Influence of Postural Change during Venous Blood Collection: A Knowledge, Attitude, and Practices (KAP) Survey on Patient Preparation Practices of Selected Healthcare Professionals in Bataan, Philippines

Shantel Gayle Q. Tayag [1], Ana Patricia M. Villamin [1], Shyra Clarisse S. Santos[1], Yannah Franzine T. Vendivil [1], Erica Angel Nadeen R. Ruga [1], Ma. Issabela J. Villalino[1], Glaiza Lenn C. Rosales [1], Vivian G. Villegas[1]

[1] Faculty of Pharmacy, Department of Medical Technology, University of Santo Tomas, Manila, Philippines.

Corresponding Author: shantelgayle.tayag.pharma@ust.edu.ph

Abstract: Postural change before and during venous blood collection can influence the concentration of analytes. This study aimed to assess the knowledge, attitude, and practices (KAP) of medical technologists and nurses in selected hospitals in Bataan, Philippines regarding the effects of postural changes on the concentration of hemoglobin, hematocrit, albumin, and total cholesterol during supine to sitting, supine to standing, and sitting to standing. A cross-sectional survey of four primary hospitals was conducted through an online questionnaire. The quota was set to 170 respondents (137 nurses and 33 medical technologists) and met with a total of 177 respondents. Results showed that majority of the respondents are aware on the effect of postural changes on hemoglobin and hematocrit, while most were unaware of the changes in albumin and total cholesterol. Majority of the medical technologists (61%) acquired perfect scores on the knowledge section. The healthcare professionals had mixed attitudes towards postural changes. For practice, more medical technologists carry venous blood collection compared to nurses. Most medical technologists always position their patients in a sitting position, while most nurses sometimes position their patients from supine to sitting. A significant association was observed between professional status and knowledge (p-value= <0.001), attitude (p-value= 0.001) and practices (p-value= 0.003), as well as between practice and gender (p-value 0.01) and associated hospital (p-value= 0.001). Inadequate KAP on patient positioning practices may contribute to pre-analytical errors. Thus, the standardization of patient posture during phlebotomy should be done to provide reliable results and optimal patient care.

Key Words— *Postural Change, Analytes, Venous Blood Collections, Preanalytical Variability.*

I. INTRODUCTION

In the clinical setting, various laboratory tests are utilized to determine underlying conditions and disorders of a patient. Generally, laboratory testing is composed of three phases namely, pre-analytical, analytical, and post-analytical. According to the study by Abdollahi et al. [1], errors committed in any of the phases affect the quality of healthcare as laboratory tests have a major impact on the decisions done by the physicians to the patients. In fact, a large number of deaths have been associated with medical errors and is also the reason why laboratory medicine sets standards of high quality and is regulated through various accreditation and certification [2,3]. Among the different phases of laboratory testing, the pre-analytical is one of the most crucial parts of laboratory testing. However, the study by Rana [4] showed that the pre-analytical phase has the greatest number of errors accounting for 70% in the testing process. Included in this phase is the patient positioning before and during venous blood collection.

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Postural change, referring to the patient's position at the time of blood extraction, is crucial as it can induce a significant change on the tested analytes. Stokke et al. [5] demonstrated the physiology of plasma volume with gravitational force and hydrostatic pressure. It has been shown that during a postural shift, there is a forceful action to which it affects plasma's volume of distribution, particularly to bipedal species. The study by Hagan et al. [6] associated the plasma volume changes and found that hemoconcentration and hemodilution are related to postural changes thereby affecting the analyte concentrations. Changing the positioning of the patient during blood collection induces a significant bias in the resulting laboratory values because of gravitational adaptation that can influence the hydrostatic pressure including numerous body districts [7]. In line with this, the study by Lippi et al. [8] found that postural changes particularly, supine to sitting, supine to standing, and sitting to standing, had resulted to a significant increase in various tested analytes including hemoglobin, hematocrit, albumin, and total cholesterol. However, despite the postural change being crucial, the most overlooked in the pre-analytical factor is still the patient positioning [9]. Thus, establishment of a widespread standardization of posture during blood collection is deemed necessary. In fact, the Clinical Laboratory Standard Institute and World Health Organization have published information regarding the proper posture of a patient during venous blood collection which refers to two positions, supine and sitting [10].

As the process of venous blood collection involves an invasive method, theoretical and practical knowledge is crucial among the healthcare professionals conducting this process [11]. Concrete evidence has shown significant changes in terms of the unforeseen disparity among the concentration of certain blood elements when patients are subjected to different postural changes prior to venous blood collection [12]. Over the years, it is apparent that there has been insufficient interest in taking into account such effects in clinical practice. If not few, available studies are relatively outdated and limited. Therefore, to ensure a high level of quality and reliability of test results, it is important to assess the knowledge, attitude, and practices of the healthcare professionals involved in blood collection regarding the possible influence of patient posture from supine to sitting, supine to standing, and sitting to standing that dramatically alters the analyte concentrations on specific blood tests.

Hence, this study assessed the knowledge, attitude, and practices (KAP) of medical technologists and nurses in selected primary hospitals of Bataan, Philippines namely, Jose C. Payumo Jr. Memorial Hospital in Dinalupihan; Bagac Community & Medicare Hospital in Bagac; Mariveles District Hospital in Mariveles; and Orani District Hospital in Orani, regarding the effects of postural changes on hemoglobin, hematocrit, albumin, and total cholesterol with the use of survey questionnaires. This study was limited to the following postural changes: supine to standing, supine to sitting, and sitting to standing. On the other hand, the association between the demographic characteristics with knowledge, attitude, and practices of the health care professionals was also assessed.

The findings of this study would serve as a baseline for further comprehensive studies as this is the first research conducted in the Philippines up to date. This study would then serve as a stepping-stone in the medical field and health-associated organizations to evaluate the current protocols for patient posture during venous blood collection and assess the need for its standardization to improve knowledge, attitude, and practices of healthcare professionals, to increase reliability of results, and provide optimal patient care.

