



Original Article

Factors Affecting Provider's Satisfaction Regarding the Newly Introduced Laboratory Information System in Armed Forces Institute of Pathology, Dhaka

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ABSTRACT

Background: Armed Forces Institute of Pathology (AFIP), Dhaka is the biggest laboratory setup in Bangladesh Armed Forces. In line with government vision, AFIP also started laboratory automation for provision of pathological service through Laboratory Information System (LIS). However, there is little information about the usability of LIS and provider's satisfaction, challenges and limitations faced by them. We aimed at finding out the usability and its associated factors affecting the provider's satisfaction regarding the newly introduced LIS in AFIP, Dhaka.

Methods: This cross-sectional analytical study was carried out among 68 staffs or providers within AFIP. All providers within the institution who were involved in working with the LIS were included as participants in the study. Self-Administered semi-structured questionnaire was used as research instruments. Socio-demographic, LIS usability, effectiveness, and supportive infrastructure related variables were taken into consideration to collect data. Data analysis was performed using SPSS version 25.

Results: The mean age of the respondents was 34.59 years (SD±8.8). Among the respondents, 48 (70.6%) were male and 20 (29.4%) were female. The research explored that among the participants, 44.1% (30) had good computer knowledge, 30.9% (21) had average and 25% (17) had poor knowledge. The study also revealed that 41.2% (28) had some idea about Information and Communication Technology (ICT) and 58.8% (40) had no knowledge about it. More than two third 54 (79.4%) staffs had more than 2 years of experience of working with the laboratory system. Most of the respondents (97.1%) stated that they have interconnected computers within the departments. More than fifty percent (40) staffs faced problem with the system and took some kind of actions. The study revealed that a majority of the respondents (89.7%) expressed satisfaction with the LIS, while a small proportion (2.9%) reported dissatisfaction. The association between sex and satisfaction is statistically significant (Chi squared value is 5.365, p value equals to 0.0205). Whereas the association between education and satisfaction is statistically insignificant (Chi squared value is 0.632, p value is equal to 0.4266).

Conclusions: This study found most of the staff working with LIS for laboratory service were satisfied, further studies are needed to find other insights to improve other avenues for improving provider satisfaction.

Keywords: LIS, ICT, AFIP, UHC, SDG

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Introduction

Digital transformation in healthcare is inevitable. Transformation is happening in various sectors, including healthcare. In 2009, the Bangladesh Government declared the vision of a "Digital Bangladesh," prompting a shift from traditional paper-based activities to IT-based automated systems across all sectors. The healthcare sector is also being shaped by technological advancements. The Armed Forces Institute of Pathology (AFIP) in Dhaka, being the largest laboratory setup in the Bangladesh Armed Forces, has embraced laboratory automation through the implementation of a Laboratory Information System (LIS) to provide all types of pathological services.

Pathology plays a crucial role in modern medicine by ensuring accurate diagnoses and appropriate treatment for patients (1). However, inadequate access to pathology and laboratory medicine services in low-resource settings poses a critical gap in healthcare systems.

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An information system comprises people, procedures, software, hardware, and data. A Hospital Information System (HIS) is a computer-based patient record system that encompasses various modules supporting clinical workflows. LIS is one of the components within an HIS. It is a computer-based system designed to manage different aspects of a medical laboratory, including inputting, processing, and storing lab information and data. LIS facilitates the timely provision of the information needed by physicians to make patient care decisions. Its functionalities include receiving orders and collecting specimens, processing orders, creating testing work orders, interfacing with lab equipment, conducting actual testing, generating transmitted results, and producing management reports (2).

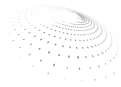
While LIS and Laboratory Information Management System (LIMS) are often used interchangeably, LIS typically focuses on clinical operations, whereas LIMS encompasses other fields such as public health, pharmaceuticals, research and development, manufacturing, food and beverage, forensics, and chemicals (3). The modern LIS has evolved to incorporate new functionalities, such as configurable clinical decision support rules, system integration, laboratory outreach tools, and support for point-of-care testing (POCT) data. Some LIS modules are now integrated into Electronic Medical Record (EMR) and Electronic Health Record (EHR) systems, offering enterprise-wide solutions that cover multiple aspects of laboratory management (4).

