Research article

Assessment of incompleteness in microbiology laboratory request forms at a University Hospital in Sri Lanka: Implications for preanalytical quality improvement

Nakkawita WMID[1], Gunasekera T[1], Senaratne UTN[2],. Kulatunga GGAK[3]

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Abstract

Introduction: A laboratory request form is an important mode of communication between the clinician and the laboratory. Accurate information provided in a microbiology request form is useful in identifying errors in the preanalytical stage, making decisions in the analytical stage, and interpreting results in the post-analytical stage of specimen processing. This study aims to describe the degree of incompleteness of microbiology laboratory requests at a university hospital in Sri Lanka.

Methods: All urine and blood culture request forms received by the microbiology laboratory during a 6-month period were studied. Each request was assessed for the completeness of the information requested on the form.

Results: Of 2087 request forms, none were filled completely. The patient's name was present in all request forms, while the age and gender were absent in 37 (1.8%) and 380 (18.2%) respectively. The location of the patient was not given in 380 (18.2%). Clinical information of the patient with a short clinical history and details of antibiotics were missing in 840 (40.2%) and in 1665 (79.7%) respectively. A high rate of incompleteness was seen in specimen details such as the date (1479, 70.8%) and time of specimen collection (2011, 96.3%). The clinician's name and designation were lacking in 1457 (69.8%) and 1110 (53.1%) respectively, while the signature was not available only in a few, 131 (6.3%,).

Conclusion: Manual completion of microbiology laboratory request forms was not satisfactory. Details mainly lacking were related to specimen collection, clinical details, and clinician details. Poor documentation on request forms may lead to incorrect reporting and/or interpretation of results, and delays in reporting. Implementation of an electronic request form with mandatory components through an Electronic Medical Record (EMR) system incorporated into a Laboratory

[1] *Faculty of Medicine, General Sir John Kotelawala Defence University & University Hospital KDU , Rathmalana, Sri Lanka*
[2] *Faculty of Allied Health Sciences, General Sir John Kotelawala Defence University, Werahera, Sri Lanka*
[3] *Health Information Unit, Ministry of Health, Sri Lanka*

Address for correspondence: Dr. W.M.I.D. Nakkawita, Faculty of Medicine, General Sir John Kotelawala Defence University, Rathmalana – 10390, Sri Lanka; Telephone: +94 714 336 343 email: dilininak@kdu.ac.lk

https://orcid.org/0000-0002-2470-9933

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Information Management System (LIMS) is an alternative that would correct these gaps, minimise errors, and enhance the quality of reporting in microbiology diagnostic laboratories.

Keywords: *Electronic request forms, Preanalytical quality improvement, Microbiology laboratory, , Electronic Medical Records (EMR), Laboratory Information Management System (LIMS)*

Introduction

Healthcare delivery is extensively dependent on clinical laboratory services. A detailed study by the Lewin Group for the Centers for Disease Control and Prevention in the USA showed that laboratory medicine is an essential component of the healthcare system and has a major impact on clinical decisions, providing healthcare workers with information aiding in the diagnosis, treatment, management and prevention of diseases.[1] It is therefore essential that test reports are accurate, relevant, reliable, timely, and interpreted correctly. To provide such good quality laboratory services, every step in the three phases of the laboratory testing process, namely preanalytical, analytical, and postanalytical, should be performed correctly. Conducting clinical laboratory audits is part of clinical governance. It is an essential component of the continuous quality improvement process to sustain a reliable laboratory service that ultimately leads to better patient care.[2] Laboratory audits can be conducted in any of the three phases of the laboratory testing process. Over many years, the quality control methods of a clinical laboratory had its focus mainly on the analytical phase, believing that most laboratory errors occur at this stage of testing. However, due to the advancement of the high-quality technology applied in the analytical phase, it is no longer considered the focal point of laboratory errors. Studies have demonstrated that 68% to 70% of laboratory errors, including lack of information on specimen collection dates and times, clinical details, and patient identification details, occurred in the preanalytical phase.[3,4,6] Furthermore, previous evidence shows that preanalytical errors are major contributors to inaccurate laboratory results.[3,5]

The preanalytical phase of laboratory testing consists of procedures from the time a clinician requests a laboratory test until the samples are ready for analytical examination. These procedures include completion of laboratory request forms or ordering of the tests, labelling of the specimens, preparation of patients, collection of specimens, transportation, and storage. While laboratory personnel have no direct control over this phase, errors occurring at this stage will adversely affect the analytical and post-analytical phases.

