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**TURNAROUND TIME OF DIAGNOSTIC LABORATORY RESULTS AS A
QUALITY IMPROVEMENT TO PATIENT SATISFACTION: A
SYSTEMATIC LITERATURE REVIEW**

Purbosari¹, Ede Surya Darmawan²

¹ *Magister Students of Hospital Administration Studies, Faculty of Public Health, Universitas Indonesia*

² *Lecturer, Faculty of Public Health, Universitas Indonesia*

*Corresponding author's email: purbosari@ui.ac.id

ABSTRACT

Background: *Laboratory information is increasingly recognized as a crucial factor to reduce diagnostic uncertainty and enhance quality care. Medical diagnoses and effective treatments depend on the accurate and timely reporting of laboratory test results, and the trend toward disease prevention and personalized care calls for more complex and effective tests and biomarkers. Today's clinical laboratory provides essential information for the diagnosis, monitoring, screening, prevention, early diagnosis, tailored treatment and more effective monitoring of human diseases. Response Time is an action that is carried out quickly and precisely to handle patients. While an ability for fast (responsive) service is the response time taken to the patient when the patient arrives to get a response. Response time is one indicator of service quality that affects patient satisfaction.*

The laboratory turnaround time is the starting point for the time of for receiving the sample, the time for registration, or the analytical sampling time and end point for analytical completion, the time for verification of results, the transfer of results to the time for medical record, and the time for report printing.

Methods: *In this systematic review, we searched Pubmed, Science Direct, and Scopus database published from January 2010 to March 2019. The included studies were broadly classified as reporting from healthcare/hospital and international survey. There were 21 studies that met keywords searching criteria. Then we analysed based on the content of studies, matching to our objectives*

Results: *Out of 21 identified studies, we recognized 6 scholarly journals of turnaround time diagnostic laboratory results as quality improvement of medical care and medical diagnoses and that affects patient satisfaction. These studies concluded that turnaround time becomes a key element to patient safety that contributes to patient satisfaction.*

Conclusion: *Turnaround time as one of quality indicator in a laboratory setting. Improvement in this parameter could give benefit to the patient and deliver service excellence. Standardized reporting method is mandatory as it will not only allow the accreditation of clinical laboratories according to the International Standard but also to assure guidance for promoting improvement processes and guaranteeing quality care to patients and patient satisfaction.*

Keywords; *diagnostic laboratory; turnaround time, quality*

INTRODUCTION

Patient satisfaction is a new emerging concept to measure healthcare quality. It has many determinants such as age, better health status, and patient experience in healthcare.[1] This measurement was an important part of healthcare accreditation based on survey toward the customer. Since the main customer of healthcare is patients, then the survey was conducted to patients.[2] The first patient satisfaction survey was conducted in Hong Kong among patients discharged from the hospital.[3]

Philosophically, patient satisfaction was derived from Maslow concept. In the classical paper, Maslow described human needs in hierarchy. Based on this concept, we could say that every patient has different needs, depends on the lowest level they get.[4]

Because patient satisfaction was a new concept, we found it difficult to formulate it. The best approach was using a questionnaire that consists of every aspect of needs. Surveyor needs to look up in patients attributes, such as affective support, health information, decision control, and professional competencies. All of them give us a big picture of how healthcare quality benefits and satisfy patients.[5]

The laboratory is a part of healthcare. This part takes important in physician decision toward patients. The demand of patient toward laboratory result is the accurate and fast result. In a management concept, the fast result is called low turnaround time.[6] Some accreditation obligates that turnaround time as low as possible. Turnaround time is defined as the elapsed time between specimen collection until the result obtained by the clinician.[7]

Turnaround time assessment should be one indicator of quality insurance in a laboratory setting.[8] Improvement in this point will affect patient satisfaction.[9,10] This review will explore the role of turnaround time in patient satisfaction.

