

Effect of remedial measures on inadequacies in the completion of laboratory request forms by clinicians

Igwebuike V Onyiaorah¹
Cornelius O Ukah¹
Daniel CD Anyiam¹
Maxy AC Odike¹
Ikewelugo CA Oyeka²

¹Department of Histopathology, Nnamdi Azikiwe University/Teaching Hospital, Nnewi, Anambra State, Nigeria; ²Department of Statistics, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria

Aims: This study sought to analyze the effect of three remedial measures, namely, hiring more pathologists, increasing the frequency of clinicopathologic conferences, and stepwise increase in the level of rejection criteria, on the adequacy of laboratory request form completion by clinicians. Based on the findings, recommendations were made that may reduce rejection rate of specimens and facilitate histopathology investigations.

Methods: This is a retrospective study covering a period of 7 years (2004–2010). Data were retrieved from histopathology laboratory request forms submitted to three laboratories in Eastern Nigeria. These data were entered in SPSS statistical software and were analyzed using simple linear regression analysis.

Results: A total of 8573 completed and submitted forms were analyzed, out of which 74.7% were found to be inadequately completed. The effect of increasing the number of pathologists in the employ on the adequacy of laboratory request form completion was found not to be statistically significant. Similarly, change in the frequency of clinicopathologic conferences was also found not to significantly affect the adequacy of laboratory form completion. However, change in the aggregated level of rejection criteria used by the laboratories was found to significantly affect the clinician's compliance to laboratory request form completion. For every 1 unit increase (or decrease) in the level of rejection criteria used there was, on the average, a 4.7% increase (or decrease) in the proportion of adequately completed laboratory request forms submitted.

Conclusion: The findings highlight the need to enforce and implement policies that would possibly enhance compliance with the requirements of laboratory request form completion.

Keywords: clinicopathologic conference, rejection criteria

Introduction

Medical laboratory quality has been historically determined by the accuracy of the analytical phase.¹ Laboratory errors are important because laboratory data influence 70% of medical diagnoses and can significantly affect the success and cost of patients' treatment.²

Various publications have highlighted the significance of laboratory errors in the pre- and post-analytical phases and their impact on results.¹ Up to 68.2% of laboratory errors occur in the pre-analytical phase,³ which refers to procedures performed neither in the clinical laboratory nor under the control of laboratory personnel;^{4,5} for example, errors in laboratory request form completion, specimen collection, handling, and transport.¹

For any specimen submitted for pathologic diagnosis, the request form should be completed in full with details of the specimen and the patient's clinical information.

Correspondence: Igwebuike Victor Onyiaorah
Department of Histopathology, Faculty of Medicine, Nnamdi Azikiwe University, PMB 5001, Nnewi, Anambra State 435101, Nigeria
Tel +234 8033011317
Email vitroni@yahoo.com

The information given should include the results of related biochemical and radiological investigations if applicable.⁶ It suffices to note at this juncture that each laboratory request has its own peculiarity. For instance, submission of gynecologic or breast biopsy specimens must be accompanied, in addition to other information, by the patient's date of last regular menses and contraceptive-use profile. A mystic perversion of this assumption prevails among those clinicians who believe that the pathologists, given only a piece of a patient's tissue, have all the other ingredients necessary to produce a statement of absolute truth at the end of his report. More unsafe to mankind is a pathologist with the same misconception.⁷

It is not uncommon to find clinicians and pathologists in the same hospital functioning inefficiently as teammates. More often, these two colleagues communicate by poorly scripted memos that often fall short of sending the required information or eliciting the expected response. Specimens are infrequently received with inadequate demographic details, but clinical details and details of the sender are more often lacking. Continuing medical education (CME) for both clinicians and pathologists is necessary for optimal communication. Education of clinician counterparts is required if pathologists are to manage the demand for the service;⁸ hence, the Medical and Dental Council of Nigeria, from 2010, insists on medical doctors acquiring a minimum of 20 units of CME for their annual licensing.

