Research Article

Assessing the Impact of Laboratory Information System on Clinical Workflow and Patient Outcomes

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ABSTRACT

This study looks at how Valenzuela Medical Center's (VMC) clinical workflow efficiency and patient outcomes are influenced by the installation of a Laboratory Information System (LIS). Due to time constraints, convenience sampling was used to collect data from sixty-three (63) medical professionals in the clinical and diagnostic laboratory departments using a descriptive study design and a mixed-methods technique. To measure participant responses, descriptive statistics such as means, standard deviations, and frequency distributions were used. Using paired sample t-tests, inferential analysis was carried out to compare metrics before and after LIS adoption, with an emphasis on factors like error rates, turnaround times, and specimen handling accuracy.

Key findings showed that LIS adoption improved data accessibility across departments, lowered transcription errors by about 28%, and cut specimen processing turnaround times by an average of 35%, all of which contributed to improved interdepartmental communication. Furthermore, 90% of respondents expressed more confidence in the accuracy of laboratory results following LIS integration, and 85% of respondents reported higher satisfaction with data processing procedures. Significant improvements were also shown in patient outcomes, with quicker diagnostic processing leading to earlier treatment commencement and, in some situations, shorter hospital stays overall. In addition to demonstrating the wider advantages of incorporating cutting-edge information systems in healthcare settings, this study emphasizes the critical role that LIS plays in improving laboratory operations, cutting down on diagnostic delays, and improving the quality of patient care at VMC.

Keywords: *Laboratory Information System (LIS), Clinical laboratory, diagnostic error*

Introduction

An organization that examines clinical specimens to collect information on a patient's condition to help with illness diagnosis, treatment, and prevention is known as a clinical laboratory. Laboratories are positioned as fundamental to the healthcare system because of the vital information they give, which is a crucial component in clinical decision-making.

Traditionally, handling, processing, and reporting laboratory samples required a lot of work and was very prone to transcribing errors. These problems spurred businesses and healthcare providers to simplify data gathering and reporting procedures. Aiming for increased accuracy and workflow efficiency, some labs developed proprietary in-house solutions, while others worked with forward-thinking companies to develop commercial reporting systems made to interface with particular lab equipment.

One in 20 persons will make a diagnostic error in their lifetime, according to a 2014 study by Singh et al. that used data from extensive observational studies of the US population. "Improving Diagnosis in Health Care," published in 2015 by the National Academy of Medicine (NAM), previously the Institute of Medicine, emphasized the pressing need to address shortcomings in the diagnostic process. This study underlined that reducing diagnostic errors necessitates an all-encompassing, multidisciplinary approach that incorporates clinical laboratory procedures and patient involvement.

A key piece of technology in contemporary labs, the Laboratory Information System (LIS) makes it possible to retrieve, record, alter, and safely store data that is essential for precise diagnosis, treatment, and illness prevention. For timely and accurate clinical treatments, LIS technology helps with client demographic management, laboratory instrument integration, and health service audit trail monitoring.

The Philippines, a country in Southeast Asia that is developing quickly, has made significant strides in improving access to healthcare. To guarantee that all Filipinos can obtain necessary medical care without facing financial hardship, initiatives like the Universal Health Care Act have increased the coverage of health insurance. Significant differences still exist, nonetheless, despite these advancements. According to a 2021 study by the Philippine Statistics Authority (PSA), 30% of Filipino households still have inadequate access to high-quality healthcare services, frequently as a result of socioeconomic limitations, geographic restrictions, and a lack of resources in medical institutions. Moreover, inefficient healthcare service delivery is still hampered by antiquated infrastructure and poor interoperability among electronic health systems, particularly LIS.

Less than 25% of Philippine hospitals had implemented LISs as of 2022, and many of those implementations were restricted to larger, private hospitals in urban regions. Given that LIS adoption is crucial for increasing laboratory operational efficiency, lowering diagnostic mistakes, and enabling accurate and timely reporting, this disparity highlights a serious weakness in the healthcare system. To evaluate and close these gaps and advance more dependable and easily available healthcare services nationwide, research on LIS is required, especially in public healthcare facilities like Valenzuela Medical Center (VMC).