II. CONCEPTUAL FRAMEWORK

This study was anchored on the KAP theory, which is a theory encompassing a health behavioral change. KAP stands for knowledge, attitude, and practices, respectively. Knowledge is defined as acquiring, retaining, and using information or skills [13]. This study assessed the knowledge of the healthcare professionals with regards to postural change and its effect in venous blood collection when subjected to varying position before and during venous blood collection. On the other hand, Eagly and Chaiken [14] defined attitude as the expressed psychological tendency through the evaluation of a particular entity with some degree of favor or disfavor. It encompasses cognition, affect, and behavior. This study assessed the attitude of the selected healthcare professionals with their preconceived ideas on the effects of postural change and their aptness in behaving in particular ways in patient preparation, particularly the patient positioning before and during venous blood collection. Lastly, this study incorporated the assessment of the practice of the healthcare professionals. Practice is defined as the demonstration of the acquired knowledge. With the application of this framework, KAP surveys are widely used in the study of human behavior when they are affected by a problem or disease.

The KAP of medical technologists and nurses regarding patient positioning before and during venous blood collection were evaluated along with their connection with gender, professional status, type of employment, age, length of employment, and associated hospital. Their knowledge was assessed by the correct answers that they have acquired in the questionnaire with regards to the affected analytes during the specified postural changes. Their attitude was evaluated by probing into their beliefs in relation to the importance of patient positioning in venous blood collection. Lastly, their practice and application of knowledge were assessed through questions that investigate how the healthcare professionals prepare their patient before and during venous blood collection. These factors were addressed through the conceptual framework demonstrated below (Figure 1).

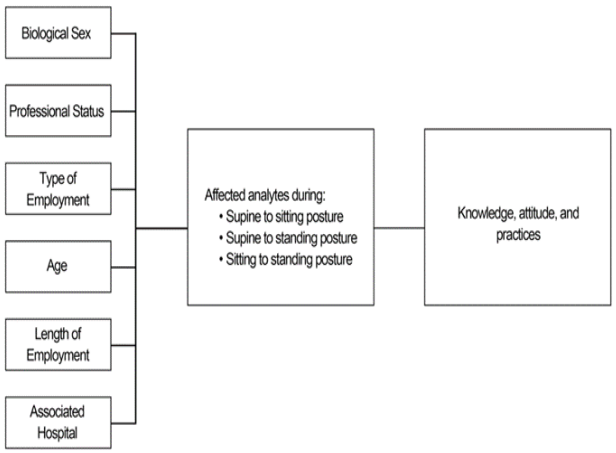

Fig.1. Conceptual Framework Showing the Knowledge, Attitude, and Practices of Medical Technologists and Nurses Regarding the Effects of Postural Changes on Selected Analytes before and During Venous Blood Collection

III. METHODOLOGY

A. Subject and Study Site

This cross-sectional study examined data from a population at one specific time specifically, the knowledge, attitude, and practices of medical technologists and nurses on the effects of postural changes in the analytes of venous blood. Within the selected four (4) hospitals including Jose C Payumo Jr. Memorial Hospital, Bagac Community & Medicare Hospital, Mariveles District Hospital, and Orani District Hospital, site suitability was considered to ensure practice of ethical and safety requirements for research respondents, accessibility of research materials, attainable quota, and that the protocols of the hospital would allow the implementation of the survey. The study used non-probability quota sampling which involves non-random selection and was based on convenience, allowing the researchers to easily collect data. Out of the 235-total population, the researchers chose a quota of 170 for convenience. Therefore, from the 193 nurses in the four (4) hospitals only 137 were needed from the study. In addition, from the 42 medical technologists, a total of 33 were needed to meet the study's quota of 170.

B. Data Measure/Instrumentation

The researchers utilized an online questionnaire via Google Forms wherein participatory pilot testing was conducted to evaluate the reliability and validity of the survey instruments prior to the final distribution of questionnaires. An initial pilot testing was done with the aid of Cronbach's Alpha which resulted to an unacceptable level of internal consistency for the knowledge section. Initially, the questionnaire consisted of multiple-choice type of questions on the knowledge section. However, after content validity by two experts in statistics, the 12 questions from the knowledge part were revised to a "yes" or "no" type of question instead of asking whether the analyte had a "significant increase/decrease, increase/decrease within the desirable bias, or no change." A second pilot study was then conducted, and the same methodology was used for the statistical treatment to increase the reliability of our questionnaire. The calculated Cronbach's alpha value for knowledge, practices, and attitude were 0.924, 0.904, 0.831, respectively indicating an acceptable level of internal consistency.

C. Data Gathering Procedure

The study population consisted of healthcare professionals, specifically medical technologists, and nurses who perform venous blood collection in four hospitals located in Bataan. Pilot testing was conducted from March 13 to March 29, 2021, and the respondents were given 16 days to answer the questionnaire. A total of 64 randomly selected medical technologists and nurses from the selected hospitals located in Bataan have participated in the pilot testing of the survey questionnaire. Prior to the survey proper, an informed consent form was introduced to the respondents and were then requested to accomplish a web-based questionnaire through google forms. Dissemination of access to the questionnaire was

facilitated by a point person per hospital which was assigned by the chief of hospital. The data was collected from March 30 to April 18, 2021, and 20 days were allotted for answering the online questionnaires to ensure that all the respondents can answer.

