Surveying the influence of laboratory information system: An end-user perspective

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ABSTRACT

Background: The goal of the present survey is to investigate the effect of the Laboratory Information System (LIS) among users in a tertiary healthcare facility in Saudi Arabia.
Methods: The current cross-sectional descriptive study was carried out at the National Guard laboratory department of KAMC in Riyadh. All the active users of LIS at the laboratory department were included in the study. A total of 427 questionnaires were distributed of which 268 were returned completed. The response rate was 62.76%. The study instrument was developed to examine the effect of LIS on end-users based on five interrelated variables; External Communication, Service Outcomes, Personal Intentions, Personal Hassles, and Increased Blame. Descriptive statistics, Pearson's correlation, and ANOVA were used to analyze the data.
Results: The users had a general positive perception towards the LIS system. A statistically significant relationship between user characteristics and External Communication, Service Outcomes, Personal Hassles and Increased Blame variables exists. The results showed a strong positive correlation between External Communication and Service Outcomes variables and it showed a moderate positive correlation between Personal Hassles and Increased Blame variables.
Conclusions: Overall, the study participants demonstrated a positive attitude towards the LIS on personal basis and on the basis of their daily work routine. It is a good implication of LIS success in health care sector and paves the way for incorporation of more advanced and efficient LIS system in the future.

1. Introduction

1.1. Background

The main purpose of establishing a medical laboratory is to conduct the diagnostic tests to primarily diagnose the disease and analyze the treatment outcome, thus aiding in prevention of diseases. The laboratory information system (LIS) is a software system for managing, processing, reporting, and storing laboratory information to deliver meaningful results within a stipulated time as needed by the doctors or lab technicians [1]. In recent years, LIS has become a necessity of every laboratory. It not only elevates the capacities of the clinical laboratories, but also reduces the diagnostic errors and the time required for reporting results, thus enhancing the decision making process leading to better treatment and diagnostic outcomes [1–4]. Wurtz and Cameron [5] reported that LIS usage while reporting and conveying results ameliorated the legal threats by assuring the preciseness, completeness, and accuracy of the reported results.

The LIS-based studies usually focused on assessing the software performance and quality as a diagnostic and decision support tool in medical laboratories. Considering all the studies, a significant number emphasized on examining the overall performance and quality of the LIS system itself. Nonetheless, only few studies contemplated investigating the LIS system's effect on users. The laboratory staffs not only use LIS but also interact maximally with it to certify and pass on the results to other physicians. Hence, the commencement of the LIS technology was associated with higher expectations of in terms of good laboratory management, better decision making capacities and improved overall functioning of the medical organizations. The most crucial impact of LIS is that it brings all the cadres of people working in a hospital under one roof when it comes to gaining an access to accurate, appropriate, understandable, and comparative data [6]. This positive attitude also favors increased usage of LIS by the hospital staffs [7,8]. This positive attitude can be acquired only if the system does not brings in much of changes in the work environments of the laboratory staffs including technical, social, and organizational factors. Nonetheless, introducing a new and

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advanced technology has an effect on the clinical. Oborn and Barrett [9], as well as Hill et al., [10] established that digitalization of information has bought in fear among many clinical workers about losing their position and authority. This switch of power and control from laboratory personnel has been a source of continuous concern for the LIS users. Rather than considering LIS as a tool for complementing their role in healthcare organization, the laboratory personnel have an impression that their role is compromised by digitalization [11]. Therefore, it is necessary to understand the perceptions and perspectives of the LIS-users to describe its impact on them.

Delone and McLean [12] have determined the six main factors that regulate the success of information systems. The most important factor among them is the effect of the system on its users. According to Kaplan [13], the effect of LIS is largely based on the system outcomes. Ammenwerth et al. [14] and Carayon et al. [15] mentioned that by endorsing digitalization of information in a health care organization, significant changes is introduced in the workflow and users tasks. Vogelsmeier et al. [16] pointed out that when the system's users find the software complicated and inefficient, they look for alternative ways for accomplishing their assigned tasks rather than struggling with the system itself, thus. causes annoyance among the users [17]. In addition, introduction of a technology can influence the users' performance leading to personal frustrations and dislike for the system and limiting the system usage if the users' requirements were not taken into account during implementation [18–20]. Additionally, Peute and Jaspers [21] identified that usability issues, such as paucity in the users involvement while adoption of the system, can negatively affect the users performance, ultimately causing failure of the system.