Literature Review

Numerous researches have examined the effects of LIS in clinical settings, highlighting both the implementation hurdles and the revolutionary potential of this approach. According to a review by Pantanowitz et al. (2013), LIS has been demonstrated to dramatically increase clinical workflow speed and accuracy, which has improved patient outcomes in organizations with well-integrated systems. The potential of LIS to optimize operations in hectic laboratory settings was further highlighted by a study by Georgiou et al. (2019), which discovered that LIS deployments could cut turnaround times for lab findings by up to 50% in hospitals with high specimen processing volumes.

However, challenges still exist, especially in emerging nations. According to a 2017 study by Williams et al., a lack of financing, infrastructure, and technical know-how frequently made it difficult to use LIS effectively in low-resource environments. These results emphasize how crucial it is to modify LIS to fit the local context

because standardized solutions might not be able to handle the particular difficulties of these environments. According to Sharma et al. (2020), who studied LIS adoption in India and found that data protection concerns are a major obstacle in facilities without strong cybersecurity measures, data security and privacy concerns are also becoming more and more important.

Government programs like the Universal Health Care Act, which increased health insurance coverage and sought to lower cost barriers to necessary health services, have improved healthcare accessibility in the Philippines, a rapidly developing country in Southeast Asia. Despite these initiatives, 30% of Filipino families still have inadequate access to high-quality healthcare services, according to a 2021 study from the Philippine Statistics Authority (PSA). This is frequently because of socioeconomic and geographic restrictions as well as a lack of resources in medical institutions. Less than 25% of Philippine hospitals, mostly larger private hospitals in urban areas, had implemented LISs as of 2022. This low rate of LIS adoption highlights a serious weakness in the healthcare system. Enhancing laboratory productivity, decreasing diagnostic mistakes, and delivering timely reporting that improves patient outcomes all depend on LIS.

Relevance of this Study

Given these difficulties and the distinct healthcare environment of the nation, more research into the use of LIS in Philippine healthcare settings is needed. To evaluate LIS's influence at Valenzuela Medical Center (VMC), this study focuses on its present use, obstacles, and prospects for development that are specific to the local healthcare setting. The goal of this analysis is to support larger initiatives to improve clinical effectiveness, precision, and patient care quality in the Philippine healthcare system.

Methodology
Research Design

Descriptive quantitative and qualitative research procedures were combined in a mixed-methods approach to find, describe, and clarify the relationships among the study's key variables. In order to give a thorough grasp of how Laboratory Information Systems (LIS) impact clinical workflow and patient care results, this dual approach was selected.

Surveys were used to collect data for the quantitative component, which made it possible to identify the important contributions of LIS, especially in improving the simplicity and dependability of producing laboratory results. The surveys also provided quantitative insights into the perceived problems and effectiveness of LIS, highlighting typical issues that arose during the system's installation.

Open-ended survey questions and follow-up interviews with chosen respondents were used to gather qualitative data to supplement the quantitative findings. To gain a deeper knowledge of how LIS affects their daily operations and patient contacts, this qualitative component sought to delve deeper into the experiences and viewpoints of the participants. By offering suggestions for improvement and disclosing subtle insights into the particular obstacles to effective LIS utilization, the qualitative data assisted in placing the quantitative results in context.

The study sought to provide a comprehensive picture of the effects of LIS by combining these qualitative findings with the quantitative data. This would enable more informed judgments and suggestions on how to best use and optimize LIS in clinical settings.

Population and Sampling

Employees and clinicians from VMC Laboratory participated in this study to evaluate how the deployment of the Laboratory Information System (LIS) affected clinical workflow and patient management results. The Department of Pathology and Laboratory employs eighty (80) people in total, including clinicians.

A minimum of sixty-three (63) respondents were needed to reach a ninety (90) percent confidence level with a margin of error of ±5 percent, according to the Sample Size Calculator. The survey questionnaire was completed by sixty-three (63) people as of October 5, 2024. Clinicians, resident pathologists, medical technologists, laboratory assistants/techni-

cians, and IT support personnel who were directly involved in the deployment of LIS and the provision of the agency's services and activities made the study sample.