D. Data Analysis

The analysis of the collected data for the assessment of knowledge, attitude, and practices of medical technologists and nurses on postural changes during venous blood collection was evaluated using Cronbach alpha to check its internal consistency through SPSS statistics. The questionnaire consists of multiple-choice and Likert scale questions that were substantial for the analysis. Correct answers for the questions in the knowledge portion were based on a study by Lippi et al. [8] to determine analytes affected by postural changes. The data was further processed using basic descriptive statistics via the calculation of frequencies and proportions. Spearman rank correlation was used in assessing the correlation between the knowledge, attitude, and practices with the professional status of the respondents.

On the other hand, point biserial test was also utilized in determining the relationship of knowledge, attitude, and practices with the length of employment and age of respondents. The association between the knowledge along with the type of employment and the associated hospital was determined with the type of employment and the associated hospital was determined with the use of Eta coefficient. Furthermore, Cramer's V method was also used to measure the relationship between the attitude and practice with gender, type of employment, and associated hospital. Other statistical tools such as mean rank of the scores on the knowledge section were also computed.

IV. RESULTS

A. Demographic Profile

Out of a total 235 healthcare professionals approached, 177 completed the online survey. The response rate of the survey was 75%. The reduced response rate may be due to the COVID- 19 response, full workload with vaccination schedule of healthcare professionals, and some may not have access to internet or equipment to answer the forms.

The demographic profile of the respondents comprises a majority of female workers (77%), nurses (81%), full time employees (75%), and 21-35 years age group (76%). While most of the respondents were employed for 1 to 3 years (See Table 1).

Table.1. Demographic characteristics of study respondents (N = 177)

Characteristics	Frequency (n)	Percentage (%)
Sex		
Female	137	77%
Male	40	23%
Professional Status		
Registered Nurse	144	81%
Registered Medical Technologist	33	19%
Type of Employment		
Full time	132	75%
Job order	24	14%
Probation (<6 months of employment)	18	10%
Regular	1	1%
Casual	1	1%
Part time	1	1%
Age Groups		
21-35 yrs old	134	76%
36-50 yrs old	33	19%
≤ 20 yrs old	6	3%
51-65 yrs old	4	2%
Length of Employment		
1-3 years	72	41%
<1 year	32	18%
4-6 years	28	16%
7-9 years	26	15%
≥ 10 yrs	19	11%
Associated Hospital		
Orani District Hospital	63	36%
Jose C Payumo Jr. Memorial Hospital	53	30%
Mariveles District Hospital	42	24%
Bagac Community & Medicare Hospital	19	11%

B. Knowledge

When a patient is subjected from supine to sitting during blood collection, 55% of the 177 respondents answered that hemoglobin (g/L) will be affected while 51% answered for hematocrit. In contrast, 68% answered that the total cholesterol (mmol/L) will be unaffected while 63% answered for albumin (g/L). On the other hand, when subjected to a postural change from supine to standing, with the analytes being affected, 62% answered "yes" for hemoglobin (g/L) and 61% for hematocrit. In contrast, 59% answered "no" for total cholesterol (mmol/L) and 55% for albumin (g/L). Lastly, when asked whether the analytes will be affected when subjected to a postural change from sitting to standing, majority of the respondents answered "yes" for hemoglobin (g/L) (57%) and hematocrit (54%). On the contrary, 59% answered "no" for albumin and total cholesterol, respectively.

On the other hand, the correct answers acquired by the respondents were tallied according to their health profession. Among the 144 nurse respondents, 18% obtained a perfect score of 12 on the evaluation of their knowledge on the effects of postural change on the routinely measured analytes. In contrast, a big portion of the nurse respondents (36.11%), obtained a score of 0 out of 12. On the other hand, out of 33

medical technologist respondents only a small percentage (12%) scored 0 on the evaluation of their knowledge on the effects of the said analytes. While a notable number (60.61%) of medical technologist respondents received 12 correct answers (See Table 2 and 3).

Table.2. Responses to the Effects of Postural Change on the Analytes Knowledge Items

Items		Yes n (%)	No n (%)
In venous blood collection during SUPINE TO SITTING posture, are the following analytes affected?	Hemoglobin (g/L)	**98 (55%)**	**79 (45%)**
	Hematocrit	**91 (51%)**	**86 49%**
	Albumin (g/L)	**66 (37%)**	**111 (63%)**
	Cholesterol, total (mmol/L)	**57 (32%)**	**120 (68%)**
In venous blood collection during SUPINE TO STANDING posture, are the following analytes affected?	Hemoglobin (g/L)	**109 (62%)**	**68 (38%)**
	Hematocrit	**108 (61%)**	**69 (39%)**
	Albumin (g/L)	**79 (45%)**	**98 (55%)**
	Cholesterol, total (mmol/L)	**73 (41%)**	**104 (59%)**
In venous blood collection during SITTING TO STANDING posture, are the following analytes affected?	Hemoglobin (g/L)	**101 (57%)**	**76 (43%)**
	Hematocrit	**95 (54%)**	**82 (46%)**
	Albumin (g/L)	**72 (41%)**	**105 (59%)**
	Cholesterol, total (mmol/L)	**72 (41%)**	**105 (59%)**

Table.3. Score Count and Percentage of the Correct Items among the Registered Nurses and Medical Technologists

	Registered Nurse		Registered Medical Technologist	
Score	**Count**	**%**	**Count**	**%**
0	52	36%	4	12%
1	1	1%	0	0%
2	3	2%	2	6%
3	3	2%	0	0%
4	10	7%	0	0%
5	3	2%	0	0%
6	24	17%	1	3%
7	3	2%	1	3%
8	8	6%	0	0%
9	6	4%	4	12%
10	4	3%	0	0%
11	1	1%	1	3%
12	26	18%	20	61%
Total	**144**	**100%**	**33**	**100%**

C. Attitude

A few of the respondents believed that positioning of the patients significantly affects the analytes being tested where 27% were neutral. Moreover, 37% agreed and 26% remained neutral that it is necessary to differentiate whether the analyte significantly increases or decreases due to postural change. Furthermore, 37% agreed that taking note of the patient's position prior to venous blood collection is important, while 29% remained neutral.