The distinction between LIS and LIMS has blurred in recent years, with vendors using the "LIMS" acronym to market their clinical laboratory data management systems (5). These advancements highlight the evolving nature of LIS and its significance in streamlining laboratory operations and improving patient care. Armed Forces Institute of Pathology (AFIP) Dhaka endeavoring ceaselessly for laboratory automation and started in 2014. It started providing service through the software laboratory information system (LIS) to all departments since 2017. A busy medical lab may have hundreds of patients each week. It can be very difficult to keep all this information organized, but a LIS does just that. A LIS helps to keep all this information organized, which is vitally important for a medical lab to run smoothly. There is ample research regarding Electronic Health Record (EHR) usability, but very little information about the usability of laboratory information systems (LISs). It is a big question how it is going on with provider's satisfaction, challenges and limitations faced by the staffs or providers this study may find all those points regarding the new lab automation system and ultimately can help to implement this system in all other CMHs of Bangladesh Armed Forces.

Methods and Materials

This study used cross-sectional analytic method. It included all the providers at the Armed Forces Institute of Pathology (AFIP) who were involved with the Laboratory Information System (LIS). Data were collected through multiple visits and questionnaires from November 2017 to July 2018. The participants were staff members from various departments at AFIP, including Microbiology and Immunology, Histopathology, Biochemistry, Hematology, Clinical pathology, and Blood Transfusion. Those not involved with LIS and new staff members with less than 2 months of experience were excluded from the study. Initially, there were 70 staff members providing laboratory services with LIS, but 2 were missed due to transfers, resulting in a final sample size of 68. This sample represented the entire population, as the study used total population sampling, which examines the entire population as a purposive sampling technique.

A self-administered semi-structured questionnaire was developed in English through collaboration with a knowledgeable guide. Valuable input and guidance helped refine the questionnaire. It underwent a pretesting phase at AFIP to assess wording, sequence, and suitability based on feedback from a small group, leading to necessary modifications for clarity and effectiveness with the intended respondents. Due to the busy schedules



and concerns about potential career implications, the researcher had to make multiple visits to each individual to collect the questionnaires. After data collection, the information was checked, cleaned, and entered into a computer program (SPSS) for analysis. The analysis was conducted using SPSS-25.

Results

The study involved approximately 70 personnel utilizing the Laboratory Information System (LIS) for patient pathological tests. A total of 68 completed questionnaires were collected, with 2 individuals excluded due to transfer. The data were analyzed using SPSS version 25. The findings are stated in following tables and figures:

Table 1 Distribution of respondents by their knowledge of computer skills (n=68)

Level of computer knowledge*	Frequency	Percent (%)
Poor knowledge	21	30.9
Average knowledge	17	25.0
Good knowledge	30	44.1
Total	68	100.0

Table 1 revealed that among the respondents, 30 (44.1%) have good computer knowledge, 21 (30.9%) average and 17 (25%) poor computer knowledge.

Table 2 Distribution of respondents by training mode of respondents in LIS (n=68)

Training mode	Frequency	Percent (%)
Trained by software company	5	7.4
Training by AFIP	39	57.4
Self-trained	17	25.0
AFIP + self	7	10.3
Total	68	100.0

Table 2 described the way of training respondents gained regarding LIS. Staff working with LIS trained by software company 5 (7.4%), by Armed Forces Institute of Pathology (AFIP) 39 (57.4%), self-trained 17 (25%), self + AFIP 7(10.3%).

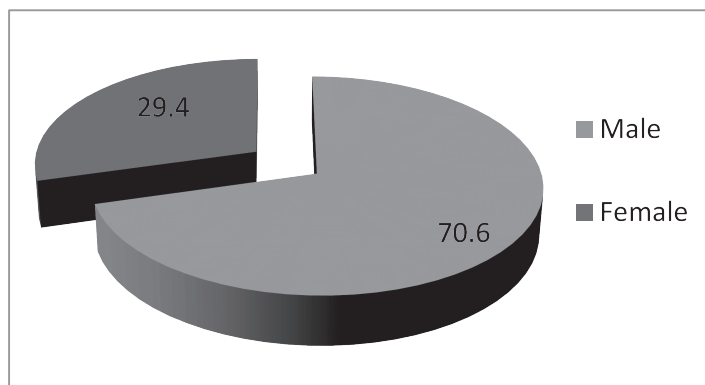


Figure 1 Distribution of respondents by their sex

Figure 1 shows the distribution of respondents by sex. Among the respondents 48 (70.6%) were male and 20 (29.4%) were female. The male and female ratio was 2.4.



