respondent "agree" that undefiled tube does not cause hemolysis which is contrary to the list of causes of hemolysed blood. Findings also revealed some important perceptions of the respondents. According to Rana (2012), there is a lot of factors to be considered in the collection of blood, she stressed that selection of veins for collection, containers, and time factors are all factors that may lead to hemolysed blood. Plebani (2004), mentioned in his article published in the International Federation of Clinical Chemistry and Laboratory Medicine(IFCC), sample collection is a key step for quality in laboratory service. He stressed that further training and practice are required in the collection of blood. It can be noted also that even the size of the needle can contribute to the hemolysis of blood. In the transportation of specimen, Plebani, mentioned that it needs specific standard in

collecting the specimen. The BD published a guidelines in the prevention of hemolysis of blood.

Insufficient of blood is another cause of hemolysis especially when using EDTA which caused dilution of the blood with anticoagulant (x=3.73).

Overall, sample integrity is low in terms of level of awareness with overall average of 3.06 which indicates that medical technologist should be properly trained in handling and collecting of specimen. Also in the training of transportation of specimen which is important to maintain the sample integrity.

The trainings of Medical Technologist are stressed in several researches in the sample collection. In the conclusion of Hawkins (2014), effective improvements in the intial steps of the TTP can be achieved further through the efforts of every stakeholders in the healthcare. It is important that laboratory quality especially in the integrity of specimen should be properly addressed and improved,

TABLE VI. EXTENT OF LEVEL OF AWARENESS WHEN GROUPED ACCORDING TO HOSPITAL IN TERMS OF APPROPRIATE OF TEST RESULT

	Bacoor, Cavite Private Hospitals														
	PH1			**PH2**			**PH3**			**PH4**			**PH5**		
QUALITY INDICATORS	M	SD	VI	M	SD	VI	M	SD	VI	M	SD	VI	M	SD	VI
1. It is important that the initial diagnosis of the patient be provided by the requesting physician	4.50	.57	SA	5.00	0	SA	4.92	.28	SA	4.40	.97	SA	4.00	.82	A
2. The specimen should be rejected or refuse to collect specimen if the initial diagnosis of the patient is not provided	1.75	.83	SD	2.57	.73	D	2.76	.70	U	2.10	.94	D	3.00	1.41	U
3. The Medical Technologist can ask the requesting physician about test ordered if it is not clear or incomplete with regards to patient initial diagnosis	3.25	.69	U	4.57	.49	SA	4.31	.21	SA	4.0	1.40	A	4.33	.82	SA
4. It is a concern to be addressed in the laboratory of an increased incident of misidentified request of patient	3.5	1.73	A	4.57	.53	SA	4.31	.75	SA	4.3	1.25	SA	3.99	1.73	A
5.The laboratory should have a clear policy of carrying out "add-on tests" and be included in the manual	4.75	.50	SA	3.99	.71	A	3.75	1.36	A	3.40	.91	A	3.65	1.53	A
6. The medical technologist can select the most appropriate test based on the clinical diagnosis of patient	2.5	1.29	D	2.43	.88	D	3.08	1.35	U	2.8	1.28	U	3.66	1.53	A
OVERALL AVERAGE	**3.37**	**.94**	**U**	**3.86**	**.56**	**A**	**3.86**	**.78**	**A**	**3.5**	**1.12**	**A**	**3.77**	**1.31**	**A**

Table VI shows the level of awareness of medical technologist when grouped according to the hospital in terms of appropriateness of test result. Findings revealed, private hospital 1 (PH1) has the low level of awareness in the appropriateness of test result with overall average of 3.37 while the rest of the hospitals respondents have a moderate level of awareness. PH1 perceived low in question # 2 that specimen should be received even if there is no initial diagnosis of the patient provided by the physician. The level of awareness of PH2 in questions no.4 is low that Medical Technologist can select the most appropriate test based on the clinical diagnosis of patient (x-2.43 SD 1.29)