Among the respondents, 40% agreed that it is necessary for patients to rest for at least 20 minutes prior to venous blood collection whereas 28% remained neutral.

In addition, 36% agreed that changes in analytes can be prevented with proper positioning of patients prior to blood collection and 32% still remained neutral.

Furthermore, from the 177 healthcare professionals, 38% agreed that knowing the effects of various postural changes prior to venous blood collection is a must to avoid any erroneous result, while 31% of the respondents remained neutral with regards to this idea. Likewise, 41% agreed that filing an error report is needed when a wrong postural change is suspected, while 30% remained neutral. Despite a relatively positive attitude towards postural changes in venous blood analytes, with most answers lying between "agree" and "neutral," it is shown that 19% of the respondents agreed and 8% strongly agreed that the position of the patient prior to venous blood collection does not matter. Additionally, a total of 32% respondents still remained neutral. Moreover, 30% of the respondents agreed that the concentration of analytes regardless of position will produce the same results, while 28% remained neutral.

As for the items regarding desirable biases, a mixed response was observed wherein most answers usually lie within "agree" and "neutral".

As for questions regarding the specific postural changes and their effects on venous blood analytes, majority of the respondents remained neutral with the idea that patients can be positioned in certain ways prior to venous blood collection which would not affect the concentration of the analytes. About 32% were neutral that the concentration of analytes are not affected when the patient is positioned from supine to standing. As for supine to sitting, 33% were neutral that this postural change does not affect the concentration of venous analytes. Lastly, for sitting to standing, 33% were neutral that the venous analytes are not affected with this postural change.

Respondents with neutral answers were evidently greater than healthcare professionals who believed that the posture of the patient could significantly affect certain analytes (See Table 4).

Table.4. Responses to Postural Change in Venous Blood Collection Attitude items

Items	PS	SA n (%)	A n (%)	N n (%)	D n (%)	SD n (%)
Positioning of the patients prior to blood collection significantly affects the concentration of the analytes being tested.	RMT	20 (11%)	7 (4%)	4 (2%)	2 (1%)	0 (0%)
	RN	18 (10%)	49 (28%)	43 (24%)	23 (13%)	11 (6%)
	T	**38 (14%)**	**56 (32%)**	**47 (27%)**	**25 (14%)**	**11 (6%)**
It is necessary to differentiate whether the change in analyte due to postural change would result to a significant increase or decrease in concentration	RMT	15 (8%)	10 (6%)	4 (2%)	4 (2%)	0 (0%)
	RN	17 (10%)	55 (31%)	42 (24%)	17 (10%)	13 (7%)
	T	**32 (18%)**	**65 (37%)**	**46 (26%)**	**21 (12%)**	**13 (7%)**
It is important to take note of the patient's position prior to venous blood collection	RMT	13 (7%)	12 (7%)	4 (2%)	2 (1%)	2 (1%)
	RN	23 (13%)	54 (31%)	48 (27%)	8 (5%)	11 (6%)
	T	**6 (20%)**	**66 (37%)**	**52 (29%)**	**10 (6%)**	**13 (7%)**
The position of the patient prior to blood collection doesn't matter as long as I am able to extract blood.	RMT	3 (2%)	2 (1%)	12 97%)	7 (4%)	9 (5%)
	RN	11 (6%)	32 (18%)	45 (25%)	40 (23%)	16 (9%)
	T	**14 (8%)**	**32 (19%)**	**57 (32%)**	**46 (27%)**	**25 (14%)**
It is necessary to let the patients rest for at least 20 minutes prior to blood collection.	RMT	7 (4%)	14 (8%)	8 (5%)	2 (1%)	2 (1%)
	RN	24 (14%)	56 (32%)	41 (23%)	13 (7%)	10 (6%)
	T	**31 (18%)**	**70 (40%)**	**49 (28%)**	**15 (8%)**	**12 (7%)**
The concentration of the analytes regardless of the position of the patient will produce the same result.	RMT	6 (3%)	12 (7%)	1 (1%)	7 (4%)	7 (4%)
	RN	8 (5%)	41 (23%)	48 (27%)	34 (19%)	13 (7%)
	T	**14 (8%)**	**53 (30%)**	**49 (28%)**	**41 (23%)**	**20 (11%)**
Significant changes on the concentration of the analytes can be prevented if proper positioning of patients is done prior to blood collection.	RMT	14 (8%)	12 (7%)	5 (3%)	0 (0%)	2 (1%)
	RN	16 (9%)	51 (29%)	52 (29%)	16 (9%)	9 (5%)
	T	**30 (17%)**	**63 (36%)**	**57 (32%)**	**16 (9%)**	**11 (6%)**
Prior to venous blood collection, the patient can be positioned from supine to standing without affecting the concentration of the analytes (Hemoglobin, Hematocrit, Albumin, and Total Cholesterol) being tested.	RMT	7 (4%)	8 (5%)	2 (1%)	6 (3%)	10 (6%)
	RN	6 (3%)	37 (21%)	54 (31%)	30 (17%)	17 (10%)
	T	**13 (7%)**	**45 (25%)**	**56 (32%)**	**36 (20%)**	**27 (15%)**
Prior to venous blood collection, the patient can be positioned from supine to sitting without affecting the concentration of the analytes (Hemoglobin, Hematocrit, Albumin, and Total Cholesterol) being tested.	RMT	5 (3%)	11 (6%)	4 (2%)	8 (5%)	5 (3%)
	RN	11 (6%)	34 (19%)	55 (31%)	32 (18%)	12 (7%)
	T	**16 (9%)**	**45 (25%)**	**59 (33%)**	**40 (23%)**	**17 (10%)**
Prior to venous blood collection, the patient can be positioned from sitting to standing without affecting the concentration of the analytes (Hemoglobin, Hematocrit, Albumin, and Total Cholesterol) being tested.	RMT	5 (3%)	9 (5%)	4 (2%)	9 (5%)	6 (3%)
	RN	10 (6%)	31 (18%)	55 (31%)	34 (19%)	14 (8%)
	T	**15 (8%)**	**40 (23%)**	**59 (33%)**	**43 (24%)**	**20 (11%)**
Knowing the effects of various postural changes prior to venous blood collection is a must to avoid any erroneous result.	RMT	11 (6%)	16 (9%)	6 (3%)	0 (0%)	0 (0%)
	RN	23 (13%)	52 (29%)	49 (28%)	11 (6%)	9 (5%)
	T	**34 (19%)**	**68 (38%)**	**55 (31%)**	**11 (6%)**	**9 (5%)**
In venous blood collection, it is necessary to know if the changes in the result due to the different positioning of the patient lie within the desirable bias.	RMT	10 (6%)	15 (8%)	6 (3%)	1 (1%)	1 (1%)
	RN	15 (8%)	54 (31%)	55 (31%)	12 (7%)	8 (5%)
	T	**25 (14%)**	**69 (39%)**	**61 (34%)**	**13 (7%)**	**9 (5%)**
Desirable bias specification on various analytes should be regularly reviewed and be strictly observed in blood collection.	RMT	11 (6%)	15 (8%)	5 (3%)	2 (1%)	0 (0%)
	RN	19 (11%)	55 (31%)	58 (33%)	6 (3%)	6 (3%)
	T	**30 (17%)**	**70 (40%)**	**63 (36%)**	**8 (5%)**	**6 (3%)**
If a deviation from desirable bias specification is evident then an investigation must be done to rule out the pre-analytical error.	RMT	12 (7%)	14 (8%)	5 (3%)	2 (1%)	0 (0%)
	RN	16 (9%)	63 (36%)	52 (29%)	6 (3%)	7 (4%)
	T	**28 (16%)**	**77 (44%)**	**57 (32%)**	**8 (5%)**	**7 (4%)**
If a pre-analytical error from a wrong postural change is suspected, an error report must be filed and reviewed.	RMT	9 (5%)	14 (8%)	8 (5%)	2 (1%)	0 (0%)
	RN	24 (14%)	59 (33%)	45 (25%)	7 (4%)	9 (5%)
	T	**33 (19%)**	**73 (41%)**	**53 (30%)**	**9 (5%)**	**9 (5%)**