Bacterial cultures and antibiotic sensitivity testing, which represent the majority of clinical microbiology investigations, are essential in the definitive diagnosis and targeted treatment of infectious diseases, infectious disease surveillance and appropriate infection control. A microbiology laboratory request form contains demographic and identification information of the patient, the patient's clinical diagnosis or a short clinical history, antimicrobial therapy to be started or already on, specimen details, specimen collection and receiving times, and clinician details. Hence it creates an important communication platform between the laboratory personnel and the requesting clinician. A duly filled request form is important during decision-making at all 3 stages of microbiology laboratory testing, including selection or rejection of specimens, use of appropriate culture media, using special identification tests, interpretation of culture isolates, decision on the need for antimicrobial sensitivity testing, selection of antimicrobials for sensitivity

testing, interpretation, authorisation and selective reporting of the results and release of a valid report to the correct patient.

Excluding or supplying inadequate information in the request form may have a negative impact on the accuracy of the test result, eventually affecting patient management and safety.[6] Furthermore, inadequate and/or incorrect details on test request forms can result in repetition of testing, thereby leading to wastage of resources and loss of patients' trust in the diagnostic services.[7,8,9]

Only a few government hospitals in Sri Lanka currently operate electronic platforms for requesting and report viewing of laboratory tests, mainly for chemical pathology and haematology tests. A functional Laboratory Information Management System (LIMS) is operated for microbiology tests at the National Institute of Health Sciences, Kalutara which caters to the Teaching Hospital Kalutara. Implementation of a national-level LIMS project is under way and will be available for government sector hospitals in the future.[10] However, currently, the common practice is requesting microbiology laboratory tests on manually filled standard paper-based request forms. In many instances, incomplete request forms are sent and accepted by the laboratory due to the paucity of knowledge on the importance of a completely filled request form.[8,11,12]

Several studies have described how inadequately filled request forms have led to medical errors compromising patient safety.[3,8,11] Although published Sri Lankan data in this area is scarce, we experience the lack of the required information on laboratory request forms, giving rise to problems in specimen processing, interpretation of results, and delays in reporting and issuing reports to patients. This study aims to assess the incompleteness of microbiology laboratory request forms and make necessary recommendations to minimise or eliminate such deficiencies in order to ensure high quality laboratory reports and maximise patient safety.

Methods

A retrospective, cross-sectional study was conducted at the microbiology laboratory of the University Hospital of Kotelawala Defence University (UHKDU). All laboratory request forms for blood and urine cultures received from the wards and from the outpatient department from July 2019 to December 2019 were evaluated for the presence/absence of each parameter mentioned in Table 1. Blood and urine culture request forms were selected for evaluation since they are the commonly sent specimens to microbiology laboratories and their results can make a significant impact on patient management. Statistical analysis was conducted using Microsoft Excel and the incompleteness of each parameter was reported as a percentage.

Results

The study reviewed 2087 request forms of which none had 100% completeness. As shown in Table 1, the patient's name was mentioned in all request forms. The age of the patient and the bed head ticket or clinic number were recorded in almost all the forms. However, the gender was absent in 380 (18.2%). Details of the specimen showed the lowest completeness of all the parameters reviewed. The specimen collection date was not mentioned in 1479 (70.8%), and the time was absent in 2011 (96.3%). The type of specimen was missing in 1150 request forms (55.1%), while the test required was missing in only 12 forms.

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Table 1: Summary Percentage incompleteness of the parameters requested in the laboratory request forms for blood and urine cultures

Parameter	No of incomplete request forms (n)	% incomplete (n/2087*100)
Patient's Identification & Demographic Information		
Name	0	0
Age	37	1.8
Gender	380	18.2
Clinic / Bed Head Ticket Number	38	1.8
Location (Ward/Unit)	380	18.2
Specimen Information		
Date of the Specimen Collection	1479	70.8
Time of the Specimen Collection	2011	96.3
Specimen type	1150	55.1
Test Required	12	0.6
Clinical Information		
Short Clinical History	840	40.2
Antibiotic given/to be given	1665	79.7
Clinician Information		
Name	1457	69.8
Designation	1110	53.1
Signature	131	6.3

With regard to the patient's clinical information, 840 (40.2%) forms did not give a short clinical history of the patient, while 1665 (79.7%) of the request forms lacked information on antibiotics given or to be given. Details of the clinician, name, and designation were absent in the majority and only a signature was available on most of the forms.