Convenience sampling has several drawbacks, including the possibility of bias because it does not fully represent the community of clinicians and laboratory workers. The findings' generalizability may be impacted by this sample technique's potential to overrepresent some viewpoints while underrepresenting others. For example, the results might show a distorted perception of the system's overall influence if certain groups—like those with more LIS experience—are more inclined to engage. As a result, even though the results might offer insightful information about the impact of the LIS, care should be used when extending these findings to the larger group of VMC staff members and physicians.

Research Instrument

Quantitative information on the study's primary variables—(1) clinical workflow efficiency, (2) system usability, (3) insufficient training, (4) error reduction and accuracy and reliability improvement, (5) interdepartmental flow on patient care, and (6) LIS optimization strategies for better patient outcomes—was gathered using a self-made survey questionnaire.

An academic expert in research methodology thoroughly reviewed and validated the survey instrument. The review's comments were taken into consideration in order to improve the questionnaire's questions' relevance and clarity.

Several actions were made to guarantee the validity and reliability of the instrument:
1. Pilot Testing: A small sample of respondents who were representative of the target population participated in a pilot study of the survey. Before the complete deployment, changes could be made thanks to this preliminary testing, which helped find any unclear or deceptive questions.
2. Reliability Assessment: Cronbach's alpha coefficient, a statistical indicator of internal consistency, was used to evaluate the questionnaire's reliability. To conclude that the items consistently assess the same underlying construct, a Cronbach's alpha value of 0.70 or more was deemed appropriate.
3. Validity Assessment: Construct validity and content validity were used to evaluate validity. To assess the instrument's content validity, an academic professional reviewed the questions to make sure they fully addressed the research variables. To verify that the instrument appropriately reflects the constructs it seeks to assess, construct validity was investigated by comparing survey responses with outside benchmarks or similar measures.

Accurate data was ensured and efficient data collection and management were made possible by using Google Forms. The entire study process was improved by the digital format's ability to track data in real-time.

Data Gathering Procedure

Google Forms was used in the creation of the survey. The URL was shared online via text messaging, social media, and email to improve participant accessibility and convenience.

Participants were gathered from the clinical and laboratory divisions of VMC. A brief overview of the study's goals, significance, and purpose was sent through the same methods before the survey link. In addition to stressing that participation is entirely optional, this introduction made sure that prospective participants were aware of the study's emphasis on evaluating the Laboratory Information System's (LIS) influence on clinical workflow and patient management results.

Participant Consent: Participants had to read an informed consent form outlining the goals, methods, possible hazards, and advantages of the study before they could access the survey. Respondents were reassured by this form that participation was entirely voluntary and that their answers would be kept private and used only for scholarly research. Participants gave their consent to participate in the study by selecting "I agree" at the start of the survey.

For nine days, from September 27 to October 5, 2024, the survey was accessible. Follow-up

emails and text messages were used to remind nonrespondents around the halfway point and close to the end of the survey session to guarantee a reasonable response rate. These prompts urged involvement and reaffirmed how crucial their opinions were to comprehend the LIS's efficacy.

Effective outreach was made possible by the systematic method of data collecting, which guaranteed that all ethical standards pertaining to participant consent were respected while permitting a wide variety of responses.

Data Analysis Procedure

To guarantee the integrity of the analysis, all collected data were first checked for accuracy and completeness. Google Sheets was the main tool used to examine the data because it made simple computations and initial data arrangement easier. The opinions of respondents regarding the following variables were compiled using descriptive statistics, which included measures of central tendency (mean, median, and mode) and frequency distributions: (1) clinical workflow efficiency; (2) system usability; (3) insufficient training; (4) lowering errors and enhancing accuracy and reliability; (5) interdepartmental flow on patient care; and (6) methods to optimize LIS for better patient outcomes.

For more complex analysis, statistical tools like SPSS (Statistical Package for the Social Sciences) were used in addition to Google Sheets. The use of inferential statistical tests to find important correlations and variations between the variables was made possible by this software. In particular, the experiments listed below were carried out:

- T-tests: To compare the means of two independent groups' opinions about the efficacy of LIS, such as laboratory employees and clinicians.
- ANOVA (Analysis of Variance): To evaluate variations between three or more groups, offering information on how different employee types view LIS.
- Correlation Analysis: To investigate the connections between continuous variables, like perceived clinical workflow efficiency and system usability scores.

