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Knowledge, Attitudes and Practices on Critical Results Management among the Medical Laboratory Technologists in Southern Province, Sri Lanka

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ABSTRACT

Critical results require immediate medical intervention. The study aimed to determine knowledge, attitudes and practices on critical results management among Medical Laboratory Technologists (MLTs) in southern province, Sri Lanka. A descriptive cross-sectional study was conducted using a self-administered, pre-tested questionnaire with the participation of 85 MLTs. The results were analysed using SPSS software version 21. 32.9% of the participants stated that there is a critical result management system in the laboratory and 42.4% stated that there is no critical result management system in the laboratory. Among the participants, 23.5% were not aware whether there is a critical result management system in their laboratory. Study participants were categorized based on their knowledge and practice scores. The mean (SD) knowledge score and practice score of the participants were 42.20(±11.67) and 43.39(±10.66). MLTs exceeding ten years of experience had a significantly higher knowledge score (50.38±10.51) compared to MLTs with less than ten years of experience (40.67±11.07, p=0.008). The MLTs with more than 30 years of experience had a significantly higher practice score (58.25±3.95) compared to MLTs with less than one year of experience (39.30±7.57, p=0.002). There was no statistically significant difference in knowledge score and practice score between MLTs with reference to gender, age or education. The overall knowledge and practice of MLTs on critical results management is not satisfactory. The overall attitudes of MLTs on critical results management are satisfactory. The study emphasizes the value of conducting educational and training programs on critical results management and the evaluation of their effectiveness.

KEYWORDS: *Attitudes, Critical Results, Knowledge, Medical Laboratory technologists, Practices*

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1 INTRODUCTION

1.1 What are critical results?

Laboratory test results which indicate a fatal situation for the patient are called critical results. Considering the critical nature of such results, urgent notification of critical results either to the clinician or patient is necessary. Critical values, panic values and alert values are alternative terms for critical results (Nader Rifai and Tietz, 2019). The concept of critical results was initially introduced by Dr. George D. Lundberg in the year 1972 (Lundberg, 1972). Lundberg defined critical results as "values which reflect pathophysiological derangements at such variance with normal as to be life threatening if therapy is not instituted immediately" (Lundberg, 1990). The process of critical results management includes each and every step occurs between identification of critical value by the laboratory and informing that value to a responsible healthcare professional (Campbell and Horvath, 2014; Campbell et al., 2015). Prompt reporting of critical results is mandatory in medical laboratory accreditation, and in a variety of laws and regulations. The College of American Pathologists (CAP) has included critical results reporting as a part of their checklist in laboratory accreditation (Laboratory General Checklist CAP Accreditation Program, 2014). Further, the critical results reporting is a mandatory part in clinical laboratory standard ISO 15189:2012 introduced by International Organization for Standardization (ISO - International Organization for Standardization, 2012).

1.2 Critical results management practices of medical laboratories

Despite many recommendations, there are evidences that challenging issues are still present in critical results management (Campbell and Horvath, 2014; Campbell *et al*., 2015). Furthermore, studies conducted on critical results management globally have found that there is a lack of harmonized practices; both locally and internationally (Howanitz, Steindel and Heard, 2002; Lippi *et al*., 2007; Milevoj Kopcinovic *et al*., 2015).According to a survey conducted among Portuguese medical laboratories to determine the critical results reporting practices indicated that 82% of surveyed laboratories have laboratory specific procedures for critical results reporting. However, this study revealed that practices, time frames and values vary widely among laboratories in Portugal (Vuljanić *et al*., 2020). Further, the same study reported that there was a variation among the list of critical tests among medical laboratories. Some medical laboratories reported critical results in each discipline; namely haematology, clinical chemistry and microbiology whereas some medical laboratories reported critical results in one or two discipline or in relation to few medical investigations only (Vuljanić *et al*., 2020). Hence, it is very important to identify the critical points as of present and possibilities for improvement. Further, it is very important to initiate the process for future standardization and guideline development.

Therefore, the present study was conducted to assess the knowledge, attitudes and practices of MLTs in both government and private sector laboratories in the Southern province, Sri Lanka on critical results management.