The findings revealed that a majority of the respondents (89.7%) expressed satisfaction with the LIS, while a small proportion (2.9%) reported dissatisfaction.

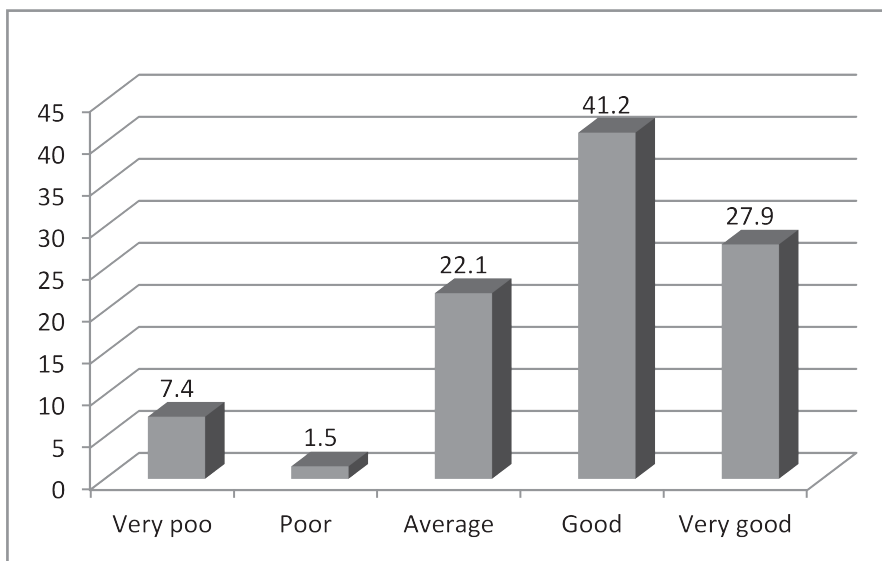


Figure 2 Distribution of respondents by their overall satisfaction level regarding LIS

Figure 2 revealed that direct responses from the respondents to a single question about overall satisfaction regarding LIS activities. Here all 68 staff’s responses to satisfaction grading in ascending order- very poor (1), poor (2), average (3), good (4), very good (5) in questionnaire. It reveals satisfaction - very good 19 (27.9%), good 28 (41.2%), average 15 (22.1%), poor 1 (1.5%), very poor 5 (7.4%). For easy understanding if satisfaction defined as satisfied= (good + very good), average, and dissatisfied= (poor+ very poor) then satisfied were 47 (69.1%), average 15 (22.1%), and dissatisfied were 6 (8.9%).

