An evaluation of improperly completed laboratory request forms in a tertiary mono-specialist hospital in Kaduna, north-west Nigeria

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Abstract

Background: Most laboratory errors occur in the early pre-analytical phase of the total testing process, part of which is the completion of laboratory request form (LRF). The challenges of improperly/inadequately completed or illegible data on the LRF could lead to negative patient's outcome. However few studies have examined the frequency of improperly completed LRFs. This study is, therefore, designed to quantify the occurrence of improperly completed LRFs in Federal Neuropsychiatric Hospital (FNPH), Barnawa, Kaduna to serve as an initial step in an error reduction strategy.

Methodology: An audit of 518 paper based (manually completed) laboratory request forms received in FNPH laboratory in the month of January 2021, was retrospectively conducted to assess the level of completion of LRFs The data were extracted manually from the LRFs and entered into an Excel Sheet indicating adequately and correctly-filled information, or otherwise for any item missing. The data was further categorized into groups of quality indicators (QI), based on International Federation of Clinical Chemistry-Working Group (IFCC-WG) guidelines, and results were expressed in percentages.

Results: Of the 518 laboratory request forms audited, 29.0% were improperly completed. The patient's name and test required were the only variables with 100% filled data, and none of the forms was 100% adequately filled. Furthermore, error rates of 94.5%, 5.3%, 4.2% and 2.1% were recorded for patient's clinical information, demography, clinicians' information and appropriateness of the test requests, respectively.

Conclusion: This study reveals a high occurrence of inappropriately filled laboratory forms in the place of study. These could add to raise the laboratory errors in the hospital. There is the need to encourage clinicians to fill LRF appropriately.

Key Words: Improperly completed, LRFs, FNPH Barnawa Kaduna, North-West Nigeria

Introduction

The concept of the total testing process (TTP) was first described by Gambino[1] and later became the familiar nine steps notion of the brain-to-brain loop for laboratory diagnostics as modified by George Lundberg over 30

years ago.[2] The first step in the Lundberg loop model involves the selection of appropriate laboratory tests in the brain of the physician, which is then communicated through a laboratory request form (LRF). This is followed by numerous intermediary steps, such as identification of the patient, specimen collection, specimen handling and then by the actual specimen analysis in the laboratory.[3]

Traditionally, laboratory practice is divided into three phases – pre-analytical, analytical and post-analytical.[4] Evidence showed that majority of the laboratory errors (50%–70%) occur during the pre-analytical phase and involved the handling of the laboratory requisition form.[5] Moreover, ISO:15189[(6)] standard for medical laboratory quality defines the pre-analytical phase as 'steps starting in chronological order, from the clinician's request and including the examination requisition, preparation of the patient, collection of the primary sample, transportation to and within the laboratory, and ending when the analytical examination procedure begins.[7]

While the pre-analytical phase is known to be error-prone, only recently have data been collected to demonstrate that the errors occurring are mainly related to procedures performed outside the laboratory walls, by healthcare personnel not under the direct control of the clinical laboratory.[8] Quality improvement initiatives must therefore take into account both the 'classical' pre-analytical steps and the initial procedures included in the so-called 'pre-pre-analytical phase', because it has the highest error rate of 46%–68%.[7] Pre-pre analytical phase refers to a group of activities 'usually performed neither in the clinical laboratory nor, at least, in part under the control of laboratory personnel.'[9]

Insufficient, incorrect or incompletely filled-out or illegible data on the laboratory requisition form accompanied with specimen often rejected by the clinical laboratory can delay communication of important clinical information, such as life-threatening results, and cause resource wastage.[10,11] It can also make interpretative comments difficult, which may delay communications with the requesting clinician or may cause the primary care provider to initiate improper treatment or to withhold required treatment.[2]

Some previous studies noted laboratory request forms' error rate as ranging from 10.5% to 81.0%.[3,13-16] The error rates reported are as follows: in Kano, North–West Nigeria, the rate was respectively 18.8% and 10.5% in blood transfusion service and haematology departments;[3] in Ghana, it was

respectively 25% and 32.7% based on age and sex;[13] in South Africa, it was 14.7% from clinical information;[14] in Pakistan, it was 81% error rate on patients' identifiers;[15] and from England, the rates of error in clinical diagnosis were respectively 61.2% and 25.6% by surgeons and physicians.[16] Many researchers recommended educating the clinicians on proper completion of laboratory request forms as a quality improvement strategy.[14,16,17]

Accurate laboratory diagnosis begins with proper and adequate filling of the patient's laboratory request form by the physicians. It is in line with this reality that the International Organization for Standardization (ISO:15189)[6] for medical laboratories states that the laboratory test request form should contain sufficient information to identify the patient, the authorized requester as well as significant clinical information.[7] This clearly recognises the need to evaluate, monitor and improve on all the procedure and processes in the initial phase of the brain-to-brain loop. This study was therefore, designed to quantify the occurrence of improperly completed LRFs which will be used as a key performance indicator in assessing future quality improvement strategies of service delivery in Federal Neuropsychiatric Hospital, Barnawa, Kaduna North-West, Nigeria.