METHOD

Search Strategy

In this review, we located studies using electronic database such as Science Direct, SCOPUS, and Pubmed published between 2010 and 2019. Selection of eligible articles for this study using the PRISMA (*Preferred Reporting Items for Systematic Reviews & Meta-Analyses*) protocol. Irrelevant articles through the process of identification, screening, and eligibility were eliminated.[11,12]

Document Selection

The research was a systematic review through article review to analyze the turnaround time as a quality indicator for patient satisfaction. The article inclusion criteria used was "turnaround time" AND "laboratory" AND "patient satisfaction" "quality" keywords, while the exclusion criteria were articles that are not full text and not a management article. Article searching was limited to English articles accessed from internet searches from databases, namely: ScienceDirect, Pubmed, and Scopus. Articles that meet the inclusion criteria were collected and examined systematically. Exploring literature was focused on the articles published from 2010 to 2019. Exploring process was explained in figure 1. The exploring process obtained 21 articles that met the requirements for inclusion and exclusion criteria. 6 articles were found using the last filter which was titles and abstracts selection and examination.

Data Extraction

Extraction and data analysis were performed in the individual-level studies, we then classified the articles into six separate groups, as presented on the table. The process was showed in Figure 1.

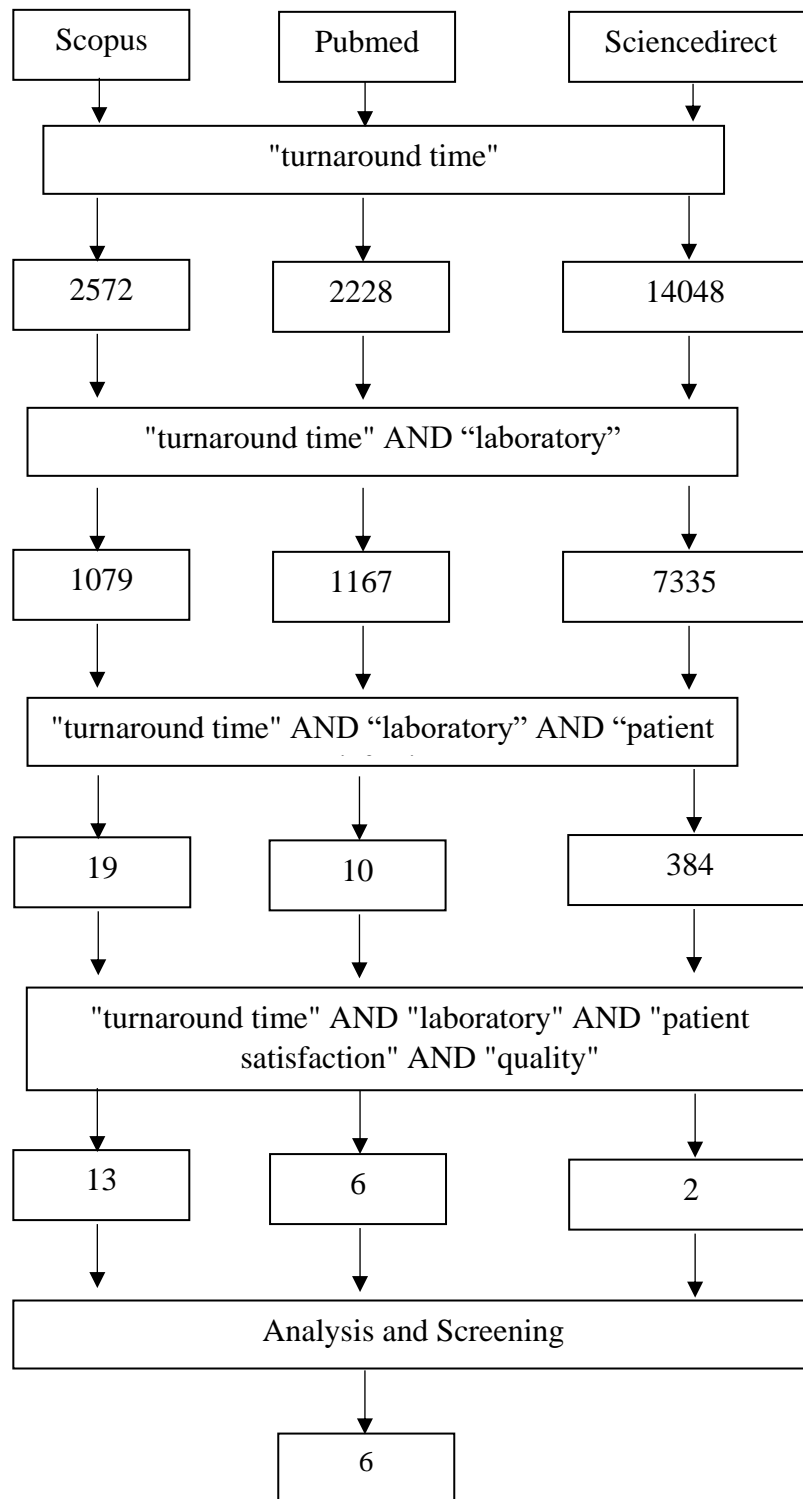


Figure 1. Literature searching process

RESULTS

Data extraction was done by analyzing the data based on the name of the author, title, purpose, research method and results. This is called grouping important data in the article. The results of data extraction can be seen in the table below.

Koh et al (2014) identify some points in quality indicators that influence patient satisfaction such as laboratory information system, laboratory users' guidebook, critical value notification, specimen collection and delivery process, laboratory facilities and equipment, consignment laboratories, phlebotomy services, turnaround time for test results, quality of test results, specialty of laboratory personnel, responsiveness of laboratory personnel, courtesy of laboratory personnel, communication with laboratory personnel, cost of laboratory tests.[13]

Turnaround time is an important indicator of performance and it is even seen as a "necessary condition for trust between patient and physician". Turnaround time in laboratory comprises of a fixed component, which is assay dependent (that is, the time which is required for analyzing a sample), and a variable component (the time which is taken to receive the specimen and order, and to post the result).[14] Together with accuracy, turnaround time will help the clinician make a fast decision in hospital care.[7] Delayed in laboratory result contributes to the mortality rate.

