PREVENTIVE MAINTENANCE PRACTICES SURVEY IN HOSPITAL LABORATORIES IN JAKARTA INDONESIA

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Abstract

During the Covid-19 pandemic, the suitability of the results of a health test is an important note in order to stay healthy and carry out activities in the midst of a pandemic. Measuring a health test can be carried out properly and accurately in a laboratory whose measurement tools are regularly maintained, the results of this health test can be used by consumers to determine the condition of the body and what steps must be taken to get further medical action, in this study we investigated about both internal and external factors from recalibration of medical laboratory equipment as a form of maintenance to obtain appropriate results. With reference to the answers obtained using the likert scale, we hope that the data we convey is more objective and closer to the truth, what our FGD is to find out what factors, both internally and externally, have the most significant impact on the maintenance and recalibration of health measuring instruments, then do a mapping with SWOT to draw conclusions on our research.

Keywords:

Preventive Maintenance, Hospital Laboratories, Survey, Survey Maintenance

1. Introduction

In December 2019, a local outbreak of pneumonia of unknown origin was detected in Wuhan (Hubei, China), and was quickly confirmed to be caused by a new coronavirus (WHO, 2020), namely Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2). The outbreak of the corona virus (Covid-19) which is rapidly spreading throughout the world has made the number of positive cases of Covid-19 increase. Indonesia was first detected with Covid-19 on March 2, 2020, when two people were confirmed to be infected by Japanese citizens.

Transmission of COVID-19 is reported directly and indirectly, directly through droplets when coughing, indirectly when someone touches the surface of an object that has the virus and then touches the mouth, nose, eyes before washing hands. WHO recommends doing physical distancing by keeping a distance and avoiding crowds and using masks (WHO, Covid-19, Geneva, 2020)

The health and hospital industry are one of the many sectors affected by the Covid-19 pandemic. At the beginning of the arrival of the Covid-19 pandemic, many hospitals and health checkpoints were overwhelmed and unable to serve consumers who wanted to check their health for fear of being infected with the Covid-19 virus.
To prevent errors in testing, a preventive maintenance is needed that can continue to maintain accuracy for medical devices that will be used in providing an overview of the health condition of consumers as a reference for them to get advanced health services.

Laboratories in health facilities such as hospitals are media consisting of humans and medical devices, all laboratories experienced a significant increase in testing samples for health conditions compared to conditions before the Covid-19 pandemic, in this case to continue to maintain the quality of their measurements in the midst of the Covid-19 pandemic. 19 required re-measurement and preventive maintenance as the responsibility of the laboratory for its consumers. According to (Rahmat Nurcahyo, 2021) Calibration activities are an important part of the quality infrastructure system because incorrect calibration results can lead to the withdrawal of distributed products, and can lead to customer doubts about the quality of the products. The results of case studies in Indonesia require additional accredited calibration laboratories for more than 49% of the current number. This study took 31 samples of health laboratories in the DKI Jakarta area.

Based on the above background, this study focuses on discussing what factors have the most influence on preventive maintenance in the recalibration process of medical devices in laboratories in DKI Jakarta.

1.1 Objectives

This study is made to determine what factors have the most influence on measurements both internally and externally in 31 health laboratories in DKI Jakarta. From the results of the analysis using the SWOT Matrix method, it can be used as a laboratory reference to standardize.

2. Literature Review

Preventive maintenance (PM) is the regular and routine maintenance of equipment and assets in order to keep them running and prevent any costly unplanned downtime from unexpected equipment failure. Then, the preventive maintenance will be gain from the manual of the vendor or manufacturer itself. However, if calibration cannot solve the operational failure, then with the correspondences of FMEA as guidance to identify the primary and secondary root cause of the problem this step is necessary for personnel to ask for replacement parts (Rahmat Nurcahyo & Ff Farizal, 2017).

