

Cell and Molecular Biology: How the Role of Technology in Medical Laboratories

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ABSTRACT

Medical laboratories have a strategic position because they support several important roles, especially in terms of examination services in the fields of Hematology, Clinical Chemistry, Clinical Microbiology, Clinical Parasitology, Clinical Immunology or other fields related to individual health interests, especially to support efforts to diagnose disease, cure disease and health restoration. This research was conducted by conducting a search on several relevant literature studies with the focus of research focused on the role of technology in medical laboratories, with the results of the study explaining that the information system contained in a medical laboratory certainly involves several important elements in it such as, patients, laboratory staff, and a medical laboratory technologist. Providing detailed information is one of the efforts that must be made for the satisfaction of patients in accessing various information related to the history or clinical symptoms that they are suffering from. In addition, medical laboratory information systems are needed to improve the performance of employees and health organizations with the aim of increasing work productivity, adding new computerized integrated services to make it easier for users to collect, process and present data in as much detail as possible, easy to understand and timely. The medical laboratory as a medical support service unit is expected to be able to provide accurate and accurate information about the laboratory aspects of specimens/samples whose tests are carried out in the laboratory by a Medical Laboratory Technologist (ATLM).

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1. Introduction

The use of technology has been seen and needed to be carried out in managing the number of laboratory data and information transactions in various hospitals and other health services, starting from recording the number of patients with their data, requesting examination benchmarks to routine reporting both daily and monthly for patients. It is common knowledge that the mechanism of recording and reporting work is indeed a burden for laboratory workers in all hospitals. The use of computerized information systems can reduce the burden of reporting and providing information for the purposes of various parties through automation mechanisms controlled by information technology. The development of the application of the laboratory management information system can in fact reduce time and also costs, especially for hospital staff [1].

In addition, the computer system can also function for several activities related to laboratory actions, including (1) reducing sample processing time in the laboratory (2) increasing the quality and efficiency of work in the laboratory (3) increasing the success power and increasing the safety of laboratory personnel (4) Minimizing errors by medical personnel (5) Improving specimen handling, which in turn has a positive impact on patient safety. In the medical world, the use of

information systems is deliberately designed to speed up the work of health workers in analyzing various daily activities, for that the use of this information system allows health workers to perform more tests in a short time and get very good results. accurate and reliable as laboratory systems in general.

The laboratory is now organized with a program and computer system that exchanges patient data, test requests, and test results, which is better known as a laboratory information system. This system allows the laboratory to order the correct test requests for each patient, maintain individual patient data and specimen history, and can help ensure even better quality results. An information system in the laboratory world is an organization that brings together the daily transaction processing needs, supports managerial operations and strategic activities of an organization with the required reports. The use of this system is one solution to overcome some of the difficulties often faced by medical personnel in determining strategies and making decisions [2].

The health laboratory as a medical support service unit is expected to provide accurate and accurate information about the laboratory aspects of specimens/samples whose tests are carried out in the laboratory by a Medical Laboratory Technologist (ATLM). One of the main tasks and functions of a medical laboratory technology expert is to master science related to the main tasks and functions in the laboratory and to apply the Standard Operating Procedures (SOP) that have been determined. Medical Laboratory Technologists or ATLM are health workers belonging to biomedical engineering personnel. Based on the Minister of Health Regulation Number 42 of 2015 Medical Laboratory Technology Expert (ATLM) is defined as a person who has graduated from Medical Laboratory Technology Education or Health analyst or medical analyst and has the competence to perform analysis of fluids and tissues of the human body to produce information about individual and community health in accordance with with the applicable laws and regulations [3] [4].

Based on information obtained from the Indonesian Health Human Resources Development and Empowerment Agency, it is known that in 2018 the number of biomedical engineering personnel throughout Indonesia was only 32,308 people, of course this value is very low when compared to several other health workers such as nursing (296,876 people), midwifery (163,541 people), medical (103,700 people), and pharmacy (38,829 people). Nationally, the ratio between ATLM and 100,000 population in Indonesia is 1:18, this figure is not yet balanced, although in reality ATML has very wide job opportunities, but ATLM is not as popular as its colleagues in professions such as doctors, nurses and midwives. This can happen because ATLM is a health worker who does not directly interact with patients, besides the change in the nomenclature of the name of the Health Analyst department to Medical Laboratory Technology also makes the popularity of the Medical Laboratory Technology department quite low in Indonesia [5].