Research carried out by Rooney and Schilling (2014) indirectly showed that rapid laboratory result was needed by the clinician. It is unavoidable that this study carried out in the emergency department setting which was overcrowded. Quality improvement using point of care testing (POCT), a laboratory test in patient bedside, provides rapid laboratory result. This will reduce overcrowding in the emergency room. The physician could save more time to save other patients. Some study revealed that overcrowding contributes to patient death. This benefit of POCT helps to decrease in delay treatment initiation. This study also indicated that POCT could save 46 minutes in turnaround time. Issue point of using POCT is about analytical performance. Laboratory stewardship needs to take attention to this aspect.[15]

Turnaround time will get attention when the magnitude of the problem is big. Shiferaw and Yismaw (2019) described delayed turnaround time in Ethiopia. Delayed turnaround time causes delayed treatment that contributes to treatment failure in HIV cases. Improvement in laboratory management could cut off this delay and increase patient adherence to a counselor. In tuberculosis cases, this delay contributes to the development of drug resistance. This cases impacted to failure to treat. In patient satisfaction context, delayed turnaround time gives a bad stigma for healthcare services. High workload supposed to contribute to this delay. The key point learned from this study that every parameter has a different turnaround time target. This target should be discussed with a clinician as laboratory client to meet their expectations.[16]

Kaushik et al (2018) proved that 1-minute decrease in laboratory turnaround time was associated with 0.50 minutes of decrease in emergency department length of stay. Turnaround time in the emergency setting is a key contributor to the emergency workflow. Quick turnaround of test results in patients admitted to the emergency department contributed a faster therapeutic intervention and better patient outcomes. Reduction in the emergency department length of stay can have several other positive impacts on the patients and hospitals: wait time for new patients awaiting an empty bed, a number of patients who left without being seen and ambulance diversion rates may be reduced, with attendant potential improvements in patient satisfaction and outcomes. Overall this improvement gives the better acceptance of health care.[17]