Incorrect calibration results can lead to the withdrawal of distributed products, and can lead to customer doubts about the quality of the products. Based on Permenkes Number 43 of 2019 concerning public health centers and Permenkes Number 54 of 2015 concerning medical devices' testing and calibration, all equipment in health service facilities must be calibrated periodically by an accredited laboratory (Nur Aeni, Rahmat Nurcahyo & Djoko Sihono Gabriel,2021). Non-core functions can be outsourced to utilize the different types of knowledge and expertise available in the industry and enhance their own core competencies. Therefore, they can use their limited resources to focus on their core competencies without sacrificing their performance (Rahmat Nurcahyo & Ramdha Dien Azka, 2019)

Likert Scale is a psychometric scale commonly involved in research that employs questionnaires. It is the most widely used approach to scaling responses in survey research, such that the term (or more fully the Likert-type scale) is often used interchangeably with rating scale, although there are other types of rating scales.

SWOT analysis is a tool to determine opportunities, threats, strengths, and weaknesses, which is designed to be used in the early stages of decision making and serves to measure organizational resources, market opportunities, and possible threats (Srivastava et al. 2005).

3. Methods

This paper is using a questionnaire as a survey instrument based on the Likert scale to gather informations from partisipants about variables of Preventive Maintenance and SWOT analysis to get information about how to improve the hospital laboratories in Jakarta region. The data collected from the survey we use will be processed using the likert scale in order to make a SWOT Matrix. Likert scale and SWOT Matrix will be used to get some improvements for health facilities in DKI Jakarta Indonesia

4. Data Collection

From the questionnaire filled by the partisipants from 31 hospital laboratories, the data of distribution of medical laboratory personnel analysts based on DKI Jakarta region shown at Table 4.1

Table 4.1 Distribution of Medical Laboratory Personnel Analysts based on DKI Jakarta region

Medical Laboratory Personnel Analysts Area	Participant Quantity (persons)
Hospitals in West Jakarta	4
Hospitals in North Jakarta	5
Hospitals in East Jakarta	13
Hospitals in Central Jakarta	5
Hospitals in South Jakarta	4

The swot matrix analysis is obtained from the results of the discussion group forum between researchers and medical laboratory technical analysts those involved in research.

Table 4.2 SWOT Matrix for Hospital Laboraroties

IFAS / EFAS	**STRENGHTS:** - Daily Maintenance - Competent medical laboratory analyst - Competent medical device technician - Good management laboratory	**WEAKNESS:** - Not checking outside the jobdesk - Ignore when there is a broken tool warning - The condition of medical devices and reagents affects the results of the examination - No maintenance record - Can't save medical devices spare parts
OPPORTUNITIES: - Adding skills to replace parts that are not feasible - Sterile laboratory - Not all medical devices are in daily maintenance	**Strategy SO:** - Can replace or repair if the medical devices is damaged - Keep checking or maintenance on tools that don't require daily maintenance - Briefing before work - Write an opera book every shift change - Maintain cleanliness - Do not increase the temperature of the air conditioner which causes the appliance to heat up quickly	**Strategy WO:** - Increase accuracy and awareness outside the job desk to avoid damage early on the medical devices and inaccurate results - Training to repair broken medical devices - Can repair / replace damaged spare parts - Make a minimal mark in the regane place - Make a maximum limit sign in the waste - Work with caution when near hazardous and flammable reagents
THREATS: - Can't repair the medical devices if it's broken - Don't want to add skills to replace parts - Laboratory is flammable or explosive - Medical devices are easily damaged if the waste is full or the reagents run out	**Strategy ST:** - Perform training on simple repairs on medical devices - Make a schedule and fill out the daily maintenance checklist sheet - Make a room that is impervious to explosion or fire to avoid fire from dangerous reagents - Make symbols or signs that are attached to flammable or explosive reagents	**Strategy WT:** - Evaluation of equipment repair and maintenance training - Increase collaboration within the laboratory - Monitoring maintenance