Kaplan assessed the impact of administrative interventions such as clinical presentations, telephone calls, ward visits and informal discussions by medical doctors, strict application of rejection criteria to defective request forms and inappropriate specimens, and distribution of instructive memoranda, illustrating the ideal way laboratory request forms are to be completed. Approximately 16% reduction in the rate of inappropriately completed request forms followed this intervention.⁹

Integrated health care networks including electronic communication (eg, email, file transfer) are required to facilitate extensive communication among physicians in the network.¹⁰ The computer can make information processing and management faster, more efficient, more extensive, more interactive, and in some cases, may enable activities that could not be performed manually.¹¹ Computers used in hospitals must include medical informatics applications that are part of clinical practice.¹² Miller and Sim, affirmed that "systematic quality improvement using electronic medical records (EMRs) will improve quality of care."¹³

Fraser and Woodford stated that requesting policies in various specialties and clinical circumstances endorsed by senior clinicians and prestigious professional bodies seems

a promising approach to more appropriate laboratory test requesting. They also suggested that redesigning laboratory request forms into a problem-orientated format is the simplest and most effective contribution by the laboratory.¹⁴

Compliance to rules by individuals depends on a number of factors, including age, gender, education, and race. In workplace settings, decisions by workers to comply with or contravene rules are based on perceptions of punishment associated with noncompliance and on perceptions of rewards associated with compliance.¹⁵ Colvin et al and Kobayashi and Kerbo, observed that "whether punishment or reward for compliance is most salient appears to depend on culture rather than gender, age or education."^{15,16}

As yet, no study has been done in Nigeria to assess the effect of measures introduced to reduce the proportion of inadequately completed laboratory request forms submitted by clinicians. In this paper, the effect of three interventions on the adequacy of completion of laboratory request forms submitted by clinicians to three histopathology laboratories in Eastern Nigeria is analyzed.

Aims

The objectives of this work were to:

1. Check the level of compliance of clinicians with proper laboratory request form completion and analyze the effect of three remedial measures (namely, hiring more pathologists, increasing the frequency of clinicopathologic conferences (CPCs), and stepwise increase in the level of rejection criteria) on the adequacy of laboratory request form completion.
2. Make recommendations based on the findings that may reduce rejection rate of specimens and facilitate histopathology investigations.

Materials and methods

This is a 7-year retrospective study which seeks to analyze the inadequacies in laboratory request forms submitted by clinicians to one public and two private histopathology laboratories in Eastern Nigeria. Nnamdi Azikiwe University Teaching Hospital Nnewi (NAUTH) is the biggest tertiary health care institution in Anambra State, Eastern Nigeria. The institution also provides primary and secondary health care on site and at three other satellite hospitals. The histopathology department of NAUTH and the other two private laboratories (Pathocon Specialist Clinic and Research Institute, Nnewi and Nkeoma Specialist Hospital, Onitsha) from where data were extracted receive and report the entire histopathology requests in Anambra State and some from the

neighboring states. These three laboratories are accredited by the appropriate state agency, the Department of Hospital Services. The histopathology laboratory request forms in use in these three laboratories have similar design.

The omissions in laboratory request forms were broadly grouped into four categories which include (1) inadequate information on patient's biodata, (2) inadequate information on specimen submitted, (3) inadequate clinical summary, and (4) a combination of two or more of the omissions listed above (see Table 1). The omissions in the inadequately completed forms were retrieved from notes made on the forms to the requesting clinicians by the histopathology registrars before the forms were corrected and returned for eventual laboratory investigation. Sources of the completed laboratory request forms, whether they were from private or public health care centers, were also recorded. From 2005, two interventions were introduced in a graded manner to improve the compliance of clinicians to proper laboratory request form completion (see Table 2). These interventions were (1) increasing the number of pathologists in service and (2) increasing the frequency of CPCs. These were followed in 2006 by a third intervention: stepwise increase in the level of rejection criteria used by the laboratories. The level of rejection criteria used each year was jointly agreed upon by the pathologists working in these three laboratories and ranged from 1 to 4 (see Table 3). The data were collected and analyzed with SPSS Statistics (IBM Corporation, Somers, NY) software. The resultant effect of these interventions on the adequacy of laboratory request form completion was estimated using simple linear regression analysis.

All histopathology request forms submitted and seen by the registrar were included in the study. Nonhistopathology laboratory request forms were excluded from the study. Histopathology forms which were seen and recorded earlier and returned by clinicians after correction (that is repeated forms) were also excluded.

Results

A 7-year retrospective study was carried out on the laboratory request forms submitted to three histopathology laboratories. A total of 8573 laboratory forms were studied,

out of which 6401 (74.7%) were found to be inadequately completed, ie, lacking in one or more type of information needed for proper pathologic diagnosis (see Table 4). Of the 6401 inadequately completed forms, 7.2% were lacking in some aspect of the patients' biodata (such as full names, age and gender), 18.3% had incomplete information about the specimen submitted, 33.3% lacked relevant information on patients' clinical summary (such as information on clinical history or physical examination or findings during surgical operation) and 41.2% had a combination of two or more of the omissions listed in Table 1 (see Table 5).