Table 1. PRISMA element of literature review

No.	Names of researcher & year	Research titles	Journals	Objective	Methods	Result
1.	Rooney & Schilling (2014)	Point-of-care testing in the overcrowded emergency department- can it make difference?	Critical Care	This study aimed at making the highlight of point-of-care testing uses in the emergency department and give benefit to patient care	Review	Overcrowding represents a serious impediment to the ability of the ED to provide the public with quality emergency care. Prolonged waiting times and treatment delays can have substantial effects on patient satisfaction and outcomes. Increased mortality rates in the ED suggest that overcrowding should be treated as a serious public health concern and not solely as a the problem of departmental efficiency.
2.	Shiferaw & Yismaw (2019)	Magnitude of delayed turnaround time of laboratory result in Amhara Public Health Institute, Bahir Dar, Ethiopia	BMC Health Service Research	This study aimed at assessing the magnitude of turn around time (TAT) of laboratory tests in Amhara Public Health Institute, Bahir Dar, Ethiopia	Retrospective cross-sectional study	A total of 34,233 patients were tested during the study period (9 months). Monthly average turnaround time ranged from 38.6 to 51.3 days for tuberculosis (TB) culture, 5.3 to 42.4 days for exposed infant diagnosis (EID) for HIV, 8.4 to 26 days for HIV 1 viral load, and 1.9 to 3.5 days for TB gen expert tests. Compared with the standard, 76.5% of the viral load, 68.1% of the EID for HIV and 53.8% of the TB gen expert tests had delayed turnaround time. Repeated reagent stock out,

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						high workload, activities overlapping, and staff turnover were major reasons for the result delays
3.	Goswani et al (2010)	Turn Around Time (TAT) as a Benchmark of Laboratory Performance	Indian Journal of Clinical Biochemistry	Our study aimed at evaluating laboratory analytical turnaround time in our laboratory and appraise the contribution of the different phases of analysis towards the same.	The turnaround time (TAT) for all the samples (both routine and emergency) for the outpatient and hospitalized patients were evaluated for one year. Turnaround time was calculated from sample reception to report dispatch.	The average turnaround time for the clinical biochemistry samples was 5.5 h for routine inpatient samples while the TURNAROUND TIME for the outpatient samples was 24 h. The turnaround time for stat samples was 1 h. Pre- and Post analytical phases were found to contribute approximately 75% to the total turnaround time.
4.	Kaushik et al (2018)	Reduction in laboratory turnaround time decreases emergency room length of stay	Open Access Emergency Medicine	To evaluate the effect of a reduction in laboratory turnaround time on ED LOS using retrospective analysis of Electronic	Retrospective analysis of ED encounters from a large, US-based, de-identified EHR database and a separate analysis of ED encounters from the EHR of an ED at a top-tier	Multivariate regression analysis of patients from the multisite study showed that a The 1-minute decrease in laboratory turnaround time was associated with 0.50 minutes of decrease in LOS. The the single-site analysis confirmed our findings from the multisite analysis that a positive correlation between laboratory turnaround time and ED LOS exists in the ED population as a whole, as well as across

No.	Names of researcher & year	Research titles	Journals	Objective	Methods	Result
				Health Records (EHR)	tertiary care center were performed.	different patient acuity levels. In addition, based on the calculations from the efficiency model, for a 5-, 10- and 15-minute turnaround time reduction, the single-site ED
5.	Koh et al (2014)	Customer Satisfaction Survey With Clinical Laboratory and Phlebotomy Services at a Tertiary Care Unit Level	Annals of Laboratory Medicine	A satisfaction survey was conducted to evaluate the clinical laboratory and phlebotomy services.	They performed customer satisfaction surveys for physicians and nurses regarding clinical laboratory services, and for outpatients who used phlebotomy services at a tertiary care unit level to evaluate our clinical laboratory and phlebotomy services. A satisfaction survey for clinical laboratory services was conducted with 370 physicians and 125 nurses by using an online or paper questionnaires. The satisfaction	Mean satisfaction scores of physicians and nurses was 58.1, while outpatients' satisfaction score was 70.5. We identified several dissatisfactions with our clinical laboratory and phlebotomy services. First, physicians and nurses were most dissatisfied with the specimen collection and delivery process. Second, physicians and nurses were dissatisfied with phlebotomy services. Third, molecular genetic and cytogenetic tests were found more expensive than other tests