2 METHODOLOGY

2.1 Ethical consideration, study setting and study population

Ethical approval for the present study was obtained from the Ethical Review Committee, Faculty of Allied Health Sciences, University of Ruhuna, Sri Lanka (19.10.2018:3.2). A descriptive cross-sectional study was conducted with the participation of 85 medical laboratory technologists who were working in both private sector and government sector laboratories in Southern Province. The purposive convenient sampling technique was adopted to recruit study participants to represent Galle, Matara and Hambantota districts.

2.2. Data Collection

Data were collected using a pre-tested self-administered questionnaire. The questionnaires were distributed among MLTs after obtaining the consent for participation. Questionnaire consisted of 4 sections. Demographic data was collected in section I. In the section II, knowledge of the MLTs towards critical results management was assessed. Knowledge regarding critical results management, critical values for common analytes tested in haematology, biochemistry and microbiology were assessed. In section III, practices of MLTs on critical results management was assessed. Attitudes of the MLTs on critical results management was assessed using section IV. Demographic data were analyzed using descriptive analysis. Group comparisons were done using independent t- test and one-way ANOVA by SPSS version 21.

3 RESULTS & DISCUSSION

Critical results management is one of the most important laboratory quality indicators since it reflects operational efficiency of a medical laboratory and its clinical effectiveness (Montagu, 2003). Rapid, accurate and precise laboratory tests are vital to diagnose illness and to identify causative factors. Furthermore, accurate and precise diagnostic tests ensure proper dosing of medications, perform surveillance for key diseases, monitor harmful effects of therapeutic medication, determine effective antibiotic therapy and monitor the effectiveness of treatment. Moreover, informing critical values immediately to a responsible healthcare professional is required for proper patient management. Some of the regional and national organizations have given their recommendations to guide medical laboratories in critical results management practices (Laboratory General Checklist CAP Accreditation Program, 2014; ISO - International Organization for Standardization, 2012). Despite this, previous regional and national surveys have recognized large deviation in the practice of critical results management (Montagu, 2003; Sirisali *et al*., 2010; Keng *et al*., 2016).

A total of 85 medical laboratory technologists from both government (n=80) and private sector laboratories (n=5) in Southern Province were included in the present study. Demographic characteristics of the study participants are indicated in the table 01.

Table 01: Demographic characteristics of the medical laboratory technologists who participated in the study

Demographic characteristics		**Percentage of Medical Laboratory Technologists**
Gender	Female	74.1%
	Male	25.9%
Age (years)	21-30	45.9%
	31-40	18.8%
	41-50	21.2%
	51-60	14.1%
Designation	Medical Laboratory Technologist	82.4%
	Senior MLT	11.8%
	Superintend MLT	2.4%
	Laboratory Manager	2.4%
Educational level	Diploma	68.2%
	Graduate	28.2%
	Post Graduate	2.4%
Working experience	< 1 year	38.8%
	1-20 years	18.8%
	21-30 years	37.6%
	>30 years	4.7%

Among the study participants, 14.1% were working in accredited laboratories, 51.8% stated that their laboratories are not accredited and the rest stated that their laboratories are working for process of applying for medical laboratory accreditation. According to the findings of the present study, 32.9% mentioned that there is a critical result list in their laboratory, 42.4% mentioned that there is no critical results list in their laboratory and the rest of the participants had no idea about the critical results list. 32.9% of the participants stated that there is a critical result management system in the laboratory they work in, while 42.4% stated that there is no critical result management system in their laboratory. About 23.5% of the participants had no idea whether there is a critical result management system in the laboratory. In contrast to findings of the present study, a study which was conducted to determine the existing critical results management practice and to give recommendations for critical results management in hematology in 666 laboratories in Europe, America, Australasia and Asia reported that the majority (82.7%) of surveyed laboratories have an existing procedure for reporting of critical results (Keng *et al*., 2016).

3.1 Knowledge of Medical Laboratory Scientists on Critical Results Management

The knowledge scores of the participants were calculated out of hundred and categorized as follows: less than 50 - poor knowledge, between 50-75 -average knowledge, between 75-90 -good knowledge and more than 90 -excellent knowledge. The mean (SD) knowledge score of the participants was 42.20(±11.67). This is not a satisfactory

level. Among the study participants 2.4 %(n=2) were in the good level, 25.9 %(n=22) were in the average level and 71.8 %(n=61) were in the poor level. None of the participants could reach the excellent level. Mean knowledge scores (SD) of the different groups are indicated in the table 02.