Of the inadequately completed laboratory request forms, 51% and 49% were sent from private and public hospitals respectively (not shown in the tables). There was therefore no statistically significant difference between the compliance of doctors working in private and those in public hospitals.

As can be seen from Table 4, over the 7-year period, the proportion of properly completed forms rose steadily from 17.3% in 2004 to 29.5% in 2010. However, there was a decline in 2007, with reduction in proportion to 16.4% from 19.0% seen in 2006. This was probably caused by new medical doctors (ie, fresh users of these laboratories) who even though they may have become aware of the availability of histopathology services in these laboratories, may not have been familiar with the strict requirements in place for such laboratory requesting. This is evidenced by the 66% increase in 2007 from the 721 histopathology requests received by the laboratories in 2006. In 2008, the percentage of properly completed forms remarkably rose to 30.6% and then became fairly stable in the years that followed. This is probably due to those new medical doctors gradually becoming accustomed to the requirements of the histopathology laboratories.

Regression analysis using the data of Table 2 showed that increasing the number of pathologists had no significant effect on the adequacy of request form completion (regression effect $b = 0.037$; t -value = 1.94; P -value = 0.1100). Similarly, increasing the frequency of CPCs was found not to have a significant effect on the proportion of adequately completed laboratory forms (regression effect $b = 0.031$; t -value = 1.938; P -value = 0.0571).

However, changes in the level of rejection criteria implemented by the laboratories had a highly significant effect on the proportion of adequately completed laboratory request forms (regression effect $b = 0.047$; t -value = 4.273; P -value = 0.0032). In this case, the fitted regression line is $\hat{P}_i = 0.121 + 0.047.X_{i3}$, where p_i is the proportion of laboratory forms adequately completed, and X_{i3} is the level of rejection criteria used in year i , $i = 1, 2, \dots, 7$. The fitted

Table 1 Categories of inadequacy in laboratory request form completion

- Inadequate information on patient's biodata
- Inadequate information on specimen submitted
- Inadequate clinical summary
- A combination of two or more of the omissions listed above

Table 2 Data on the proportion of properly completed forms (p_i) and the remedial measures (x_{i1}, x_{i2}, x_{i3})

Year (i)	Proportion of properly completed forms (p_i)	Number of pathologists (x_{i1})	CPC per month (x_{i2})	Level of rejection criteria (x_{i3})
2004	0.173	1	1	1
2005	0.193	2	2	1
2006	0.190	3	2	2
2007	0.164	3	4	2
2008	0.306	3	4	3
2009	0.273	4	4	3
2010	0.295	4	4	4
Total	1.594	20	21	16

Abbreviation: CPC, clinicopathologic conferences.

regression line shows that there exists a significant linear relationship between the adequacy of laboratory request form completion by clinicians and the level of rejection criteria used. With a regression coefficient estimated as 0.047, we can infer that every 1 unit increase (or decrease) in the level of rejection criteria applied would on the average result in a 4.7% increase (or decrease) in the proportion of adequately completed laboratory request forms. The coefficient of determination, R^2 , is 0.727. This means that the fitted regression model accounts for about 72.7% of the total variation in the proportion of the properly completed laboratory request forms, indicating a good fit.

Discussion

Submission to medical laboratories of inadequately completed laboratory request forms by clinicians adversely

affects utilization of the laboratory and the benefits expected to be derived from medical laboratory services.

As shown above, 74.7% of the forms submitted to the laboratories were inadequately completed. This is supported by findings of Plebani and Carraro who stated that 68.2% of errors are rooted in the pre-analytical phase.³ Of the inadequately completed forms, 7.2% were lacking information on either full names, age, gender of patients, or a combination of these, 18.3% had incomplete information on the specimens submitted for investigation, 33.3% lacked relevant information on clinical summary, and 41.2% had a combination of two or more of the omissions listed above. Thus, the present results seem to support the observation by Burton and Stephenson that specimens are infrequently received with inadequate demographic details, but clinical details and details of the sender are more often lacking.⁸

To perform intelligently, a consultant must know all the facts that have any bearing on a case. It is unwise to render a diagnosis on a piece of puzzling tissue with only vague knowledge of its source and no conception of the clinical problem.¹⁷ Providing better clinical information will help the pathologist produce an improved interpretative report and include comments with a beneficial effect on diagnosis and treatment.⁹ There exists limitation to measuring and improving laboratory-related patient outcomes if the survey is only focused on analytical errors.¹⁸