Methodology

Study Design

This is a retrospective descriptive analysis of laboratory review forms carried out at the Medical Laboratory Services Department of Federal Neuropsychiatric Hospital (FNPH), Barnawa, Kaduna which is a 300-bed mono-specialist hospital in North- Western Nigeria offering mental health care services, training of mental health specialists and mental health nurses. Ethical clearance was obtained from FNPH Health Research and Ethics Committee, and confidentiality of the data was observed, by omitting patients' name and other identifiers in the data collection processes.

Study Procedure

An audit of 518 completed laboratory request forms received at the hospital laboratory in the month of January 2021 from both in- and out-patients was retrospectively conducted to assess the level of completion of eleven (11) data variables contained on the LRF, such as name, age, sex, hospital number, ward/clinic, clinical diagnosis, antibiotics/drugs used, investigation(s) required, date of request and clinician signature. All the LRFs completed by the hospital clinicians, irrespective of the test requested, were included in this study.

The data was extracted manually from the completed LRFs and entered into an Excel 2007 Version spreadsheet (Microsoft Inc.

USA); a score of ***0*** was used to indicate complete and correctly filled information, whereas a score of ***1*** was recorded when any item is missing. The data was further categorised into groups of quality indicators (QI) based on International Federation of Clinical Chemistry-Working Group (IFCC-WG) guidelines,[18] and the result was expressed in percentages.

Sample Size Determination

The sample size was determined using the formula $n = (z^2pq)/d^2$, where n= minimum sample size, z= critical value at 95% confidence level, usually set at 1.96, p = prevalence, q= (1-p), d = precision of 5%.[19]

The prevalence of 18.8% (Approx. 19%) was used as an error rate of audited LRFs from the Department of blood transfusion, Aminu Kano Teaching Hospital (AKTH) Kano[3] – a hospital in the same geo-political zone as our study site. Inputting the variables in the formula above, $n = (1.96^2 \times 0.19 \times 0.81)/0.05^2 = 236.5 = 237$. In this study, we analysed 518 LRFs, which is higher than the calculated sample size.

Data Analysis

Microsoft Excel version 2007 (Microsoft Inc., USA) was used to analyse the data obtained. Error rates were determined as missing data variables divided by the total number of laboratory test request forms reviewed and expressed in percentages.

Results

A total of 518 completed LRFs were evaluated for completeness and correctness, and it revealed an overall error rate of 29.0% (Table I). Patient's name and investigation requested were the only variables that are 100% completely and correctly provided on all the LRFs examined. None of the forms was completely and correctly filled by the clinicians. Additionally, 100% error rate was recorded on the patients' medications (prescribed drugs and or antibiotics used). Furthermore, Table I showed that patient's demographic information recorded 13.5%, 4.2%, 8.5%, 0.4% and 0.0% error rates for age, ward, hospital number, sex and patient's name respectively. Patients' clinical information revealed 83.4%, 100% and 100% error rates for clinical diagnosis, prescribed drugs and antibiotic used, respectively; for clinician's information, an error rate of 4.2% was recorded for clinician's signature, being the only parameter on the LRF relevant to clinicians' information. While on the appropriateness of the test request, an error rate of 0% and 4.2% were observed for investigation required and date of request, respectively.

Table I: The proportion of incompleteness of the laboratory request forms (LRFs) at FNPH Kaduna (N=518)

Patients' Demographic Information		
Parameter	Uncompleted (n [%])	Completed (n [%])
Name of Patient	00 (0.0)	518 (100.0)
*AD	36 (6.9)	448 (86.5)
*Blank	34 (6.6)	-
Sex	02 (0.4)	516 (99.6)
Hospital Number	44 (8.5)	474 (91.5)
Location (Ward/Clinic)	22 (4.2)	496 (95.8)
Total	5.3%	94.7%
Patients' Clinical Information		
Clinical Diagnosis	432 (83.4)	86 (16.6)
Drugs Prescribed	518 (100.0)	00 (0.0)
Antibiotics Used	518 (100.0)	00 (0.0)
Total	94.5%	5.5%
Appropriateness of the Test Request		
Name of Investigation	00 (0.0)	518 (100.0)
Date of request	22 (4.2)	496 (95.8)
Total	2.1%	97.9%
Requesting Physicians' Information		
Doctor's Signature	22 (4.2)	496 (95.8)
Total	22 (4.2)	496 (95.8)
Overall Total	**29.0%**	**71.0%**

*The errors in respect to age are in form of writing any of the following instead of the patient's actual age: (1) AD or Adult; (2) Nothing or leaving the space blank.