Source: Data Analysis

5. Results and Discussion

5.1 Numerical Result

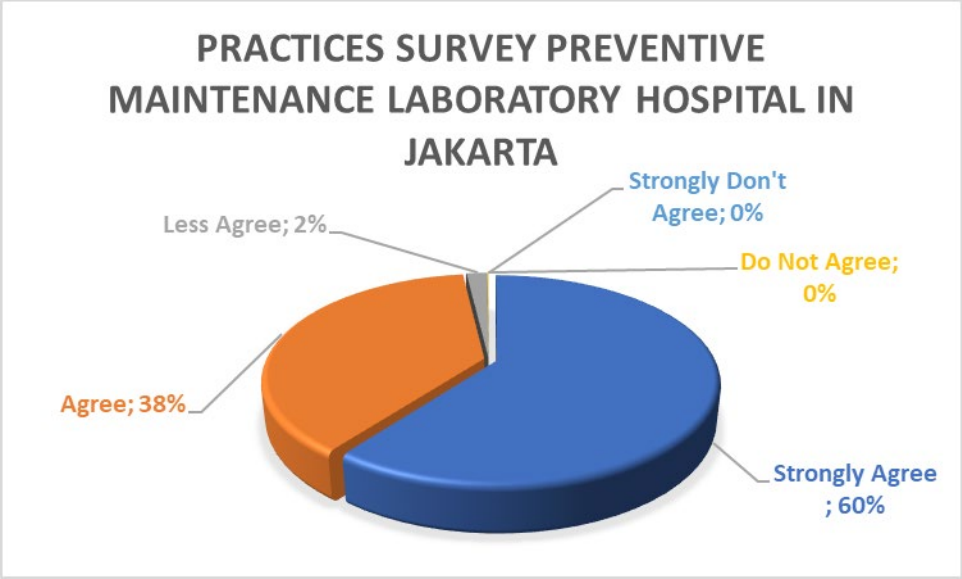
The data is processed from the results of the questionnaire answered by 31 medical laboratory technical analysts spread over five areas in Jakarta. The questionnaire includes 7 preventive maintenance factors, each factor has 3 question variables.

Table 5.1 Top 5 based on questions on each Preventive Maintenance factor in Hospital Laboratories

No	Question	Participant Response (%)
1.	Control	80,6
2	Do not use expired/damaged reagents	77,4
3	Checking reagent expiration date	71%
4	Daily running control	67,7%
5	Check list of tool performance checks	64,5 %

Source: Data Processing

5.2. Graphical Result



Source: Data Analysis

Figure 5.1 Preventive Maintenance Survey Practices Percentage

From the results of data collection and processing, the Top 5 sequentially factors/variables of Preventive Maintenance in the Hospital Laboratories in DKI Jakarta are obtained, namely:

1. Compliance test
2. Condition monitoring
3. Autonomous dan schedule Maintenance
4. Realibility
5. Inspection

The explanation for each factor is as follows:

1. **Compliance Test:** a test used to show whether a characteristic or property of an item meets the specified requirements
2. **Condition Monitoring:** an activity, performed either manually or automatically, intended to measure at predetermined intervals the characteristics and parameters of the true state of an item
3. **Autonomous and scheduled maintenance**: minor maintenance activities performed by equipment users and maintenance carried out according to a set time schedule or set number of units of use
4. **Reliability:** the ability of an item to perform a required function under certain conditions for a certain time interval
5. **Inspection:** conformity checks by measuring, observing, or testing the relevant characteristics of an item

Meanwhile for the Insurance Spare Part factor which is a spare part that is usually not needed during the useful life of the item but its unavailability will cause unacceptable downtime due to its supply and the Maintenance Record factor which is part of the maintenance documentation that contains a history of all data related to maintenance for a particular product. the items are considered by the participants as a factor that is mostly the responsibility of the tool supplier and its technicians.