Note: PS – Professional Status, RMT – Registered Medical Technologist, RN – Registered Nurse, T – Total, SA – Strongly Agree, A – Agree, N – Neutral, D – Disagree, SD – Strongly Disagree

D. Practice

- Based on the results, 13% of the medical technologists answered that they always engage in venous blood collection in a week whereas 36% of the nurses answered that they sometimes assist in venous blood collection.
- Four items regarding the positioning of the patient were given, including sitting, supine to sitting, supine to standing, and sitting to standing. Around 28% of the respondents answered that they sometimes position the patient to sitting before and during blood collection.
- Moreover, 34% of the 177 healthcare professionals answered that they sometimes position the patient from supine to sitting before and during blood collection. Furthermore, 45% of the healthcare professionals stated that they never position the patient from supine to standing prior to venous blood collection. Lastly, 46% answered that they never position the patient from sitting to standing before and during blood collection.
- As for the items regarding the time the respondents allow the patient to rest, around 36% answered that they sometimes allow their patient to rest for 5 minutes only.
- When asked about how often they allow their patient to rest for 10 minutes only, the responses consist of varied answers with 8% who answered for always, 21% for often, 34% for sometimes, 25% for rarely, and 11% for never.
- On the other hand, 37% answered sometimes on the item pertaining to how often the healthcare professionals allow their patients to rest for only 15 minutes. Lastly, 33% answered that they sometimes allow their patient to rest for at least 20 minutes before performing venous blood collection.
- When asked about how often the healthcare professionals take note of the positioning of the patient prior to venous blood collection, 34% of the respondents answered that they sometimes do the said practice while, 21% never take note of it at all (See Table 5).

Table.5. Responses to Responses to Postural Change in Venous Blood Collection Practices Items

Items	PS	A n (%)	O n (%)	S n (%)	R n (%)	N n (%)
How often do you carry or assist in venous blood collection in a week?	RMT	23 (13%)	5 (3%)	2 (1%)	2 (1%)	1 (1%)
	RN	3 (2%)	11 (6%)	63 (36%)	50 (28%)	17 (10%)
	T	**26 (15%)**	**16 (9%)**	**65 (37%)**	**52 (29%)**	**18 (10%)**
How often do you position the patient to SITTING before and during blood collection?	RMT	19 (11%)	7 (4%)	1 (1%)	4 (2%)	2 (1%)
	RN	12 (7%)	31 (18%)	48 (27%)	35 (20%)	18 (10%)
	T	**31 (18%)**	**38 (21%)**	**49 (28%)**	**39 (22%)**	**20 (11%)**
How often do you position the patient from SUPINE TO SITTING before and during blood collection?	RMT	1 (1%)	11 (6%)	9 (5%)	7 (4%)	5 (3%)
	RN	4 (2%)	18 (10%)	52 (29%)	44 (25%)	26 (15%)
	T	**5 (3%)**	**29 (16%)**	**61 (34%)**	**51 (29%)**	**31 (18%)**
How often do you position the patient from SUPINE TO STANDING before and during blood collection?	RMT	0 (0%)	3 (2%)	10 (6%)	4 (2%)	16 (9%)
	RN	1 (1%)	10 (6%)	33 (19%)	37 (21%)	63 (36%)
	T	**1 (1%)**	**13 (7%)**	**43 (24%)**	**41 (23%)**	**79 (45%)**
How often do you position the patient from SITTING TO STANDING before and during blood collection?	RMT	0 (0%)	3 (2%)	9 (5%)	6 (3%)	15 (8%)
	RN	1 (1%)	9 (5%)	33 (19%)	34 (19%)	67 (38%)
	T	**1 (1%)**	**12 (7%)**	**42 (24%)**	**40 (23%)**	**82 (46%)**