Medical laboratory technology experts, previously known as health analysts, are health workers who have the competence to collect samples and perform tests on body fluids, tissues and other substances, besides that they are also capable of operating sophisticated computerized laboratory equipment with several other technological devices. According to the Minister of Health of the Republic of Indonesia No. 411 of 2010 every clinical laboratory must meet the labor requirements, including having at least two medical laboratory technology experts, four for middle general clinical laboratories, and six for general clinical laboratories. must carry out workload analysis and manpower requirements planning that refers to the volume and complexity of the work [6].

The development of increasingly advanced technology in the era of globalization as it is today has become the most important part of various aspects of human life, because there are so many conveniences offered to its users, for example the use of laboratory information systems in the health sector. As one of the public services that carries out the most examinations in the fields of hematology, clinical microbiology, disease diagnosis, disease healing and health recovery, medical laboratories are required to improve the performance of employees and health organizations, especially in terms of work productivity, adding a new integrated service system. systematic and not done manually in order to make it easier for officers to collect, process and present data in a timely manner [7].

Thus, an in-depth analysis of the health laboratory information system is needed that is more renewable and can simplify the way it works, because essentially the purpose of utilizing technology or information systems in health laboratories is to provide satisfaction to all users. In

Indonesia itself, there are still many medical laboratories that work manually and do not fully involve the role of technology, as a result, the work role of officers is hampered and far from satisfactory. Efforts to utilize information technology in medical laboratory facilities must be carried out as quickly as possible. These activities can be started from, speed of service, ease of communication with patients, connecting laboratory equipment in computer systems and accelerating laboratory services, so as to optimize the use of laboratories to be more leverage. So based on the description and description of the background above, the researcher is interested in researching the role of technology in medical laboratories in Indonesia.

2. Methods

Researchers conducted a literature search that was relevant to several events related to the role of technology in medical laboratories. In carrying out this research, the researchers also used descriptive methods, namely to collect data on indicators related to the focus of the problem being sought by the researchers. The search was carried out through electronic databases such as (Pubmed, Science Direct and Google scholar) as well as a review of several previous articles that were still relevant, while the inclusion criteria used were (1) Research articles published in the last 10 years, namely in 2010 to 2020 (2) The research article discusses about cell and molecular biology, laboratory technology and medical laboratory technology experts. (5) Research articles are published in Indonesian and/or English. (6) The full text of the article can be accessed easily. The selection process was carried out through title and abstract screening so that approximately 20 articles were obtained that were relevant to the criteria that the researchers were looking for. Then an assessment of the feasibility of the article was carried out by reading the full-text and sorting the articles according to the focus and objectives of the literature review, the results obtained 8 articles that were relevant and qualified, extracted using design, sample, instrument and analysis methods [8].

TABLE 1.
LITERATURE STUDY FINDINGS

Name of researcher (Year)	Article Title	Results
Siti Munawaroh, Isna Lailatur Rohmah, Muhammad Rizki Kurniawan (2018)	Knowledge and Attitude of Medical Laboratory Technologists to Standard Operating Procedures for Handling Sputum Samples	There is a significant relationship between ATLM knowledge and attitudes towards the application of SOPs for handling TB sputum samples. The results of the univariate test showed that based on the sub-variable categorization of ATLM knowledge of SOPs for handling sputum samples, the frequency distribution based on categories was 46 or 100% of respondents had good knowledge regarding the handling of sputum samples. Frequency distribution based on attitude category. showed a positive attitude as many as 4 or 8.7% of respondents while a very positive attitude was shown by 42 or 91.3% of respondents.
Subekah Nawa Kartikasari (2019)	The role of the laboratory as a research center to improve the quality of educational institutions in the THP department	Laboratory management is a process of utilizing resources effectively and efficiently, related to the management and use of laboratory facilities so that all activities carried out in the laboratory can run smoothly to improve laboratory quality. The quality of laboratory management at THP_TP_FTP has good indicators with the availability of chemicals, as well as supporting tools. Equipment maintenance and calibration need to be improved. The level of work safety (K3) and waste management is not yet available.
Mufidah (2021)	Improving the image of the medical laboratory technology study program through professional webinars	This service is carried out to improve the image of the Medical Laboratory Technology Study program as an option for health studies. Even though the webinar went smoothly with a large number of participants, the webinar held did not have a significant impact on the number of enthusiasts of the study program. Lower popularity compared to other Health majors cannot be increased from just one socialization program. Continuous efforts are needed to improve ATLM's image in the eyes of the public so as to increase