TABLE VII. EXTENT OF LEVEL OF AWARENESS WHEN GROUPED ACCORDING TO HOSPITAL IN TERM OF EXAMINATION REQUISITION AND IDENTIFICATION

	Bacoor, Cavite Private Hospitals														
	PH1			**PH2**			**PH3**			**PH4**			**PH5**		
QUALITY INDICATORS	M	SD	VI	M	SD	VI	M	SD	VI	M	SD	VI	M	SD	VI
1. It is important that a detailed test requisition form should be provided by the laboratory to the physicians.	3.50	1.29	A	3.42	1.41	A	4.61	.51	SA	4.5	.53	SA	4.67	.82	SA
2. It is essential that complete and accurate information of the patient and physician be provided prior collecting and receiving specimen	4.75	.41	SA	4.57	.53	SA	4.54	.66	SA	4.9	.44	SA	2.99	1.58	U
3. The requisition form should indicate the complete information of the requesting physician including the contact number and clinic address if out-patient	3.5	.58	A	3.86	1.07	A	3.85	1.07	A	3.9	1.01	A	4.0	1.0	A
4. Specimen should be rejected and refuse to collect specimen if information provided is not clear which include patient indentification	4.75	.50	SA	4.71	.49	SA	4.0	1.47	A	4.30	1.25	SA	4.0	1.73	A
5.Specimen should be rejected and refuse to collect specimen if there is no physician signature and there is no date when signed	2.5	1.29	D	2.14	.90	D	3.38	1.04	U	2.70	1.49	U	2.67	1.53	U
6. It is a requirement in the identification of patient to have a two or more identifier of the patient	2.75	1.71	U	2.85	1.22	U	3.69	1.11	A	3.7	1.42	A	4.33	.58	SA
7. The request form should include the date of birth of the patient	4.0	.82	A	4.85	.38	SA	4.54	.66	SA	4.20	1.23	SA	4.33	1.15	SA
8. The laboratory should have a clear policy on test request and patient identification. These policies should be included in the manual and strictly enforce as part of quality management in the laboratory.	4.5	1.00	SA	5.00	0	SA	4.92	.28	SA	4.60	.70	SA	4.66	.81	SA
OVERALL AVERAGE	**3.78**	**.95**	**A**	**3.92**	**.75**	**A**	**4.19**	**.85**	**A**	**4.10**	**1.00**	**A**	**3.96**	**1.15**	**A**

Table VII is the level of awareness of Medical Technologist clustered according to hospital in terms of examination requisition and identification. PH3 perceived strong in these quality indicators with overall mean of 4.92. Medical Technologists are aware that request form should include the date of birth of the patient (x-4.85). PH2 perceived low in the question no.1 that it is important that a detailed test requisition form should be provided by the laboratory to the physician. Quality indicator that laboratory should require two or more identifier in the identification of patient got the lowest perception among the respondents which can develop into a pre-analytical errors.