(continued)

Table.5. (Continued). Responses to Responses to Postural Change in Venous Blood Collection Practices Items

Items	PS	A n(%)	O n(%)	S n(%)	R n(%)	N n(%)
How often do you usually allow your patient to rest for 5 MINUTES ONLY prior to venous blood collection?	RMT	13 (7%)	11 (6%)	4 (2%)	2 (1%)	3 (2%)
	RN	7 (4%)	32 (18%)	60 (34%)	30 (17%)	15 (8%)
	T	**20 (11%)**	**43 (24%)**	**64 (36%)**	**32 (18%)**	**18 (10%)**
How often do you usually allow your patient to rest for 10 MINUTES ONLY prior to venous blood collection?	RMT	8 (5%)	9 (5%)	8 (5%)	5 (3%)	3 (2%)
	RN	6 (3%)	29 (16%)	52 (29%)	40 (23%)	17 (10%)
	T	**14 (8%)**	**38 (21%)**	**60 (34%)**	**45 (25%)**	**20 (11%)**
How often do you usually allow your patient to rest for 15 MINUTES ONLY prior to venous blood collection?	RMT	1 (1%)	8 (5%)	10 (6%)	9 (5%)	5 (3%)
	RN	4 (2%)	28 (16%)	55 (31%)	35 (20%)	22 (12%)
	T	**5 (3%)**	**36 (20%)**	**65 (37%)**	**44 (25%)**	**27 (15%)**
How often do you usually allow your patient to rest for AT LEAST 20 MINUTES prior to venous blood collection?	RMT	0 (0%)	5 (3%)	10 (6%)	11 (6%)	7 (4%)
	RN	8 (5%)	23 (13%)	48 (27%)	38 (21%)	27 (15%)
	T	**8 (5%)**	**28 (16%)**	**58 (33%)**	**49 (28%)**	**34 (19%)**
Prior to venous blood collection, how often do you take note of their position?	RMT	3 (2%)	9 (5%)	11 (6%)	3 (2%)	7 (4%)
	RN	12 (7%)	22 (12%)	49 (28%)	31 (18%)	30 (17%)
	T	**15 (8%)**	**31 (18%)**	**60 (34%)**	**34 (19%)**	**37 (21%)**

Note: PS – Professional Status, RMT – Registered Medical Technologist, RN – Registered Nurse, T – Total, A – Always, O – Often, S – Sometimes, R – Rarely, N - Never

E. KAP Correlation

Scores on knowledge, attitudes, and practices were also correlated with the demographic characteristics of the respondents to find any significant relationship that may have existed between the identified variables. Various statistical tools were used to identify the relationship which depended on the nature of data being compared. It was found that there was a positive very weak correlation between knowledge and gender using the point biserial correlation with a rho value of 0.033 whereas the relationship between attitude and practices and gender using Cramer's V was found out to be 0.138. However, both these associations were also regarded as not significant based on the computed p-value of 0.663 and 0.494, respectively. For knowledge and professional status, the rho coefficient was calculated as 0.344 with a p-value of <0.001.

Furthermore, for the knowledge part of the questionnaire, the medical technologists were able to garner a mean rank of 9.212 while the nurses attained a mean rank of 4.979. As for the attitude and professional status, a rho coefficient of 0.243 was calculated with a p-value of 0.001. Lastly for practices, a rho coefficient of 0.226 was attained with a p-value of 0.003. Conversely, the association of type of employment with knowledge, attitude, and practices, Eta coefficient test and Cramer's V were used, respectively.

There was a positive very weak correlation found between the type of employment with knowledge (Eta coefficient= 0.103), attitude (Cramer's φ= 0.135), and practices (Cramer's φ= 0.151) section. Furthermore, there was no significant association found between the type of employment with knowledge (p-value= 0.394), attitude (p-value= 0.597), and practices (p-value= 0.426) section. The association between the knowledge, attitude, and practices with the respondent's age were determined using Spearman rank correlation. As per the data obtained, the knowledge (rho= -0.146), attitude (rho= -0.093), and practices (rho= -0.060) in relation to age showed a negative very weak correlation. In addition, the association between age and knowledge (p-value= 0.053), attitude (p-value= 0.218), and practices (p-value= 0.426) were not significant.

Similarly, the association between the knowledge and the length of employment, Spearman rank correlation was utilized where the rho value calculated was -0.017. This indicated that there was a negative very weak correlation between the two variables. Furthermore, the association between the two variables was not significant (p-value= 0.824). To determine the association of the attitude and the length of employment,

spearman rank correlation was likewise utilized in which the rho value calculated was 0.031, indicating that there was a positive very weak correlation between the two variables. However, the association between the attitude and length of employment was not significant (p-value= 0.677).

The association between the practices and the length of employment was also assessed through Spearman rank correlation with a negative rho value of 0.062. The result showed that there was a negative very weak correlation between the two variables.

In terms of the association between the practices and length of employment, it was revealed to be not significant (p-value= 0.411). Finally, the association between the knowledge, attitude, and practices of the healthcare professionals and the associated hospital were evaluated.

The Eta coefficient test and Cramer's V revealed that there was a positive, very weak correlation between knowledge (Eta coefficient= 0.126) and attitude (Cramer's φ= 0.187) with regard to the associated hospital, respectively. Furthermore, the association between the associated hospital and knowledge (p-value= 0.424) and attitude (p-value= 0.1) was not significant. Conversely, Cramer's V showed that there was a positive weak correlation between practice and the associated hospital (Cramer's φ= 0.253), and that the association between the two variables was significant (p-value= 0.001) (See Table 6).