Name of researcher (Year)	Article Title	Results
Benuriadi, Osman Sianipar, Guardian Yoki Sanjaya (2020)	Information systems in laboratory services	its popularity as a choice of health workers. The basic pattern of an information system in the laboratory that was developed in a participatory manner by HR in RSUD Praya shows benefit for all user groups. However, limitations information system infrastructure is still an obstacle to the wider use of the basic pattern. By paying attention to the power of opportunity. With this information technology, it is important for regional general hospitals to take laboratory management information systems. However, the shift from the old system to the new one must be done gradually with good assistance to face resistance user. The power of opportunity to link laboratory modalities to archetypes will be further improve the role of information technology in the management of laboratory services. A Executive dashboard management in graphical form needs to be added to display real time instructions for laboratory service performance for hospital managers.
Mohammad Andriyas ,Anjik Sukmaaji, Tan Amelia (2018)	Design and Build a Web-Based Clinical Laboratory Information System at SAFIRAH Sidoarjo's Main Clinical Laboratory	After testing and evaluating the data processing system at the SAFIRAH Sidoarjo clinical laboratory, it can be concluded that the following conclusions are drawn: 1. The system created is already available handle data processing integrated administration well. 2. This system can already provide reports on a regular basis so that manager can evaluate each end month or year end.

3. Results and Discussion

3.1 Information needs in the management of medical laboratories

Clarity or availability of information is basically very necessary to support the service and management of medical laboratories. Some of the important information needed, among others, is the cost of laboratory examinations, calculation of facilities and services, preparation of reports on laboratory examination results and routine reports for the benefit of managerial management. However, some special explanations are needed for certain groups, for example information on the use of reagents in patients, this can also be used as a plan, as well as for an assessment of the number of certain tests that have been carried out [9].

This is of course very important for the laboratory unit as a controller of unrecorded or missing examinations. Clarity on the length of time for laboratory examinations will also be very helpful for both groups of medical staff and laboratory users to estimate laboratory results that have been carried out. Through observation of laboratory service forms, service flow, types of laboratory examinations, number of visitors, and identification of resources, it is possible to know a number of data and information needed to support the management of Laboratory Units in accordance with established procedures [10].

TABLE 2.
DATA AND INFORMATION REQUIREMENTS BASED ON SYSTEM USER GROUPS

No	System user group	Data and information needs
1	Hospital Manager (Head of medical services, Head of medical support section)	a. Number of benchmarks for laboratory tests b. Reagent usage information c. Laboratory test sender data d. Laboratory test information that cannot be checked e. Information on the timeliness of laboratory examinations (difference in length of time) inspection based on predetermined standards) f. Number of patient visitors to the laboratory
2	Laboratory Manager (Head of Laboratory Installation,	a. Patient identification information b. Laboratory test results

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No	System user group	Data and information needs
	Analyst or laboratory personnel, laboratory administration staff)	c. Number of laboratory facilities and services d. Reagent usage information e. Laboratory test information that cannot be checked f. Information on the timeliness of laboratory examinations (difference in length of time) inspection based on predetermined standards) g. Number of patient visitors to the laboratory
3	Medical Staff (Doctor on duty at the hospital, Chief hospital room)	a. Laboratory test results b. Laboratory test information that can be checked c. Information on laboratory examination fees d. Information on the results of laboratory examinations e. Information for sending laboratory examination services
4	Patient/patient visitors Laboratory (Internal hospital patient, Hospital external patient, General public)	a. Laboratory test results b. Laboratory test information that can be checked c. Information on laboratory examination fees d. Information on waiting time for laboratory examination e. Information on the results of laboratory examinations