Discussion

The overall error rate of 29.0% in filling-out the LRFs in this study is moderately high. It is higher than the 10.5%, and 18.8% from Kano[3] and 16.0% from Ile-Ife[10] and lower than 43%, 82.2% and 98.3% from Jos,[20] Kenya[21] and Lagos[22] respectively. These variations could be due to the different levels of monitoring and evaluation of the LFR by the management of the various Institutions.

Our data reveal that none of the request forms evaluated was completely and correctly filled which agrees with previous studies.[3,10,20-23] This is a worrisome finding and needs urgent intervention. The study also showed that the variables that are 100% completely and correctly filled in all the forms are the patient's name and requested investigation which agrees with a previous study's findings.[24] This may not be unconnected with the fact that laboratories usually reject test

requests without name of patients and the tests requested.

The error rates with respect to age is 13.5% consisting of 6.6% having nothing written in the space provided for age while Ad was documented on 6.9%; this could be misleading during results interpretation, because the adult age group for example has a wide range (18years and above) and vary in terms of physiology, disease epidemiology and pathophysiology.[26] For example, the reference intervals in complete blood count and some parameters in clinical chemistry are age specific, or in microbiology assessment, classifying *Escherichia Coli* isolates from stool sample as normal intestinal flora or pathogenic depend on the age of the patient. This study further reveals an overall error rate of 5.3% on patients' demographic information of six parameters consisting of patient's name, age, sex, hospital number and location. These parameters are used in patients' identification which is recognised as the cornerstone of patient safety.[27]

However, in our study, clinical information on the completed LRFs has the highest error rate because 94.5% of the request forms were without clinical data. This is by far higher than 6.7 – 57.8% reported by some previous studies[9,20,28-30] Although some may attribute this to the ratio of patients to a clinician in a clinic per day which could result in too much pressure due to limited hands or protecting patients from stigma of linking their mental health diagnosis to their information on the LRFs. Nonetheless, there is still the need to stress the importance of providing this information. This is because the non-provision of relevant clinical information could make interpretation of test result difficult especially among psychiatric patients being managed with psychoactive medication such as clozapine, sodium valporate, barbiturates, carbamezapine, benzodiazepines that might likely induce fatal agranulocytosis.[31-34]

In this study, only two parameters were captured under appropriateness of the test request - they are: name of test, and the date of request. This showed an error rate of 2.1%. However, vital information such as time, nature or type and site of sample collection were conspicuously missing on the request form. Although, often not emphasized on the LRFs, the time of sample collection for example is vital in interpreting changes in samples and analytes due to delay in reaching the laboratory, calculating turnaround time (TAT) of tests,[20] therapeutic drugs monitoring as reference values of certain

analytes differs according to the time of the day[9] as well as circadian rhythm. Hence, it is important to note that results of some laboratory investigations such as glucose estimation, erythrocytes sedimentation rate among others are time dependent. Therefore, ambiguous results could be due to a prolonged time between the time of sample collection and the time of sample separation or analysis as often seen in arterial blood gas analysis, electrolytes estimation and pus cells in urine microscopy.[20] The type of specimen obtained is important because bloody taps of other body fluids can be confused with blood and may lead to the use of inappropriate reference ranges.[9]

Our study also reveals that the signature of the authorizing requester was inadequately filled with 4.2% error rate which is comparable to 3.4% reported in Ife-Ife.[10] However, it is lower than 9.9% and 14.4% respectively reported by studies from Kano[10] and South Africa.[14] According to IFCC-WG,[18] availability and completeness of requesting physicians' identifiers, such as clinician's name, signature, telephone number, email address, etc., on the LRF, is highly recommended. These are necessary so that critical values can easily be communicated. The Royal College of Pathologists and Royal College of General Practitioners are aware of the fact that laboratory staff are often unable to communicate life threatening or severely abnormal results to primary care General Practitioners after working hours; thus necessitating ISO:15189[6] to make it mandatory for LRF to contain sufficient information to identify the patient, the authorized requester as well as provide pertinent clinical data.[7]

A major limitation of this study is our inability to assess the opinion of the clinicians on why the request forms are not filled completely and correctly. Additionally, we could not classify the requesters based on physicians' ranking such as NYSC, Registrars and Consultants due to the study nature.

Conclusion

Our study revealed a significant occurrence of improperly completed laboratory request forms in FNPH Barnawa, Kaduna North-West, Nigeria. The highest error rate was recorded in filling-out the patient clinical information which could add to the errors emanating from laboratory result of the hospital. To reduce the error rate, it is recommended that: clinicians should be trained on the importance of proper completion of LRF; continuous auditing of

completed LRFs should be instituted; the current LRF should be re-designed to include some vital quality indicators like time of sample collection, requesting physician's additional identifiers like email, phone number, the cadre of the ordering clinician, etc., and the paper-based LRF should be replaced with electronic one.

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