TABLE VIII. EXTENT OF LEVEL OF AWARENESS WHEN GROUPED ACCORDING TO HOSPITALS IN TERM OF SAMPLE MANAGEMENT

	Bacoor, Cavite Private Hospitals														
	PH1			PH2			PH3			PH4			PH5		
QUALITY INDICATORS	M	SD	VI	M	SD	VI	M	SD	VI	M	SD	VI	M	SD	VI
1. It is essential for the laboratory to have a policy on the maximum hours for the specimen to be received in the laboratory..	4.0	.82	A		1.13	SA	3.93	.88	A	4.8	.42	SA	5.0	0	SA
2. Specimen should be rejected if the sample container is wrong or the sample collected is not appropriate in the test ordered.	5.0	0	A	5.0	0	SA	4.77	.44	SA	4.8	.42	SA	4.33	1.15	SA
3. Specimen should be rejected if the sample is insufficient to the test ordered.	5.0	0	A	4.29	1.11	SA	4.07	.86	A	4.5	.71	SA	4.66	,58	SA
4. Specimen can still be accepted even if it is insufficient to the test ordered provided the phlebotomist will collect new sample.	3.0	1.41	U	3.14	1.54	U	3.53	1.33	A	3.5	1.27	A	4.66	.58	SA
5.Sample inappropriate to the test ordered should be rejected and advise for re-collection	4.75	.50	SA	5.0	0	SA	4.46	.66	SA	4.7	.67	SA	4.00	1.00	A
6. Sample that is hemolyzed can still be used for test that is not affected by the condition	3.50	1.29	A	3.57	1.13	A	3.46	.78	A	3.6	1.26	A	3.00	1.00	U
7. Sample collected insufficient is still valid provided that an additional blood should be collected to augment the desired volume ratio.	2.25	1.31	D	2.57	1.34	D	3.00	1.0	U	2.9	1.52	U	4.33	.58	SA
8. Transportation of specimen should be included in the manual that any violation is a reason for rejection of sample.	4.50	1.00	SA	4.29	1.11	SA	4.23	1.09	SA	4.3	1.25	SA	4.33	.58	SA
9.Labeling of test tube should be done before collection for the purpose of precise identification of patient.	1.75	1.37	SD	2.43	1.62	D	2.54	1.13	D	2.9	1.52	U	2.33	.58	D
10. The proper labeling of test tube should include patient name, test ordered, date and time collected and name of phlebotomist.	3.0	1.83	U	4.43	1.13	SA	4.00	1.0	A	3.0	1.56	U	3.0	1.73	U
11. Unlabeled sample container can still be accepted besides you can always ask the phlebotomist for labeling of test tube.	2.5	1.29	D	1.43	.53	SD	2.23	1.17	D	2.3	1.64	D	2.67	.58	U
12.Pre-analytic activities should include separation and aliquoting of specimen.	2.0	1.41	D	3.43	1.40	A	4.00	.71	A	4.3	.95	SA	4.66	.58	SA
13. Pre-analytic error is common error in the laboratory and should be addressed immediately	4.75	.50	SA	5.00	0	SA	4.00	.91	A	4.8	.42	SA	3.66	2.30	A
14. Pre-analytic errors can cause the laboratory an additional cost and can result of a longer turnaround time for the result	4.25	.50	SA	4.29	1.11	SA	4.54	.52	SA	4.3	1.25	SA	3.66	1.53	A
OVERALL AVERAGE	3.59	.95	A	3.80	.94	A	3.77	.89	A	3.90	1.06	A	3.87	.91	A

Table VIII presented a various perceptions in terms of sample management. These standards of quality indicators is important in the quality management of laboratory, PH5 is perceived low that hemolyzed sample can still be used for analysis (x=3.0). This quality indicator is also perceived low by the respondents which are at risk of developing pre-analytic errors. Another important quality indicator is the sufficient amount of sample for the testing process. PH1 perceived low in this area that they will accept even if the sample is insufficient. This quality indicator revealed of at risk of developing pre-analytical errors. Respondents showed various perceptions which is an indicator of such conditions.