Discussion

The results of this study indicate that none of the request forms for blood and urine culture tests received by the microbiology laboratory during the study period were fully complete and had one or more components missing.

Overall, more than 50% incompleteness was observed in specimen information, clinician information and patient clinical information, while less than 20% incompleteness was noted in patient identification details.

Patient identification data and basic demographics

Sending a correct report on time to the correct patient is the responsibility of the laboratory. Failure to accurately identify patients by the laboratory staff will result in erroneous patient identification details on laboratory reports and untraceable reports. Given the similarity of patient names, it is crucial to have the Bed Head Ticket (BHT)/clinic number and other demographic parameters readily available. These details are essential for verifying identity and accurately sorting out the samples.[15] Therefore, the patient's name, age, gender, and BHT/clinic number are essential components in a laboratory request and should be 100% completed. Several studies have shown

that lack of patient identification has led to specimen rejection by the laboratory.[1,7,12,13,14] Moreover, in local settings, missing identification details would result in difficulties in the interpretation of certain results according to patient demographics, delays in reports reaching the patients or delays in communicating important results to clinicians, and patients receiving incorrect reports.

Location of the patient is another important component that should be indicated in all request forms. Absence of this information leads to difficulties in communicating results to the wards and the patients on time. It is good laboratory practice to inform critical results to the ward via telephone without any delay to ensure patient's safety. In the present study, 18 % of the requests failed to provide the ward/unit number. This is higher than a previous similar study done in a chemical pathology laboratory in South Africa which was 4.9% and is remarkably low when compared to an audit done in a haematology department of a tertiary hospital in Ghana which reported a 52.2% completion rate.[3,8]

The patient's gender revealed a 18.2% incompleteness in the present study, contrary to the much lower incomplete rate of 2.2% reported by Oyelekan *et al.* (2018) and 5.1% by Nutt *et al*. (2018).[3,15] However, the study done by Oyelekan *et al*. (2018) indicated a higher incomplete rate (57.1%) for the field of age, whereas in the present study age was missing only in 1.8% of the forms evaluated. Gender and age of the patient are important in the interpretation of positive bacterial cultures and selective reporting of antibiotic sensitivity. The significance of pathogenic bacteria isolated from cultures may differ according to the age of the patient, and missing these parameters could hamper the reporting of culture results and antibiotic sensitivity which may lead to misuse and overuse by prescribers.

Specimen Data

Date and time of sample collection is another important parameter that should be recorded in the request form as most microbiology laboratory analyses are time dependent. These two parameters are also important in deciding whether the specimen is suitable for processing. Loss of viability of likely pathogenic microorganisms or overgrowth of contaminants or colonisers can result with long time gaps between specimen collection and processing or due to inappropriate storage conditions. In this study 70.8% and 96.3% of the forms evaluated failed to state the date and time of collection respectively. Our results were similar to studies done by Olumide *et al*. (2018) Emange *et al*. (2018) and Oyalekan *et al*. (2018) reporting 98.2%, 80% and 99.3% incomplete rates respectively for time of specimen collection.[15,16,17] Inability to identify unsatisfactory samples and processing them will results in a high chance of negative results or over reporting of colonisers which again contributes to undertreatment, over treatment or use of inappropriate antibiotics. Therefore, knowing the date and the time of specimen collection is an essential component in determining the quality of the sample received for microbiology testing.

The type of the specimen was missing in 55.1% of request forms in the current study, while a similar study conducted by Jegede *et al*. (2016) reported a greater figure of 85% incompletion.[18] However, the present observation contrasted with the findings by Adegoke *et al*. (2011) and Nutt *et al*. (2008) who reported 10.1 % and 11% of incompletions respectively.[3,11] With regard to urine cultures, it is important to mention whether it is a midstream specimen, catheter specimen, or obtained directly from bladder, renal pelvis or from a nephrostomy tube. This information is needed to make decisions in the analytical phase as well as for interpretation of results by the

clinical microbiologist before sending the report. Similarly, with requests for blood culture, it is necessary to mention whether the specimen is peripheral blood or taken from a central catheter to allow appropriate interpretation of results in case of catheter colonisation, central catheter-associated blood stream infection, or contamination of blood cultures with skin normal flora during sample collection.