In order to improve our understanding of how LIS affects clinical operations and patient care outcomes, the results of both descriptive and inferential analyses will be used as the foundation for pertinent conclusions and study suggestions.

Ethical Considerations

The respondents were treated with the highest respect and regard during the study's execution. No personal information was gathered beyond what was required for the study to guarantee that ethical standards were respected. The collected data will not be shared with any parties and will only be utilized for scholarly reasons.

Measures for Confidentiality: All data were anonymized before analysis in order to safeguard the identities of the respondents. To make sure that their answers could not be linked to them, each respondent was given a unique identification number. Furthermore, no personally identifying information, like names, work titles, or precise locations, was intended to be gathered by the poll. Only the research team had access to the password-protected devices where all the files were safely kept.

Ethical Approval: Before data collection, the study was approved by Valenzuela Medical Center's Institutional Review Board (IRB). The study's adherence to ethical standards for research involving human subjects was guaranteed by the IRB review procedure. To further emphasize that participation in the study was entirely voluntary, participants were told that they might leave at any time without facing any repercussions.

The researchers' dedication to upholding the anonymity and rights of each participant while preserving the integrity of the research process is reflected in these ethical considerations.

Results and Discussions

The demographic characteristics of respondents are presented in this chapter, along with their degree of agreement with the ways in which the Laboratory Information System impacted the Clinical Workflow and Patient outcomes. The mean scores for each item eval-

uated, as well as the frequencies and percentages of respondents, are used to interpret the results.

A survey was conducted with 63 respondents to gather their perspectives on how the Laboratory Information System (LIS) affects clinical workflow and patient outcomes. The highest percentage of the respondents are Medical technologists, making up 54% of them, 19% of the responders were clinicians, 11.1% of the participants were resident pathologists, both laboratory technician/aide and IT staff comprises 7.9% of the participants. The wide range of responders makes it possible to conduct a thorough assessment of the LIS's influence on different laboratory operations.

In assessing the duration of usage of the Laboratory Information System (LIS) among respondents, the results revealed that 48% have employed the system for 1 to 2 years, 27% of staff members said they had been using the LIS for 6 months to a year, 19% among the respondents have been using the system for more than 2 years and 7.9% of them were still under training period.

The study assessed how the Laboratory Information System affects the overall clinical workflow during its implementation and transition phase. The respondent's level of agreement with the statements involving this is summarized in Table 1.

Table 1. Respondents assessment on how the Laboratory Information System affects the overall clinical workflow during its implementation and transition phase

Impact of LIS on Clinical Workflow	Mean	SD	Interpretation
The implementation of LIS has improved the overall efficiency of clinical workflows	4.54	0.66	Strongly Agree
The transition to LIS caused minimal disruptions in day-to-day clinical operations	3.97	1.01	Agree
Impact of LIS on Clinical Workflow	**Mean**	**SD**	**Interpretation**
LIS has reduced the time taken to process and retrieve laboratory results	4.67	0.67	Strongly Agree
Workflow interruptions due to system issues were minimal during the LIS transition	4.06	0.96	Agree
Adequate training on LIS was provided to facilitate a smooth transition of clinical workflows	4.30	0.77	Strongly Agree
The transition to LIS did not significantly increase the workload or stress on clinical staff	4.06	0.96	Agree
LIS has enhanced communication and coordination between the laboratory and other departments	4.41	0.81	Strongly Agree
The LIS implementation improved the accuracy and completeness of patient data records	4.60	0.68	Strongly Agree
Staff members adapted quickly to the new LIS, minimizing disruptions in clinical workflows	4.22	0.86	Strongly Agree

The overall impact of LIS on workflow efficiency was positive despite initial challenges	4.51	0.69	Strongly Agree
Average	**4.33**	**0.81**	**Strongly Agree**

Strongly Disagree (1.00-1.80), Disagree (1.81-2.60), Neutral (2.61-3.40), Agree (3.41-4.20), Strongly Agree (4.21-5.00)

Based on the data, the respondent's strongly agree that the Laboratory Information System (LIS) has a positive effect on overall clinical workflow (M=4.33, SD=0.81) from its implementation specifically during the transition phase. The respondents also strongly agree that there is no significant increase in workload and stress on clinical staff during its transition phase (M=4.06, SD=0.96).