The information generated through the above characteristics is related to the ease of reach, useful laboratory information for all visitors so that all processes involved in it can be carried out more clearly and completely. With various laboratory service activities in hospitals, it will be more efficient and effective, especially for administrative officers and laboratory officers in terms of data collection, analysis, report generation to providing information for decision making. This research is also supported by several findings from literature studies related to the dimensions of laboratory management, such as the research according to Sutrisno in 2010 where the design of medical laboratory system users can be measured from laboratory organization, laboratory administration (inventory of laboratory equipment and facilities, administration of laboratory use) [11]. Administration of borrowing laboratory equipment, administration of maintenance of laboratory equipment) and work safety in the laboratory. His research also reports that there is a significant contribution between laboratory management and the effectiveness of the learning process because there is a positive influence on the level of laboratory management [12].

Then the results of Anggraeni's research in 2013 which in his research explained that good laboratory management was able to support the performance of users and laboratory managers [13]. In addition, the lack of laboratory facilities, as well as the lack of facilities and infrastructure to support laboratory activities and laboratory assistants who do not master basic laboratory techniques and manage laboratories can disrupt the process of implementing services to patients. All activities carried out in the laboratory can run smoothly, through a good laboratory operational management system and in accordance with local conditions.

TABLE 3.
MEDICAL LABORATORY FACILITIES AND INFRASTRUCTURE

Input	Process	Output
Organization	Control	Quality Inspection
Space and Facilities	Quality	Patient Satisfaction
Equipment	Supervision	
Ingredients	Evaluation	
Inspection Method		
Recording and reporting		
Quality of occupational health and safety		

User acceptance is an important issue in the successful implementation of a computerized system. Various system implementation failures are due to user resistance which is possible because the system tends to burden users compared to helping with their daily routine activities. For this reason, user acceptance at the assessment stage is carried out by assessing user

perceptions in terms of affordability, relevance, clarity and completeness of the basic pattern information being carried out. Thus the basic pattern of the information system for the new medical laboratory was made to be well received by all respondents. Computerized systems can provide and manage data more quickly and easily, besides that the information system is declared of quality if the information produced can satisfy patients, therefore improving the quality of information in medical laboratories is the most important component, especially in improving the quality of services in hospitals. There are other benefits that users get related to the development of information systems in medical laboratories, which can facilitate the work of both laboratory administration officers and analysts in serving patients/patients. Basic pattern data and information can also help or support management activities in order to improve the quality of laboratory unit services by optimizing electronic-based computer functions as a provider of laboratory data or reports [14][15].

The move from the old system to a new, more renewable method must be done gradually and with great care. Switching can be started from the features that are the easiest and don't burden the user. Although it is carried out in stages and on request for limited laboratory examinations, all user information needs must be met by the laboratory system. Another advantage with the existence of a computerized system is that errors in writing laboratory test results can be significantly reduced. In addition, the presentation of both laboratory results and routine reporting can be done more quickly, so that it has a strong opportunity to increase the overall success of the medical laboratory unit, besides that laboratory services with information technology can also increase customer satisfaction through clarity of information, reduce production costs that are expensive. impact on increasing the competitiveness of hospitals.

4. Conclusion

The medical laboratory is a very important component in disseminating information about health, which is equipped with various biomedical instruments, equipment materials and reagents to carry out various examinations, one of which is biological specimens. Medical laboratory information systems are very necessary to improve the performance of employees and health organizations with the aim of increasing work productivity, adding new computerized integrated services to make it easier for users to collect, process and present data in as much detail as possible, easy to understand and timely. The medical laboratory as a medical support service unit is expected to be able to provide accurate and accurate information about the laboratory aspects of specimens/samples whose tests are carried out in the laboratory by a Medical Laboratory Technologist (ATLM). One of the main tasks and functions/obligations of ATLM is to master knowledge related to the main tasks and functions in the laboratory and to apply the correct Standard Operating Procedures (SOP). By taking into account the power of information technology opportunities, it is important for medical laboratories to be able to make the best use of them. The strength of the opportunity to link medical laboratory modalities with the basic pattern of computerized technology will further improve the role of information technology in the management of laboratory services.

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