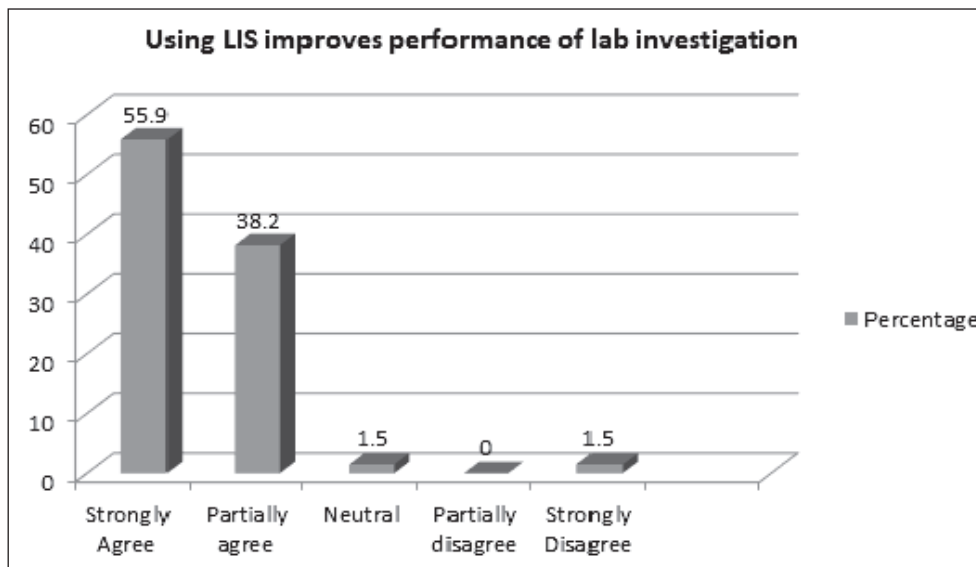


Figure 3 Distribution of respondents by their views on LIS improves performance of lab investigation

Figure 3 shows that (55.9% + 38.2%) = 94.1% agreed, (0%+1.5%) = 1.5% disagreed, 1 (1.5%) neutral, and 2 (2.9%) non-responding response to question that LIS improves the performance of the lab investigations. Strongly agree and partially agree were considered as agreed; Partially disagree and strongly disagree were considered as disagreed.



Working experience	Frequency	Percent
<1 year	9	13.2
1-2 years	5	7.4
>2years	54	79.4
Total	68	100.0

Table 3 Responses on working experience of staffs working with LIS (n=68)

Table 3 shows the working experience of staff working with LIS. Maximum staffs 54 (79.4%) had >2 years of experience, 9 (13.2%) of <1 year and 5(7.4%) of 1-2 years of experience of working with the laboratory system.

Table 4 Relationship between educational status and satisfaction of the respondents about LIS

Educational Status of responds	Dissatisfied	Satisfied	Total
Graduate	05	34	39
Post -graduation	02	27	29
Total	07	61	68

Table 4 shows the association between education and satisfaction is statistically insignificant (Chi squared value is 0.632, p value is equal to 0.4266).

Sexual Status of responds	Dissatisfied	Satisfied	Total
Male	04	44	48
Female	07	17	24
Total	11	61	68

Table 5 Relationship between sex status and satisfaction of the respondents about LIS

Table 5 revealed that the the association between sex and satisfaction is statistically significant (Chi squared value is 5.365, p value equals to 0.0205).

During the study, respondents provided valuable comments and suggestions regarding the newly established LIS in AFIP. Approximately 44% of the respondents shared their views. Some expressed satisfaction with the system's understandability, performance, and benefits for both lab personnel and patients. However, concerns were raised regarding issues such as data collection procedures, temporary unavailability of power supply, internet or server functions, incorrect information from test sample containers, and the need for better data preservation. Other suggestions included connecting the LIS with other military hospitals, improving sample transportation, introducing an auto signature system, enhancing training opportunities, enabling online report delivery, and improving the speed, capacity, and storage of computer systems. Additionally, requests were made for the introduction of e-mail report delivery and administrative permission for necessary system improvements.

Overall, this study highlighted a high level of satisfaction among lab personnel using the LIS in the Armed Forces Institute of Pathology. However, it also identified areas for improvement, including data collection processes, system reliability, and communication between different military hospitals. The feedback and suggestions

provided by the respondents will play a crucial role in enhancing the usability and effectiveness of the LIS in AFIP, ultimately benefiting both lab personnel and patients.

Discussion

There is ample research on EHR usability while there is little information on the usability of laboratory information systems (LISs). Furthermore, LISs facilitate the timely provision of a getting the information needed by physicians to make patient care decisions.

Out of 68 interviewees only 30 (44%) put their comments in the suggestion part of the questionnaire. Many of them remained silent to give any comment despite assuring in questionnaire that nothing will happen in their career if they comment. This might be a cultural issue since study place was in a military institution. In the study, a total of 58 (85.3%) respondents said that the system could be able to show data of previous period of same tests and 10 (14.7%) said the system can't retrieve the data properly. Either the retrieval function is N/A for that respondent or really sometime LIS failed to retrieve the previous data properly. It may show the summation picture of the same tests of previous time but not the whole tests of individual patient of previous time instantly.