The study also evaluated the difficulties throughout the system integration process of Laboratory Information Systems (LIS). The respondent's identification of multiple challenges with data integration is outlined in Graph 1.
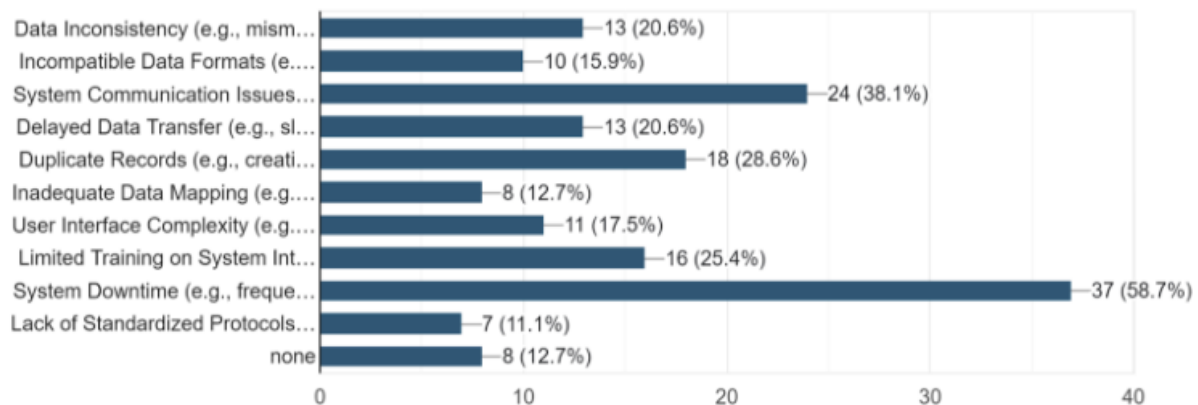

Figure 1. Challenges with data integration

The results showed that, with 58.7% of respondents, system breakdowns were the most common problem, followed by problems with system communication (38.1%) and duplicate records (28.6%). The effectiveness of clinical workflows and possibly patient outcomes were both greatly impacted by these issues. While communication breakdowns and duplicate records can result in delays and errors in patient care, system outages in particular pose a serious risk to timely and correct decision-making.

The study analyzed how factors like system usability and inadequate training provided influence the workflow performance. The respondent's level of agreement in the statements pertaining to these factors are summarized in Table 2 and 3.

Table 2. Evaluation of respondents on systems usability that influence the workflow performance

System Usability	Mean	SD	Interpretation
The LIS interface is user-friendly and easy to navigate	4.40	0.66	Strongly Agree
System errors due to poor usability are common and impact workflow efficiency	4.21	0.86	Strongly Agree

The LIS system is intuitive and requires minimal effort to operate efficiently	4.25	0.62	Strongly Agree
Usability issues with the LIS have caused delays in completing laboratory tasks	3.97	0.84	Agree
The design of the LIS supports smooth integration into existing workflows without significant disruptions	4.40	0.58	Strongly Agree
Average	**4.24**	**0.71**	**Strongly Agree**

Strongly Disagree (1.00-1.80), Disagree (1.81-2.60), Neutral (2.61-3.40), Agree (3.41-4.20), Strongly Agree (4.21-5.00)

According to the data, the respondents Strongly agree that the Laboratory Information System is user-friendly and easy to navigate (M=4.40, SD=0.66). Poor usability of the system causes system errors (M=0.21, SD=0.86), affecting the workflow performance and delays in completing laboratory tasks (M=3.97, SD=0.84). Overall, the respondents strongly agree that system usability influences the workflow performance and efficiency of the clinical laboratory (M=4.24, SD=0.71).