Table.6. Correlation and Association of Demographic Characteristics with Knowledge, Attitude and Practices

Variable	Knowledge			Attitude		Practices	
	Mean Rank	**Coefficient**	**p-value**	**Coefficient**	**p-value**	**Coefficient**	**p-value**
Gender		0.033	0.663	0.138	0.494	0.275	**0.01**
Female	5.854						
Male	5.475						
Professional Status		0.344	**<0.001**	0.243	**0.001**	0.226	**0.003**
Registered Medical Technologist	9.212						
Registered Nurse	4.979						
Type of Employment		0.103	0.394	0.135	0.597	0.151	0.426
Full Time	6.045						
Part Time	6.000						
Probation	4.881						
Age		-0.146	0.053	0.093	0.218	-0.060	0.426
≤20	8.000						
21-35	5.993						
36-50	4.788						
51-65	3.000						

(continued)

Table.6. (Continued). Correlation and Association of Demographic Characteristics with Knowledge, Attitude and Practices

Variable	Knowledge			Attitude		Practices	
	Mean Rank	**Coefficient**	**p-value**	**Coefficient**	**p-value**	**Coefficient**	**p-value**
Length of Employment		-0.017	0.824	0.031	0.677	-0.062	0.411
<1	5.281						
≥10yrs	4.211						
1-3	5.861						
4-6	7.786						
7-9yrs	5.077						
Associated Hospital		0.126	0.424	0.187	0.1	0.253	**0.001**
BCMH	5.368						
JCPMH	6.377						
MDH	4.810						
ODH	6.016						

Note. BCMH- Bagac Community & Medicare; JCPMH- Jose C Payumo Jr. Memorial Hospital; Hospital; MDH- Mariveles District Hospital ODH- Orani District Hospital

V. DISCUSSION

Although posture is one of the most important pre-analytical variables to be considered during venous blood collection, this variable is most often overlooked by healthcare professionals. In the evaluation of knowledge, the majority of the respondents were aware that hemoglobin (g/L) and hematocrit are affected when subjected to postural changes namely, supine to sitting, supine to standing, and sitting to standing. However, the majority were unaware when it comes to albumin (g/L) and total cholesterol (mmol/L). On the other hand, based on the tally of the correct answers acquired by the nurses and medical technologists, there was a remarkable contrast observed among these healthcare professionals. With this, findings of the study have shown that most of the nurses obtained no correct answers for the knowledge section, while the majority of the medical technologists garnered a perfect score in the knowledge section. This trend may be due to the fact that although both nurses and medical technologists have medical background with patient preparation prior to venous blood collection, this topic is given more emphasis by those in the field of medical technology. It may also be attributed to the significant involvement of medical technologists on the actual venous blood collection. This trend may be due to the significant involvement of medical technologists on the actual venous blood collection. As stated in the Republic Act No. 5527, The Philippine Medical Technology Act of 1969 [15], collecting body specimens, including blood, is one of the competencies and tasks of a registered medical technologist in the Philippines. This can be reflected in the data that majority of the medical technologist respondents were aware of such variation on the specific analytes in different patient positions

throughout blood collection. On the other hand, most of the nurse respondents acquired no correct answers regarding the changes in the routinely measured analytes specifically hemoglobin (g/L), hematocrit, albumin (g/L), and total cholesterol (mmol/L) when the patient is subjected to different positions during venous blood collection. Various aspects can greatly influence this instance. One of which is owing to the nurses' failure to fulfill their obligations to their patients due to a lack of knowledge regarding the necessary patient preparations [16]. Similarly, in a study by Cai, Zhou, & Yang [17], although nurses are primarily responsible for venous blood collection in the China setting, their expertise of the procedure is still regarded inadequate.

The study also revealed that nurses and medical technologists from the selected hospitals in Bataan have a mixed response for attitude and practices regarding the change in analytes when subjected to postural change. Set of questions evaluating and assessing the attitude and beliefs of nurses and medical technologists about the effects of postural changes on desirable bias specifications and pre-analytical errors revealed that most of the answers of selected healthcare professionals were distributed among the rating scale. However, the choices that present the most numbers of respondents were usually on the neutral and agreeing choice. Within the most preferred choices, the medical technologists and nurses were also distributed indicating that they possess mixed attitudes and beliefs towards this topic. The results showed that some of the respondents agreed that certain analytes being tested are affected by the positioning of the patient prior to blood collection while there were also others that were neutral regarding this matter. This indicates that the attitude and beliefs of the nurses and medical technologists towards the different statements concerning the effect of postural change on commonly tested analytes in venous blood collection were not consistent. Furthermore, succeeding statements also determined whether the healthcare professionals take proper measures to lessen the occurrence of pre-analytical errors. Such results may be due to the lack of standardization of protocols during venous blood sampling [12]. Results showed that 41% agreed that an error must be filed and reviewed whenever a pre-analytical error due to postural change occurs. Despite this number, there were still 30% who were neutral with this statement. Quality in the laboratory should be guaranteed so that each process is correctly performed to assure valuable medical decision making and effective patient care [18]. To achieve this, healthcare professionals must address the identification of errors first.

Healthcare professionals must be proficient, skillful and well-trained to perform venous blood collection [19]. Although medical technologists are more trained to perform venous blood collection, other healthcare workers such as registered nurses must also be knowledgeable about this procedure. As reflected on the results, most of the medical technologists answered that they always perform venous blood collection in a week, while few of the nurses stated that they sometimes assist in venous blood collection. In line with this, practices of nurses and medical technologists on patient positioning preparation prior to venous blood collection were also assessed to demonstrate how they frequently engage in venous blood collection, how patients were positioned during venous blood collection, whether or not they allow the patient to rest for a number of minutes, and if they take note of their patient’s positions before and during venous blood collection.