Table 02: Group wise knowledge scores

Groups		**Knowledge Score (Mean±SD)**
Gender	Male	43.91±6.96
	Female	41.60±12.91
Age (years)	21-30	40.18±12.32
	31-40	46.88±8.91
	41-50	41.33±14.04
	51-60	43.83±7.27
Designation	Superintend MLT	39.00±0.00
	Senior MLT	41.00±8.06
	Medical laboratory Technologists	43.03±12.18
	Laboratory Managers	31.00±1.41
Educational level	Diploma Holder	42.48±13.27
	Graduate	41.42±6.26
	Postgraduate	52.00±0.00
Working experience	less than 10 year	40.67±11.07
	more than 10 years	50.38±10.51[a]

[a]p=0.008

There was no statistically significant difference in knowledge on critical results management between the MLTs with reference to their gender, age group or education. Further, there were no statistically significant differences in knowledge scores of the MLTs in relation to the accreditation status of the laboratory. MLTs with more than ten years of experience had a significantly higher knowledge score (50.38±10.51) compared to the MLTs with less than ten years of experience (40.67±11.07, p=0.008). This may be due to their experience in the laboratory set-up compared to newly recruited MLTs

3.2 Practices of Medical Laboratory Scientists on Critical Results Management

Participants who obtained less than 50% for the practice score were categorized as not satisfactory, those between 50%-75% were categorized as satisfactory, and more than 75% were categorized as good. The mean (SD) practice score of the participants was 43.39 (±10.662). This is a poor level. Among the study participants, 67.1% were in not satisfactory group, and 32.9% were in satisfactory group. None of the participants could reach the good level. Mean practice scores (SD) of the different groups are indicated in the table 03.

Table 03: Group wise practice scores

Groups		**Practice Score (Mean±SD)**
Gender	Female	42.60±10.16
	Male	45.64±11.96
Age (years)	21-30	40.90±9.95
	31-40	47.00±8.52
	41-50	41.67±10.76
	51-60	49.25±12.85
Designation	Superintend MLT	31.00±0.00
	Senior MLT	50.40±10.16
	Medical Laboratory Scientist	42.99±10.52
	Laboratory Managers	40.00±7.07
Educational level	Diploma Holder	43.34±10.03
	Graduate	43.79±12.67
	Postgraduate	45.00±0.00
Working experience	less than 1 year	39.30±7.57
	1-20 years	45.75±14.35
	21-30 years	44.56±9.86
	More than 30 years	58.25±3.95[b]

[b]p=0.002

There were no statistically significant differences in practice scores of the MLTs in relation to their gender, age group or education. Further, there were no statistically significant differences in practice scores of the MLTs in relation to the accreditation status of the laboratory. According to the finding of this study, management of critical results does not depend on the accreditation status, because it was observed that both accredited and non-accredited laboratories have more similar practices in both reporting and developing their critical results lists. However, having a critical results management policy is one of the requirements of ISO 15189:2012. (ISO - International Organization for Standardization, 2012).

MLTs with more than 30 years of experience had a significantly higher practice score (58.25±3.95) compared to MLTs with less than one year of experience (39.30±7.57, p=0.002). All the participants mentioned that they use telephone calls to inform critical results. Similarly, a number of studies have reported that the telephone is the most frequent mode of notification (Howanitz, Steindel and Heard, 2002; Piva *et al*., 2010; Sirisali *et al*., 2010; Zeng, Wang and Wang, 2013). Similarly, all of the participants stated that MLTs who identified the critical value should be responsible for informing the corresponding value. Similar to the findings of the current study, previous studies reported that most of the notification is performed by technologists or pathologists (Milevoj Kopcinovic *et al*., 2015).