Table 3. Evaluation of respondents on training that influence the workflow performance

Inadequate Training	**Mean**	**SD**	**Interpretation**
Inadequate training on the LIS has led to frequent user errors and mistakes	4.19	0.81	Agree
Insufficient training has caused delays in adapting to the new system and negatively impacted workflow performance	4.21	0.78	Strongly Agree
The training provided was insufficient for mastering the LIS features and functionalities	3.68	1.05	Agree
Lack of proper training has reduced the overall efficiency of the LIS system	4.13	0.92	Agree
Comprehensive training is necessary to prevent errors and optimize the use of the LIS	4.40	0.83	Strongly Agree
Average	**4.24**	**0.71**	**Strongly Agree**

Strongly Disagree (1.00-1.80), Disagree (1.81-2.60), Neutral (2.61-3.40), Agree (3.41-4.20), Strongly Agree (4.21-5.00)

In general, the respondents agreed that inadequate training has caused frequent errors and mistakes (M=4.19, SD=0.81), and strongly agreed to have caused delays in adapting to the system which led to poor work performance (M=4.21, SD=0.78). Majority of the respondents Strongly agreed that more thorough

training is necessary to further improve workflow performance in the laboratory.

The study evaluated the effects of the laboratory information system in minimizing the errors to improve the accuracy and reliability of test results. The following statements correspond to the extent of agreement of each respondent with regards to the effect of LIS on accuracy and reliability of test results, each is measured in Table 4.

Table 4. Effects of LIS on accuracy and reliability of test results

Effects of LIS in Accuracy and Reliability	Mean	SD	Interpretation
The LIS implementation has significantly reduced the frequency of human errors in test result entry	4.33	0.73	Extremely
The accuracy of test results has improved with the use of LIS compared to the previous System	4.38	0.79	Extremely
LIS has minimized errors associated with manual data entry and processing	4.46	0.66	Extremely
The reliability of test results has increased due to the implementation of LIS	4.35	0.69	Extremely
The LIS has facilitated more accurate and timely diagnosis	4.44	0.66	Extremely
The integration of LIS has reduced discrepancies in test results between different laboratory tests	4.40	0.68	Extremely
LIS has enhanced the overall quality control of laboratory testing procedures	4.51	0.59	Extremely
The likelihood of misidentifying patient samples has decreased with the use of LIS	4.40	0.66	Extremely
LIS has contributed to a more consistent and reliable reporting of laboratory results	4.54	0.59	Extremely
The implementation of LIS has significantly improved the diagnostic accuracy of laboratory tests.	4.49	0.59	Extremely
Average	**4.43**	**0.66**	**Extremely**

Not at All (1.00-1.80), Slightly (1.81-2.60), Moderately (2.61-3.40), Very Much (3.41-4.20), Extremely (4.21-5.00)

The average response on a 5-point Likert scale was 4.43, suggesting that most respondents "extremely agree" with the statement. These results demonstrated a substantial consensus among the respondents. The moderate degree of agreement among participants is indicated by the standard deviation of 0.66, which indicates a broad alignment in perceptions regarding the efficacy of LIS.

The study also evaluated the impact of Laboratory Information System on Interdepartmental workflow and how the system improved overall patient outcome. The respondents' level of agreement to the statements with regards to the issues in information flow and strategies to optimize LIS to improve patient outcomes were summarized in Table 5.

Table 5. Issues in information flow and strategies to optimize LIS to improve patient outcomes

Interdepartmental Information Flow Issues	Mean	SD	Interpretation
Poor information flow between departments leads to delays in patient diagnosis and treatment	4.43	0.77	Strongly Agree
Inconsistent or incomplete information shared between departments negatively impacts patient outcomes	4.44	0.71	Strongly Agree
Miscommunication between departments results in errors in patient care and treatment	4.48	0.61	Strongly Agree
Lack of integration between LIS and other departmental systems causes inefficiencies in patient care	4.37	0.76	Strongly Agree
Effective interdepartmental communication is critical for timely and accurate patient management	4.44	0.64	Strongly Agree
Average	**4.43**	**0.70**	**Strongly Agree**

Strongly Disagree (1.00-1.80), Disagree (1.81-2.60), Neutral (2.61-3.40), Agree (3.41-4.20), Strongly Agree (4.21-5.00)

Overall, the results demonstrated a clear consensus that LIS favorably affects interdepartmental information flow, improving patient care. The mean score was 4.43 with a standard deviation of 0.70. According to this score, most respondents think that better communication made possible by LIS plays a major role in helping patients be managed effectively. One important discovery was related to the assertion that mistakes in patient care and treatment occur due to miscommunication among different departments. Participants expressed strong agreement with this statement, obtaining an average score of 4.48 and a standard deviation of 0.61. This impressive score highlights the importance healthcare professionals place on the negative impact of inadequate communication between departments on patient care, highlighting the necessity of information systems such as LIS in reducing these risks.

