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# The impact of automating laboratory request forms on the quality of healthcare services

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Received 23 June 2016; received in revised form 3 August 2016; accepted 1 September 2016

## KEYWORDS

Laboratory request form;  
Paper-form completeness;  
Electronic-based forms;  
Saudi Arabia

**Summary** In recent decades, healthcare organizations have undergone a significant transformation with the integration of Information and Communication Technologies within healthcare operations to improve healthcare services. Various technologies such as Hospital Information Systems (HIS), Electronic Health Records (EHR) and Laboratory Information Systems (LIS) have been incorporated into healthcare services. The aim of this study is to evaluate the completeness of outpatients' laboratory paper based request forms in comparison with an electronic laboratory request system. This study was carried out in the laboratory department at King Abdulaziz Medical City (KAMC), National Guard Health Affairs, Riyadh, Saudi Arabia. We used a sample size calculator for comparing two proportions. We estimated the sample size to be 228 for each group. Any laboratory requests including paper and electronic forms were included. We categorized the clarity of the forms into understandable, readable, and unclear. A total of 57 incomplete paper forms or 25% were identified as being incomplete. For electronic forms, there were no incomplete fields, as all fields were mandatory, therefore, rendering them complete. The total of understandable paper-based laboratory forms was 11.4%. Additionally, it was found that the total of readable was 33.8% and the total for unclear was 54.8%, while for electronic-based forms,

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<http://dx.doi.org/10.1016/j.jiph.2016.09.003>

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there were no unclear forms. Electronic based laboratory forms provide a more complete, accurate, clear, and understandable format than paper-based laboratory records. Based on these findings, KAMC should move toward the implementation of electronic-based laboratory request forms for the outpatient laboratory department. © 2016 King Saud Bin Abdulaziz University for Health Sciences. Published by Elsevier Limited. All rights reserved.

## Introduction

Today, many hospitals have implemented or are planning to implement information technology systems and solutions to improve the quality of services provided to patients. In Saudi Arabia, the uptake of technology has lagged compared to more industrialized nations. Some Saudi institutions are leading, while others are lagging in the implementation of Hospital Information Systems. For example, King Faisal Specialist Hospital and Research Center (KFSH-RC), in Saudi Arabia has reached stage 6 for the Electronic Medical Record Adoption Model (EMRAM), while other hospitals still use paper records.

One healthcare domain that has benefited from the use of information technology has been the laboratory department. Although the literature shows that the use of information technology can enhance the process of healthcare delivery, many hospitals in Saudi Arabia continue to use paper-based forms when ordering lab tests [2–4]. The process of requesting lab investigations for outpatients usually occurs manually through paper-based forms. The requesting physician fills the paper form and hands the form to the patient in order to deliver the hardcopy manually to the laboratory receptionist. Afterwards, the lab technician draws the blood samples from patients, attaches the paper form to the acquired samples, and sends them to the central lab for further study and analysis (See Fig. 1).

Many clinicians cannot be expected to stay up-to-date with every complex test and diagnostic procedure outside their specialty. Furthermore, the overcrowded environment at the lab reception slows down the workflow and influences the quality of clinical care provided to healthcare customers [1,5]. Appropriate implementation and the use of laboratory electronic form test-requesting systems can help overcome many of the aforementioned challenges [2,3,5].

Research studies have been conducted on the computerization of Laboratory Information Systems and their impacts on the organizational workflow [2–6]. Other studies investigated the impact of incomplete data and its influence on patient

diagnosis and treatment [3,4]. Based on the literature, laboratory workflow processes can be improved with the adoption of electronic laboratory forms as compared to the use of manual paper forms [2,5]. Some studies focused on the influence of missing crucial clinical parameters on the interpretation of laboratory results and the reporting of patient diagnosis [1,5].

One study focused on determining the category and regularity of errors when providing data on laboratory request forms at a hospital in Nigeria. The analysis included an assessment of the application forms, to determine incorrect or incomplete sections of the application form, and the regularity or frequency of errors. Most of the data omitted and/or regularly repeated in the laboratory forms was patient age and their location, the name of attending physician, and information regarding patient's gender. Further, audited laboratory request forms did not have enough information about the diagnosis or the type of the clinical sample. The authors emphasized the dangers of incomplete laboratory request forms that included misdiagnosis and mismanagement of patients leading to deteriorating health among patients. They suggest that laboratory request test forms should be completed to avoid issues in the healthcare systems such as misdiagnosis, repeated laboratory test and improper treatment procedures [8]. Another study collected examples of medical error cases which were a result of missing names, times, and medical record numbers. These inadequacies of missing data lead to incorrect diagnosis and an increase in the number of medical errors within the hospital [3,4]. One study compared handwritten laboratory test-requests with electronic Laboratory Information Systems. The authors identified the types and numbers of errors that existed in handwritten serology test requests received in outpatient clinics. The results showed that the written request forms had 67 out of 627 errors where 51 of these errors were transcription faults while 10 were associated with abbreviations. The study concluded that written data-entry of serology requests is a process that is prone to many mistakes. The authors suggest the use of electronic ordering because it has the potential to eliminate handwritten and

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