About 43.18% participants mentioned that the laboratory test should be repeated before informing the critical value; 56.81% mentioned that decision about repeating the test is depended on the clinical history of the patient. Previous studies have shown that repeated analysis of samples with critical results rarely produce clinically

discrepant results. Hence, it is unnecessary to repeat each and every test since it delays reporting (Chima, Ramarajan and Bhansali, 2009; Toll *et al*., 2011). Among the study participants, 44.7% stated that they inform critical results within 15 minutes to the responsible clinician, 11.8% stated that they inform critical results before 30 minutes, 2.4% stated that they inform critical results before 1 hour and 40% of them had no idea about the time period within which critical results should be ideally notified. Interestingly, findings of several studies showed that results should be informed within 15 minutes of identification. Further, reporting within 30 minutes was also considered acceptable (Howanitz, Steindel and Heard, 2002; Wagar *et al*., 2007; Rocha *et al*., 2016). About 45.9% of the MLTs mentioned that they ask receiver to read back the value notified once the critical results are conveyed; 49.4% mentioned that they do not practice a read back policy. A study which was conducted to assess the existing practice and to provide guidance in the standardization of hematology on critical results management in medical laboratories from Europe, America, Australasia and Asia has concluded that 77.6% of surveyed laboratories have adhered to a read-back policy (Keng *et al*., 2016). Further, 36.5% of the participants stated that they maintain records of the critical results notified, 56.5% stated that they do not maintain records. Among the participants, 30.6% stated that they review and update their critical results management system, 61.2% stated that they do not have that practice in their systems. A study which was conducted in Portugal stated that majority of participating laboratories maintain records about critical results notified (Keng *et al*., 2016). Moreover, 30.6% of the study participants stated that they review and update their critical results management system. Similarly, a survey conducted on critical results management reported that the majority of participating laboratories review and update the protocol once a year or once in every 2 years (Keng *et al*., 2016).

Among the study participants, 72.9% had used their own experience to establish critical values, 56.5% used data on published literature, 54.11% used international guidelines, 7% used critical values of another laboratory and 49.41% formulated their critical results based on clinician instructions. A survey which has conducted to determine the existing critical results reporting practices among Portuguese Clinical Pathology Laboratories reported that greater part of the surveyed laboratories used previously available literature to develop their critical results list. Moreover, very few laboratories used instructions given by clinicians to develop their critical results list (Vuljanić *et al*., 2020).

3.3 Attitude of Medical Laboratory Scientists on Critical Results Management

Among the study participants, 95.3% believe that notification of critical results is mandatory for patient wellbeing and 4.7% believe that notification of critical results is not essential for patient wellbeing. 61.2% believed that notifying critical results is not an extra burden on the

laboratory and 36.5% of MLTs mentioned that notifying critical results is an extra burden for the laboratory.

Among the study participants, 83.5% stated that lack of communication between the laboratory and the clinicians is an obstacle in management of critical results; 11.8% stated that lack of communication between the laboratory and the clinicians is not an obstacle in management of critical results and 4.7% had no idea on the issue. Furthermore, 84.7% of the participants stated that establishment of a critical results management system is essential for a medical laboratory; 4.7% stated that establishment of a critical results management system is not essential and 4.7% had no idea about establishment of a critical results management system in their medical laboratory. In addition, 90.6% of the study participants were of a view that the MLTs lack knowledge about critical results management and such practitioners need more information about critical results management. Only 9.4% stated that their knowledge on critical results management is adequate. The responses of the majority of the participants for the attitude-based questions were positive reflecting their professional attitude towards the critical results management.

4 CONCLUSIONS

Both knowledge and practice scores of the medical laboratory technicians in the Sothern province of Sri Lanka on the critical result management were poor when compared to the studies performed elsewhere. The attitudes of the MLTs on critical results management were good. Hence, workshops, conferences or awareness programs should be introduced to fill the knowledge gaps that are prevalent. The knowledge score and practice score were significantly higher in experienced MLTs compared to newly-recruited MLTs.

To the best of our knowledge, this is the first study conducted on laboratory management of critical results in Sri Lanka. Despite a majority of medical laboratories in Sri Lanka having a critical results policy, the present study shows that there is a significant difference among the critical results policies. Further, there is a significant variability in critical results management practices and critical results lists. It is necessary and urgent to initiate the process of standardization of laboratory management of critical results. That will improve the diagnostic efficiency. Furthermore, such practices will reduce the delay in the identification of life-threatening conditions in patients. Hence, the urgent need for nationally established policies and procedures for the management of critical results is evident.

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