5.3. Proposed Improvements

Table 5.2 Data on the number of health facilities in DKI Jakarta 2018-2020

Health Facilities	Number Of Health Facilities In DKI Jakarta Province		
	2018	2019	2020
1. Hospital	170	190	170
-Beds	27074		22209
2. Hospital/Maternity Hospital	20		19
-Beds	1599		1458
3. District Health Centre	44	44	44
4. Village Health Centre	291	271	288
5. Primary Clinic	527		
6. Specialist Clinic	86		
7. Laboratories	20		
8. Pharmacy	2860		
9. Integrated Healthcare Centre	4248	4470	4469

Source: Public Health Office of DKI Jakarta Province

Referring to the data on the number of hospitals in DKI Jakarta above, further research can be developed by increasing the number of participants based on the minimum sampling requirement that adheres to the principle of representation

so as to provide results that are more able to provide an overview of the condition of preventive maintenance practices in all hospital laboratories in DKI Jakarta Province.

5.4. Validation

Preventive maintenance activities in hospital laboratories are an important part of the quality infrastructure system because incorrect calibration results can lead to wrong medical diagnoses, can lead to medical diagnoses being issued by the hospital laboratory and the most dangerous thing can be detrimental to the lives of hospital patients. This repeated incident can result in a decrease and even loss of patient confidence in a hospital which in the end makes people no longer want to get health services at the hospital and of course directly disrupt the hospital's business.

The SWOT matrix can be the basis for determining the right strategy to improve the quality of Preventive maintenance in hospital laboratories. The hospital together with suppliers of medical equipment used in hospital laboratories must implement strategies that have been formulated regarding comprehensive and measurable maintenance strategies so that they can provide accurate results related to medical testing of patients who use hospital laboratory services according to the needs of the parav. patient. This must be done to ensure the patient's comfort because after all the results of medical testing by the hospital laboratory will be the basis for doctors to provide recommendations for what medical follow-up needs to be done by a patient.

Further research can be done by benchmarking preventive maintenance practices in hospitals with preventive maintenance practices in independent clinical laboratories.

6. Conclusion

The top 5 based on questions on each Preventive Maintenance factor in Hospital Laboratories include Control (80.6%), Do not use expired/damaged reagents (77.4%), Checking reagent expiration date (71%), Daily running control (67.7%), and Check list of tool performance checks (64.5%).
From the SWOT Matrix can be seen that Hospital Laboratories can use the WO (Weakness - Opportunity) strategy to strengthen their performance.

Preventive maintenance can be applied properly in the laboratory if it is accompanied by a strategy that has been analyzed using the SWOT matrix, namely briefing, checking equipment that does not require daily maintenance, paying more attention to the placement of hazardous reagents, for technical analysts for medical laboratories to increase skills in treating and replacing spare parts of damaged laboratory equipment and increase awareness to remain responsible and thorough and careful in working, for laboratory coordinators to evaluate activities and improve cooperation in the laboratory.

To prevent errors in testing, a preventive maintenance is needed that can continue to maintain accuracy for medical devices that will be used in providing an overview of the health condition of consumers as a reference for them to get advanced health services, in this study we used the SWOT method to map out what should be of more concern as a reference for carrying out preventive maintenance that can extend the life of measuring instruments and the accuracy of measurement results. Moreover, the large demand during the pandemic makes the laboratory know and anticipate damage so as not to result in measurement errors.

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Biographies

Gandi Bintang is currently attending a Master Degree program in Industrial Engineering at Universitas Indonesia started in September 2020. Due to the conditions of the Covid-19 pandemic, this total program lecture was conducted online. He completed his undergraduate study program from the Industrial Engineering Universitas Sumatera Utara, Medan from 1999-2005. In addition to actively studying for Master Degree, he is also still actively working in a paper and flexible packaging factory in the Supply Chain Management Department. Apart from studying and working, he also runs a small culinary business from home

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