Clinical data

Of the request forms analysed, 40.2% failed to provide a short clinical history of the patient, which is lower than the incomplete rate of 54.7% reported by Olumide *et al*. (2018).[16] Deficiency in reporting clinical details may be due to poor understanding of requestors on the importance of clinical history on analytical and post analytical phases of specimen processing. Availability of clinical history facilitates decisions of antibiotic selection and will allow microbiologists to tailor the interpretation and reporting of the test results in alliance with the clinical needs. It also aids in avoiding carrying out inappropriate antibiotic sensitivity testing and reporting, leading to proper patient management. Additionally, inadequate clinical information could result in inappropriate or repetition of tests, resulting in poor resource management.

Details of the antibiotics started or to be started were not recorded in 79.7% of the request forms. This was comparable to the findings by of Raksha *et al*. (2019) and Banu *et al*. (2012) which show incomplete rates of 92% and 73.8 % respectively for the same.[8,14] Prior use of antibiotic could give a false negative result in bacterial cultures. Generally, it is advised to collect the specimen prior to the administration of antimicrobial agents to avoid any interference with the test results. Prior antibiotic use therefore needs to be considered when analysing and interpreting test results. Also, knowledge of current antibiotics the patient is on is useful when reporting antibiotic sensitivity.

Clinician detail

The signature of the clinician was found to be satisfactory with only an incomplete rate of 6.3% whereas the name of the clinician was absent in 69.8 % of the requests made. In contrast, a study by Olayemi *et al*. (2011) reported 75.5 % completeness for the signature, while reporting the name of the clinician showed 55.4% completeness rate in haematology request forms.[7] Name of the clinician is crucial as it allows laboratory personnel to convey urgent results which need the clinicians' immediate attention. In addition, the responsible clinician can be contacted for clarification of any issues related to sampling. It also helps in obtaining any additional clinical information when required.

Laboratory errors have a significant impact on patient treatment and management process. Therefore, conducting laboratory audits to identify and eliminate such limitations is crucial for providing quality service and ensuring better patient care.

Conclusion

This laboratory-based study revealed a high degree of incompleteness of manually filled microbiology request forms. Most deficiencies were observed in recording patient location, specimen details, clinical details, and clinician information which may directly affect the accuracy and quality of the laboratory report. The results obtained from this study will be useful when addressing the importance of appropriate ordering of tests, which in turn is important in the preanalytical stage of microbiology specimen processing.

Recommendations

Future research prospectively assessing the impact of incomplete microbiology request forms on analytical and post-analytical phases of specimen processing may be useful in identifying the gravity of the problem when using manually filled request forms.

Improving awareness of doctors and nurses on the importance of sending duly completed request forms and checking the required details on specimens and request forms at the sample receiving bay by the laboratory staff are important in minimising preanalytical errors.

Introducing a hospital Electronic Medical Records (EMR) system that interacts with a Laboratory Information Management System (LIMS) will also be important in overcoming many errors when ordering a laboratory test. This will enable the creation of electronic request forms with mandatory components to be filled in, overcoming the aforementioned deficiencies during all stages of specimen processing. A Unique identity (UID) for each patient will assist in tracking previous laboratory records. Designing an EMR in line with the Sri Lankan National Electronic Medical Record (NEHR) of the Sri Lankan digital health blueprint prepared by the Ministry of Health, Sri Lanka will enable interoperability. This will minimise pre-analytical errors, minimise inappropriate antimicrobial prescriptions, enhance the continuation of care for the patient, and indirectly assist in reducing antimicrobial resistance in the country. Furthermore, we recommend including the clinician's contact information in the request as it allows laboratory personnel to contact them during a critical situation where patient safety is at stake. Moreover, medical and nursing students should be given a proper understanding of the function of the laboratory and the importance of correct test ordering. In addition, newly appointed doctors and nurses should be educated during induction programmes on the importance of sending completed laboratory requests. Proper standards and policies must be established regarding the acceptance and rejection of laboratory specimens based on the completeness of laboratory request forms and periodic audits should be conducted to ensure those standards are maintained.