Researchers have suggested different intervention strategies to improve the adequacy of laboratory request form completion.^{9,14} Kaplan claimed that team interaction is expected to improve adequacy of form completion.⁹ However, empirical evidence from the present data does not support this claim and shows that increasing the number of pathologists has no significant effect on the clinicians' compliance to proper form completion, probably because of lack of effective contact and insufficient professional interactions between the clinicians and the pathologists. Moreover, the pathologists that serve the two private histopathology

Table 3 Levels of rejection criteria used by the histopathology laboratories

Level	Defects that necessitated rejection of specimen and form
1	Forms lacking patient's full names Omission of specimen identification Illegible writing on request forms Submission of autolyzed specimen Disparity between the identification on the request form and that on the specimen container
2	In addition to level 1 Omission of patient's age or date of birth Omission of relevant clinical summary Omission of results of relevant investigation(s) Nonidentification of sides in case of bilateral organs
3	In addition to level 2 Omission of surgical findings Omission of date of sample collection Omission of patient's hospital number
4	In addition to level 3 Omission of provisional/working diagnosis Omission of other treatment/management summary Omission of hospital or department of origin Omission of clinician's name and contact

Clinical Audit downloaded from https://www.dovepress.com/ by 44.192.253.106 on 22-Jun-2021 For personal use only.

Table 4 The composition of total forms reviewed by year

Year	Adequately completed forms	% of adequately completed forms	Inadequately completed forms	% of inadequately completed forms	Total no of forms
2004	67	17.3	320	82.7	387
2005	91	19.3	381	80.7	472
2006	137	19.0	584	81.0	721
2007	196	16.4	1001	83.6	1197
2008	485	30.6	1102	69.4	1587
2009	551	27.3	1471	72.7	2022
2010	645	29.5	1542	70.5	2187
Total	2172		6401		8573

laboratories worked on a part-time basis; as such, they may not have always been available to adequately interact with the clinicians who utilized their services. Also, increasing the frequency of CPCs did not show any statistically significant change in the proportion of adequately completed laboratory request forms, probably because the doctors had low attendance and lack of effective contact even by those who attend. If attendance to the conferences were mandatory, the expected result may have been achieved. Another probable cause for the lack of significant effect of CPCs is that they were organized in the University Teaching Hospital, hence the medical doctors in the peripheral private and public hospitals may either not be aware of the schedule or may find the timing unsuitable and therefore will not attend. Results differ from the observations in the United Kingdom and Jordan, by Burton and Stephenson⁸ and Kaplan,⁹ respectively, who observed the positive effects of clinical conferences and CMEs.

Human behaviors are maintained, changed, or shaped by the consequences of the behavior.¹⁹ In agreement with the latter, rejection of improperly completed laboratory request forms positively affected the subsequent compliance to proper laboratory request form completion by clinicians. The present analysis showed that for every one unit increase (or decrease) in the level of rejection criteria implemented,

there was a corresponding 4.7% increase (or decrease) in clinicians' compliance to proper form completion.

Mather et al emphasized the positive effect of education and skill acquisition on behavior.¹⁹ Despite the education and skill of clinicians studied here, the compliance to proper laboratory request form completion was still low. This would seem to suggest that the curriculum in the formal education of medical doctors may not be sufficient and may indicate the need for curriculum restructuring and more informal education. The finding that the effect of implementation of rejection criteria is significant rather than that of baseline education of clinicians seems to reinforce the findings by Colvin et al and Kobayashi and Kerbo who observed that "whether punishment or reward for compliance is most salient appears to depend on culture rather than gender, age or education."^{15,16} However, it may be instructive that future research be conducted for the purpose of assessing the required minimum level of education and training that will enable clinicians to do proper laboratory requesting.

Good insight on error-prone steps in the laboratory process is essential to achieving error reduction; hence, in addition to maintaining quality standards within the laboratory, it is imperative to go outside the laboratory to identify the common errors made in laboratory processes and to reorganize the activity of the wards.²⁰ Policy interventions geared toward improving the effectiveness of data exchange among health care providers must be encouraged and supported towards achieving more efficient, faster, and cost-effective health care.

Conclusion

Inadequate completion of laboratory request forms by clinicians, a pre-analytic phase error, was found to be exceedingly high in the present study.