Numerous studies have indicated that the anticipated overall advantages of LIS determine the users' attitudes towards it. Higher are the benefits, greater is the acceptance level and intention to use [22–24]. In fact, the perceived notion about system's ease of use and elevation in the task performance of the working staff acts as a motivation for using the information system [25,26]. Therefore, examining the effect of LIS systems on its users will impart us a clear view on the interaction between user and the software system which will aid in identifying and overcoming any shortcomings in attaining the expected benefits while implementing the information system. Therefore, we aimed to explore the effect of LIS on the laboratory personnel at King Abdul-Aziz Medical City in Riyadh.

1.2. Goal of the study

The purpose of the current study is to investigate the status of LIS impact among end users at the laboratory department in KAMC. It will also try to explore whether there is a relationship between user characteristics and the studied impact variables. The main research question for this study is, "What type of impact does laboratory information system (LIS) has on its intended users in the laboratory department?"

1.3. Objectives

- Examining the effect of LIS on its end-users and analyzing their performances.
- Investigating the factors that affect the LIS-users in the laboratory environment.
- Finding a correlation between the users' characteristics and the variables affecting LIS usage.

2. Methodology

2.1. Study setting

The present study was carried out at the Department of Pathology & Laboratory Medicine, King Abdul-Aziz Medical City (KAMC), Riyadh from 13th May 2015 till 28th May 2015. Currently, KAMC is having the capacity of 1200 beds in total and approximately 3 million outpatient visits a year, making it the most prominent hospital of the Middle East. Moreover, the Department of Laboratory Medicine is internationally accredited by the College of American Pathologists (CAP) and the American Association of Blood Banks (AABB).

2.2. Participants

The target population included all the laboratory personnel working at KAMC, Riyadh who are using LIS routinely in their medical practice during the study period. The users approached in this study are all laboratory department personnel who are working in the laboratory and who are using the LIS in their daily practice. They are approached to test their perception towards LIS impact on their daily work and on their personal perception toward the system in general. In total, 427 LIS users were approached to participate in the study.

2.3. Study design

The present study is designed as a descriptive cross-sectional research and uses a survey-based method to collect data.

Based on the study of J. Anderson, C. Aydin, and B. Kaplan, the current survey includes five features that estimate the effect of LIS on laboratory staff [27]. These features help in evaluating the users' viewpoint about LIS. They are external communications, service outcomes, personal hassles, increased blame and personal intentions. Furthermore, association between users' perceptions toward system and demographic variables such as gender, age, work experience, area of work, academic qualification, job position, LIS training, computer experience, and time using LIS will be determined as well.

The LIS users opinion regarding various aspects of LIS was collected using a questionnaire adopted from the work of Kaplan and Duchon [28,29]. The questionnaire was developed for assessing the Laboratory Computer System. The questionnaire was modified and updated to include the current laboratory work. The study instrument was given to four laboratory technicians and one pharmacist working at KAMC to check the accuracy of the statements and to bring out any ambiguity in the questionnaire statements before beginning the survey. After receiving the feedback, few modifications were incorporated to the statements. The questionnaire includes 37 questions which is categorized into different parts:

- The first part deals with demographic and background information of the participants and consists of 9 questions.
- The second part enlists the user responses on the variables influencing the impact of LIS on users. The responses were recorded on five point Likert scale ({Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D) and Strongly Disagree (SD)}). This section is further sub-divided to contain:
- Three questions related to external communication.
- Six questions on service outcomes.
- Two questions on personal intentions.
- Eight questions related to personal hassles.
- Nine questions on assessing user blame.

The questionnaires were distributed in paper-based format to the participants. Each questionnaire had a cover page which gives a brief description about the study goal along with the assurance of confidentiality and privacy of the participants' information. The following scale was used to convert the Likert scale responses to level of user agreement: 1–1.8 strongly disagree, >1.8–2.6 disagree, >2.6–3.4 neutral, >3.4–4.5 agree, >4.5 strongly agree [30].

2.4. Data analysis

The data analysis is based on Cronbach Alpha test to check for the