Table 6. Strategies to Optimize LIS

Strategies to Optimize LIS	Mean	SD	Interpretation
Implementing standardized protocols for information sharing between departments can improve patient outcomes	4.54	0.61	Strongly Agree
Integrating LIS with other departmental systems enhances the coordination of patient care	4.57	0.58	Strongly Agree
Regular training on LIS for all departments	4.59	0.55	Strongly Agree

ensures more efficient and accurate information flow			
Utilizing real-time data exchange through LIS helps in reducing delays and improving patient care	4.56	0.61	Strongly Agree
Continuous evaluation and feedback mechanisms for LIS usage can identify and address issues in information flow	4.57	0.58	Strongly Agree
Average	**4.57**	**0.59**	**Strongly Agree**

Strongly Disagree (1.00-1.80), Disagree (1.81-2.60), Neutral (2.61-3.40), Agree (3.41-4.20), Strongly Agree (4.21-5.00)

The survey evaluated methods to enhance Laboratory Information Systems (LIS) in order to achieve better patient results. Participants unanimously believed that adopting standardized protocols for sharing information among departments can greatly enhance patient outcomes, with an average score of 4.54 and a standard deviation of 0.61. This shows a firm belief in the importance of organized communication to improve the quality of care. Survey participants also highly endorsed the idea that incorporating LIS with other departmental systems improves the coordination of patient care, with an average rating of 4.57 and a standard deviation of 0.58. This indicates that successful integration is seen as essential for optimizing workflows and promoting cohesive patient care.In general, participants expressed a high level of agreement regarding the positive effects of optimizing LIS on patient outcomes, as indicated by an average score of 4.57 and a standard deviation of 0.59. This emphasizes the agreement on the importance of improving LIS abilities to improve healthcare services.

Conclusions

This study emphasizes how important Laboratory Information Systems (LIS) are to improving patient outcomes and clinical workflow. The results conclusively show that LIS implementation promotes interdepartmental communication, expedites information sharing, and significantly lowers human error. These enhancements result in more accurate diagnostic findings and more effective laboratory operations. Despite the obvious advantages of LIS, the study emphasizes that

insufficient training for laboratory employees is still an ongoing issue. To maximize the beneficial effects of LIS on clinical performance, improved training programs are necessary to reduce errors and enhance system use.

The study also highlights how well LIS enables interdepartmental collaboration, which is essential for improving patient care. In addition to reducing result reporting delays, improved information distribution throughout the healthcare facility additionally reduces the chance of human data entry errors. Better patient outcomes are closely correlated with improved communication for immediate and accurate information is essential for making appropriate treatment decisions.

Laboratory Information Systems (LIS) have a major influence on clinical practice and patient outcomes, according to this study. The main takeaway is that LIS helps clinicians make better decisions and provide better patient care by improving access to timely and accurate laboratory results. Clinicians can focus more on providing direct patient care by streamlining workflows, cutting down on administrative time, and decreasing errors by incorporating LIS into daily clinical procedures. The study also emphasizes how crucial it is for doctors and laboratory personnel to communicate effectively since LIS fosters teamwork and minimizes miscommunications, both of which improve patient outcomes. Furthermore, the research means that by automating repetitive procedures, Laboratory Information Systems (LIS) greatly increase the efficiency of medical technologists by reducing manual errors and

frees them up to focus on more intricate analyses.

In order to maximize the advantages of Laboratory Information Systems (LIS) in diverse healthcare settings, more research should look into the specific challenges associated with their implementation. To guarantee patient confidentiality and regulatory compliance, researchers should also carry out comprehensive investigations on the integration of data privacy rules into LIS deployment.

Furthermore, analyzing how LIS affects clinical outcomes and workflow efficiency over the long run can shed light on how beneficial it is. Comparative research between establishments with different degrees of LIS integration may reveal opportunities for development as well as best practices. Examining how user feedback affects training efficacy and system optimization will assist customize LIS features to better suit healthcare practitioners' demands and enhance patient care in general.

Acknowledgement

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