TABLE IX. EXTENT OF LEVEL OF AWARENESS WHEN GROUPED ACCORDING TO HOSPITAL IN TERMS OF SAMPLE INTEGRITY

	Bacoor, Cavite Private Hospitals														
	PH1			PH2			PH3			PH4			PH5		
QUALITY INDICATORS	M	SD	VI	M	SD	VI	M	SD	VI	M	SD	VI	M	SD	VI
1. Extracting blood from small, fragile veins and exploring for veins with needle can cause hemolysis	2.75	.96	U	4.43	1.13	SA	4.23	.44	SA	3.6	1.35	A	3.66	1.53	A
2. Traumatized vein can still be good site for blood collection provided an appropriate needle should be used.	3.5	.58	A	2.57	1.51	D	2.77	.83	U	2.10	1.29	D	3.66	.58	A
3. If the vein of the patient is fragile, large volume tubes should be used to increase blood flow.	2.75	.96	U	2.14	.69	D	2.38	1.11	D	2.70	1.26	U	2.00	1.0	D
4. Alcohol used in phlebotomy can caused hemolysis for not allowing it to dry prior to extraction.	2.75	1.5	U	2.85	1.46	U	3.38	1.04	U	4.3	1.25	SA	2.33	.58	D
5.Needle size to be used in extraction is not important. The needle size available in the extraction room can be used provided the technique of the phlebotomist is precise.	2.25	1.26	D	2.71	1.33	U	2.62	1.26	U	2.7	1.57	U	2.0	1.0	D
6. Frothing of specimen can result to hemolysis	2.75	.96	U	2.57	1.51	D	3.85	.80	A	3.9	.74	A	2.0	0	D
7. Under filled tubes is not a cause of hemolysis	3.75	.50	A	3.57	1.27	A	3.15	1.07	U	4.00	1.41	A	3.66	1.53	A
OVERALL AVERAGE	2.93	.96	U	2.97	1.27	U	3.19	.94	U	3.32	1.27	U	2.76	.89	U

Table 9 is about sample integrity which is important in the testing process. Respondents perceived low in most of the quality indicators which clearly indicates that some respondents is not aware of the cause of hemolyzed sample. Underfilled tubed is a common incident that is happening in the laboratory especially if the patient has a difficult vein. PH3 is not aware that it will cause hemolysis or it will affect the result of the patient (x-2.97). PH1 also perceived low that exploring for veins with needle can rupture veins and eventually cause hemolysis (x-2.75). This quality indicators as perceived low by the respondent is at rhe risk of developing pre-analytical errors.

VII. CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this study, the respondents are aware to some of the important concept of quality management system in the pre-analytical phase. They strongly agree on the assumptions that the pre-analytical error is a common error in the laboratory which is an essential step in the implementation of quality indicators to safeguard the integrity of the pre-analytical phase in producing a quality samples for an accurate, precise and on-time results.

The quality indicators where the respondents are weak in terms of level of awareness are on the sample management and sample integrity. In sample management, this is the only indicators that are with significant difference in terms of the highest educational attainment. There are also quality indicators where the respondents are uncertain whether the procedure is applied in the clinical laboratory. In the sample integrity, though they agree on the essential procedures, there is some provisions that respondents are not aware that it will risk the integrity of the sample. One of the most common pre-analytical error is misidentification of the patient. The protocol according to the World Health Organization is to apply two or more identifier rule to identify the patient accurately. The respondents of this research are not aware of such rule formulated by the WHO. In the perceptions of the respondents, there is no significant difference as to the demographic profile because of the homogeneity of data which is most of the respondents are female and at the range of 20-30 y/o. The quality indicators that are at risk of developing pre-analytic errors are the sample management and sample integrity.

The following are the recommended measures to increase awareness of Medical Technologist on quality indicators in the pre-analytic phase,

1. The laboratory should develop clear sample acceptance and rejection which are linked to monitoring of the collection and transport processes. These criteria should be addressed properly to all the staff of the clinical laboratory.
2. The Quality Indicators that will be implemented should cover all steps of the pre-analytical phase including appropriateness of test selection which is a key issue in ensuring clinical effectiveness. The laboratory personnel must know their role in helping the physicians in selecting the most appropriate test for the patient.
3. The laboratory personnel must be supported with education in laboratory management. These trainings should go beyond theoretical with priority on the application of the concept in total quality management system. It should also include post-graduate studies on laboratory management on the laboratory staff.
4. Pre-analytical process improvement initiatives must be collaborative involving all the staff in the laboratory.
5. Standardizing work processes based on the ISO standard must be the priority of the clinical laboratory to ensure an accurate, precise and timely results.

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