During venous blood collection, it is recommended that both the patient and the phlebotomist sit in a comfortable position. The Clinical Laboratory Standard Institute (CLSI) recommended that patients should be seated or lying down during extraction of blood specimens. According to the World Health Organization (WHO), patients should be comfortable in a supine position, and healthcare professionals consequently presume that these two postural postures, supine and sitting, are identical [10]. In the study conducted by Oladeine et al. [20], uncomfortable positions taken by healthcare personnel could affect the angle of needle penetration into the patient’s skin, increasing the risk of hematoma formation. In the data gathered, a small portion of respondents agreed that they always position the patient to sitting which is consistent with the preferred position as recommended by CLSI. Patients will be positioned in one of the two positions during blood collection, either in supine or sitting. Some laboratory test values are influenced by the patient’s posture before and during blood collection.

According to the study conducted by Lippi et al. [8], the change from supine to sitting position induced clinically significant increase in blood analytes including hemoglobin, hematocrit, albumin, and total cholesterol indicating that patient posture has an influence on laboratory results. As seen on Table 5, the data showed that a few respondents answered that they often position the patient from supine to sitting. Furthermore, it was also stated in the study that changing from a supine to standing position resulted in clinically significant

increase for various parameters such as hemoglobin, hematocrit, albumin, and total cholesterol. However, there are still respondents who answered that they sometimes position the patient from supine to standing.

The parameters with meaningful bias from a sitting to standing position also showed statistically significant differences among the analytes including hemoglobin, hematocrit, albumin, and total cholesterol. However, there are still respondents who allow their patients to be subjected to the said position which likely induces a significant increase in the previously mentioned analytes when compared to the quality specifications.

Moreover, most of the medical technologists have allowed the patients to rest for only 5 minutes instead of the recommended time to rest which is 15 to 20 minutes. The patients should be given ample time to rest in the reference position to prevent variations in the measurement of different blood analytes. Lippi et al. [8] recommended that a minimum period of 15 to 20 minutes is the optimal time to subdue the potential variations caused by venous hydrostatic changes that may occur when the patient position shifts from supine to sitting or upright. This is supported by Lima-Oliveira et al. [12] and the European Federation of Clinical Chemistry and Laboratory Medicine [21] that the patient must be settled in either a supine or sitting position for at least 15 minutes before venous blood collection as certain adjustments in patient position may significantly affect the test results. However, there was only one medical technologist among the rest of the respondents who always practiced resting the patient for 15 minutes prior to venous blood collection. Lastly, the results also revealed that 34% of the healthcare professionals sometimes take note of the patient position before venous blood collection. Overall, the answers of the respondents were also distributed which may imply that their practices vary, and that no standard was normally being followed.

As for the relationship between the demographic characteristics of the respondents with knowledge, attitude, and practices, findings revealed that there were several variables with no significant associations. Due to limited resources in the time of COVID-19 pandemic, the quota was reduced and may have therefore affected the statistical significance between the variables. Moreover, the questionnaire utilized in this study was not standardized, hence the need to take into consideration that this study does not totally exclude any biases on the formulated questionnaire.

The study also found that there was a significant association between the knowledge, attitude, and practices with professional status. This association could be due to the differences in roles between medical technologists and nurses wherein medical technologists play a major role in venous blood collection as compared to nurses. Also, limited training and practices of nurses as compared to registered medical technologists may also be factors that affect their attitude and practices towards the effects of postural change in blood analytes. This association may be attributed to the different protocols and development programs provided by each hospital which the healthcare professionals must follow and participate in. There was also a significant association of practice with gender and associated hospital. In line with this, necessary efforts by the government and institutions to further standardize patient posture during venous blood collection and educate healthcare professionals about the effects of postural change in blood analytes should be done to increase reliability of results and provide optimal patient care. Such evaluations and clear protocols must be addressed to improve knowledge, attitude, and practices of healthcare professionals.

VI. CONCLUSION

Although posture is one of the most important pre-analytical variables to be considered during venipuncture, this variable is most often overlooked by healthcare professionals. Findings of the study have shown that most of the nurses obtained no correct answers for the knowledge section. The study also revealed that nurses and medical technologists from the selected hospitals in Bataan have a mixed response for attitude and practices regarding the change in analytes when subjected to postural change. It is noted however that the majority of the medical technologists garnered a perfect score in knowledge despite the varying responses for attitude and practices. Relationship between the demographic characteristics of the respondents with knowledge, attitude, and practices were also assessed and results reveal that there were several variables with no significant associations. Due to limited resources in the time of COVID-19 pandemic, the quota was reduced and may have therefore affected the statistical significance between the variables. Moreover, the questionnaire utilized in this study was not standardized, hence the need to take into consideration that this study does not totally exclude any biases on the formulated questionnaire.

The study also found that there was a significant association with the knowledge, attitude, and practice with professional status. In addition, there was also a significant association of practice with gender and associated hospital. In line with this, necessary efforts by the government and institutions to further standardize patient posture during phlebotomy and educate healthcare professionals about the effects of postural change in blood analytes should be done to increase reliability of results and provide optimal patient care. Such evaluations and clear protocols must be addressed to improve knowledge, attitude, and practices of healthcare professionals.

In addition, further studies should be done wherein a bigger sample size with improved sampling methods can be used. Furthermore, future studies should consider using a standardized questionnaire, adding more analytes in the study, and developing a scoring system for each of the sections to have a better demonstration of the correct and desirable answers.

Ethical Considerations

This study has been granted ethical approval by the University Of Santo Tomas Faculty Of Pharmacy Research Ethics Committee and is provided with the study protocol code FOP-REC-2021-01-059.

Conflict of Interest

The authors of this study declare that the research was conducted without any conflict of interest.

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