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References

1. Wolcott J, Schwartz A, Goodman C. The value of laboratory medicine to health care. In: Laboratory Medicine: A National Status Report. The Lewin Group; 2008: pp.19-65. Available at: *https://www.lewin.com/content/dam/Lewin/Resources/Site_Sections/Publications/3993.pdf* Accessed 07.12.2023.
2. Erasmus RT, Zemlin AE. Clinical audit in the laboratory. *J Clin Pathol*. 2009; 62(7):593-7. *doi: https://doi.org/10.1136/jcp.2008.056929*
3. Nutt L, Zemlin AE, Erasmus RT. Incomplete laboratory request forms: the extent and impact on critical results at a tertiary hospital in South Africa. *Ann Clin Biochem*. 2008; 45(5):463-6. *doi: https://10.1258/acb.2008.007252*
4. OA A, Idowu AA, Jeje OA. Incomplete laboratory request forms as a contributory factor to preanalytical errors in a Nigerian teaching hospital. *African J Biochem Res*. 2011; 5(3):82-5. *doi: https://10.5897/AJBR.9000134*
5. Plebani M. Errors in clinical laboratories or errors in laboratory medicine? *Clin Chem Lab Med*. 2006; 44(6):750-9. *doi: https://10.1515/CCLM.2006.123*
6. Lippi G, Chance JJ, Church S *et al*. Preanalytical quality improvement: from dream to reality. *Clin Chem Lab Med*. 2011; 49(7):1113-26. *doi: https://10.1515/CCLM.2011.600*
7. Olayemi E, Asiamah-Broni R. Evaluation of request forms submitted to the haematology laboratory in a Ghanaian tertiary hospital. *Pan Afr Med J*. 2011; 8:33. *doi: https://10.4314/pamj.v8i1.71148*
8. Banu A, Anand M, Kabbin SJ *et al*. Incomplete requisition form: potential for error in the microbiology laboratory. *Australas Med J*. 2012; 5(9):468-74. *doi: https://10.4066/AMJ.2012.1361*
9. Alavi N, Khan SH, Saadia A *et al*. Challenges in preanalytical phase of laboratory medicine: rate of blood sample nonconformity in a tertiary care hospital. *EJIFCC*. 2020; 31(1):21-27. PMID: 32256286.
10. Ministry of Health, Sri Lanka. Digital Health Blueprint. 2023. Available at: *https://www.health.gov.lk/wp-content/uploads/2023/11/Digital-Health-Blue-Print-Full-Book-01.11.2023-Final.pdf.* Accessed on 20.10.2024.
11. Adegoke OA, Idowu AA, Jeje OA. Incomplete laboratory request forms as a contributory factor to preanalytical errors in a Nigerian teaching hospital. *African J Biochem Res*. 2011; 5(3):82-85. *No doi*
12. Neogi SS, Mehndiratta M, Gupta S *et al*. Pre-analytical phase in clinical chemistry laboratory. *J Clin Sci Res*. 2016; 5(3):171-8. *doi: https://10.15380/2277-5706.JCSR.15.062*
13. Oyedeji OA, Ogbenna AA, Iwuala OS. An audit of request forms submitted in a multidisciplinary diagnostic center in Lagos. *Pan Afr Med J*. 2015; 20:423. *doi: https://10.11604/pamj.2015.20.423.5778*
14. Raksha K, Ramkumara VS. Requisition forms and reports-'garbage in garbage out' – significance of clinical data in microbial culture & antibiotic susceptibility testing of surgical samples. *Global J Res Anal*. 2019; 8:31-33. *doi: https://10.36106/gjra/4601050*
15. Oyelekan AA, Ojo OT, Olawale OO *et al*. Pattern of completion of laboratory request forms in a tertiary health facility. *Ann Health Res*. 2018; 4(2):155-61. *doi: https://10.30442/ahr.0402-7-18*
16. Olumide OB, Joel AO, Paul ME *et al*. Assessment of patients' medical laboratory request forms for compliance in Jos University Teaching Hospital, Jos-Nigeria. *Am J Biomed Sci Res*. 2019; 6(4):334-339 *doi: https://10.34297/AJBSR.2019.06.001056*
17. Emanghe EE, Ochang AE, Udoh AU *et al*. Incompleteness of Medical Microbiology and Parasitology laboratory request forms: an audit of quality service in the University of Calabar Teaching Hospital, Calabar, Nigeria. *Cross River J Med*. 2018; 2(1):28-35. *doi: https://10.1234/crjm.v2i1.28*
18. Jegede F, Mbah HA, Dakata A *et al*. Evaluating laboratory request forms submitted to haematology and blood transfusion departments at a hospital in Northwest Nigeria. *Afr J Lab Med*. 2016; 5(1):a381. *doi: https://10.4102/ajlm.v5i1.381*