No.	Names of researcher & year	Research titles	Journals	Objective	Methods	Result
					survey for phlebotomy services was performed with 347 outpatients who received phlebotomy services by using computer-aided interviews.	
6.	Ntshambiwa et al (2014)	Translating a National Laboratory Strategic Plan into action through SLMTA in a district hospital laboratory in Botswana	African Journal of Laboratory Medicine	To describes the impact of implementing Strengthening Laboratory Management Towards Accreditation (SLMTA), a structured quality improvement program in Sekgoma Memorial Hospital Laboratory (SMHL) in Serowe, Botswana.	Stepwise Laboratory Quality Improvement Process Towards Accreditation (SLIPTA) checklist was conducted at baseline and exit of the program, with scores corresponding to a zero- to five-star scale. Turnaround times, customer satisfaction, and several other health service indicators were tracked.	The laboratory scored 53% (zero stars) at the baseline audit and 80% (three stars) at exit. Nearly three years later, the laboratory scored 85% (four stars) in an official audit conducted by the African Society for Laboratory Medicine. Turnaround times became shorter after SLMTA implementation, with reductions ranging 19% to 52%; overall patient satisfaction increased from 56% to 73%, and clinician satisfaction increased from 41% to 72%. Improvements in inventory management led to decreases in discarded reagents, reducing losses from the US \$18 000 in 2011 to \$40 in 2013.

Goswami et al (2010) highlighted turnaround time as laboratory benchmark. They also analyzed factors contributing to delayed turnaround time in the analytical phase of laboratory testing. The study result showed that sample delivery, processing, and report dispatch contributed greatly to turnaround time in pre-analytical. But physician needs to be aware that some examination requires more time because of complexity. This knowledge will help to reduce complaint about turnaround time.^[7]

Ntshambiwa et al (2014) study in Botswana proved that improvement in turnaround time aspect increased patient satisfaction from 56% to 73%, and clinician satisfaction increased from 41% to 72%. This huge number represents that turnaround time impact on laboratory performance. Reduction of turnaround time and improved customer satisfaction after completion of the improvement program also indicated the positive and sustained impact on patient care. The decrease in turnaround time for laboratory test occurred despite an increase in testing volume; this was because of a combination of reduced equipment downtime as a result of effective preventive maintenance of analyzers and reduced stock-outs from the introduction of an effective inventory management system.^[18]

DISCUSSION

Quality indicator as stated by Sharma et al (2018) as an objective measurement of laboratory performance.^[19] Laboratory performance cannot be measured by cure rate or good clinical impact but it is reflected by some indicators. Institute of Medicine made some indicators such as patient safety, effectiveness, equity, patient-centeredness, timeliness, and efficiency as health care benchmarks. Those all indicators contributes to patient satisfaction.^[20]

Poor quality laboratory services lead to unnecessary expenditures, misery in human lives and suffering, and producing wrong data in disease prevalence due to misdiagnosis. The results are over-treatment and overuse of antibiotics for inappropriate clinical circumstances which lead to the emergence of drug-resistant microorganisms including multi-drug resistant TB. Likewise, patient safety is also influenced by the frequency and seriousness of errors that occur in the health care system.^[21]

The importance of customer satisfaction in driving quality improvement has been increasing in laboratory medicine. Patients are the ultimate customers of laboratory medicine, but physicians and nurses are considered preferred internal customers. Therefore, their opinions are essential to improve laboratory management. Patient satisfaction was influenced by laboratory performance. Many studies showed that a trusted laboratory always keeps patients satisfy. Therefore, quality indicator could measure patient satisfaction indirectly.^[22] It could determine good laboratory from low-performance laboratory.^[5]

Koh et al (2014) and Shiferaw & Yismaw (2019) illustrated the importance of turnaround time in their study. It was seen as laboratory quality by customer. Good laboratory stewardship should focus on this aspect as one of quality improvement elements as concluded by Goswami et al (2010). Moreover, studies by Kaushik et al (2018) and Rooney & Schilling (2014) showed us that high-speed laboratory analyses were needed by high workload unit such as an emergency unit. This improvement will increase patient safety. This element will increase patient satisfaction as claimed by Ntshambiwa et al (2014).

CONCLUSION

Turnaround time as one of quality indicators in a laboratory setting. Improvement in this parameter could give benefits to the patient and deliver service excellence. Standardized reporting method is mandatory as it will not only allow the accreditation of clinical laboratories according to the International Standard but

also assure guidance for promoting improvement processes and guaranteeing quality care to patients and patient satisfaction

Laboratory stewardship to turnaround time aspect is needed to ensure patient satisfaction. Management action urgently needed to increase patient satisfaction towards laboratory results.

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