Respondents of this study were from different departments which includes Microbiology and Immunology-14 (20.6%), Histopathology-14 (20.6%), Administration group-19 (27.9%), Biochemistry and Haematology both had 7 (10.3%) and 4 (5.9%) were from Clinical pathology, and 3 (4.4%) were from Blood Transfusion department. In contrast with another study, considering occupation, the main group of the users were grade II laboratory technicians (47.4%), followed by grade I laboratory technicians (19.0%), administrative workers (16.0%), phlebotomists (9.0%), department supervisors (5.2%), and pathologist (3.4%) (6).

While this study demonstrated high levels of satisfaction among the staff members utilizing the LIS, it is important to note that other research, such as the study by Mathew and Marc (2017) on the usability evaluation of laboratory information systems, highlighted overall dissatisfaction with LIS usability (6). Conversely, the evaluation of the LIS in two hospitals yielded positive results among laboratory staff (7). The study also revealed that a majority of respondents (88.2%) agreed that the LIS improved performance, with a significant proportion acknowledging its role in facilitating sample distribution (81.1%). These findings align with another study, which reported similar agreement levels regarding sample distribution (6). The mean age of the respondents was 34.59 years (SD \pm 8.808), with the majority falling within the 31-40 year' age group (45.6%). In terms of gender, 70.6% of respondents were male, while 29.4% were female. In contrast, another study (6) reported that 53.4% of respondents were female, with the majority falling within the age groups of <30 years and 31-40 years (6). However, 7.4% of respondents did not provide a response. In contrast, a previous study indicated that 98% of users rated their satisfaction with the overall service of the Laboratory as 3 or higher (8).

This study found most of the staff working with LIS for laboratory service were satisfied and they agreed that the system is beneficial for patients and lab personnel, but research work accomplished on 'Usability Evaluation of Laboratory Information Systems (7)' includes total number of 446 usability surveys, and finally study results indicate that overall usability of LISs is not satisfactory. But they studied Evaluating the Usability of the Laboratory Information System (LIS) in two hospitals and found positive results among lab staff (7). Furthermore, there are a few technical issues raised by lab personnel, for example, the system stops working due to poor internet connection and temporary unavailability of power supply. Limitation of data storage and preservation is also a key issue. Regular user training, system support and maintenance was a concern from lab personnel as well.



Some departments manually report lab test results, while all departments test results should report automatically. They need to get the test result directly from analyzer to computer to increase the accuracy and efficiency of the test results. To enable this feature, proper software and hardware integration is highly required. It is difficult to correct any error after printing the final reports. In the current system, if there is any correction needed, when observation and tick sign removed, printed report come out with blank space with the electronic signature only. There should be an option to hold the report without printing the paper with an electronic signature at the stage of finalization. There is a growing demand to send test reports to the patient via email. Administrative permission is required to introduce this service among patients in AFIP. Online availability of lab reports is also a concern among lab personnel. Since the study took place in a military institution, results of the study might be influenced by the context. Further studies are needed apart from the military institution, to find other insights to improve other avenues for further providers' satisfaction.

Conclusions

In the era of digitalization, advancements in medical science and information technology have led to the emergence of Hospital Information Management Systems (HIMS), including Laboratory Information Systems (LIS). These systems assist doctors in efficiently managing patients by providing quick and accurate test results. As patient loads continue to increase, pathological laboratories face the challenge of managing the influx of patients. To address this, various technologies have been developed to ease the workload. In 2017, the Armed Forces Institute of Pathology (AFIP) in Dhaka implemented a laboratory software called LIS. This study, conducted at AFIP, aimed to identify factors influencing the satisfaction of staff members working with the newly established LIS. The findings revealed high satisfaction levels among staff using the LIS for laboratory services. Further studies are recommended to explore additional insights for enhancing provider satisfaction and to gather the perspectives of clients and patients regarding the LIS, which were not included in this study.

Declaration

Authors contribution:

Authors contribution: AQMSH, Research idea, methodology, formulated the research objectives and critically reviewed; SP, methodology, data analysis, and critically reviewed, supervised; MAI, Drafting the manuscript, interpreting the study results, and drawing conclusions; TIZ, Data curation, and management and critically reviewed.

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Conflict of interest: The authors declare no conflict of interest.

Ethical Statement: Ethical clearance was taken from the Ethics Review Committee (ERC) of Bangladesh University of Health Sciences and ethics strictly followed throughout the study.



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