Strict implementation of rejection criteria by laboratories was found to be significantly effective in improving adequacy of laboratory request form completion. Adherence to rejection

Table 5 The composition of inadequately completed forms

Groups of inadequately completed laboratory forms submitted	Number	% of inadequately completed forms
Inadequate information on patient's biodata	464	7.2
Inadequate information on specimen	1173	18.3
Inadequate clinical summary	2125	33.3
A combination of two or more of the omissions listed above	2639	41.2
Total	6401	100

criteria by clinical laboratories will no doubt enhance the standard of laboratory request form completion and may enhance the continuity of care, save time, and cost, while improving subsequent clinical outcomes.

The authors recommend that:

1. accrediting agencies release properly designed easy-to-use laboratory request forms that will be universally adopted by all histopathology laboratories under their jurisdiction. This design should also be in line with international standards; and
2. medical laboratory personnel should adhere to rejection criteria set by their laboratories or the accrediting agencies.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Zemlin AE, Nutt L, Burgess LJ, Eiman F, Erasmus RT. Potential for medical error: incorrectly completed request forms for thyroid function tests limit pathologists' advice to clinicians. *S Afr Med J*. 2009;99(9):668–671.
2. Plebani M. Towards quality specifications in extra-analytical phases of laboratory activity. *Clin Chem Lab Med*. 2004;42(6):576–577.
3. Plebani M, Carraro P. Mistakes in a stat laboratory: types and frequency. *Clin Chem*. 1997;43(8):1348–1351.
4. Plebani M. Errors in clinical laboratories or errors in laboratory medicine? *Clin Chem Lab Med*. 2006;44(6):750–759.
5. Laposata M, Dighe A. "Pre-pre" and "post-post" analytical error: high-incidence patient safety hazards involving the clinical laboratory. *Clin Chem Lab Med*. 2007;45(6):712–719.
6. Anderson CE, McLaren KM. Best practice in thyroid pathology. *J Clin Pathol*. 2003;56(6):401–405.
7. Rambo ON. Limitations of histologic diagnosis. *Prog Rafiat Ther*. 1962;2:215–224.
8. Burton JL, Stephenson TJ. Are clinicians failing to supply adequate information when requesting a histopathological investigation? *J Clin Pathol*. 2001;54:806–808.
9. Kaplan NM. Adequacy of completion of clinical microbiology laboratory request forms in a Jordanian hospital. *Saudi Med J*. 2004;25(7):960–961.
10. Berner ES, Boulware DW. Medical informatics for medical students: not just because it's there. *Med Educ Online*. 1996;1:3.
11. Swanson AG, Anderson MB. Educating medical students: assessing change in medical education – the road to implementation (ACME-TRI). *Acad Med*. 1993;68(6):1–46.
12. Friedman CP, Dev P. Education and informatics: it's time to join forces. *J Am Med Inform Assoc*. 1996;3:184–185.
13. Miller RH, Sim I. Physicians' use of electronic medical record: barriers and solutions. *Health Aff (Millwood)*. 2004;23(2):116–126.
14. Fraser CG, Woodford FP. Strategies to modify the test-requesting patterns of clinicians. *Ann Clin Biochem*. 1987;24(3):223–231.
15. Colvin M, Cullen F, Vander T. Coercion, Social Support, and Crime: an emerging theoretical consensus. *Criminology*. 2002;40:19–42.
16. Kobayashi E, Kerbo HR. Punishment for noncompliance and reward for compliance: a comparison of Japanese and American workers. *NUCB J Econ Inform Sci*. 2009;47(2):125–136.
17. Raouf EN, Gordon G, Richard JZ. Necessity of clinical information in surgical pathology. *Arch Pathol Lab Med*. 1999;123(7):615–619.
18. Bonini P, Plebani M, Ceriotti F, Rubboli F. Errors in laboratory medicine. *Clin Chem*. 2002;48(5):691–698.
19. Mather N, Goldstein S. *Learning Disabilities and Challenging Behaviours: a guide to intervention and classroom management*. Baltimore: Paul H Brookes Publishing Co; 2001:96–117.
20. Siddiqui S. Laboratory errors as judged by test request slips and test reports. *J Coll Physicians Surg Pak*. 2006;16(2):136–138.

Clinical Audit

Publish your work in this journal

Clinical Audit is an international, peer-reviewed, open access journal focusing on the processes and outcomes of clinical audit in any area of healthcare. All aspects of patient care are addressed within the journal and practitioners from all disciplines are invited to submit their work. Areas covered include: Publication of audits; How an audit has changed practice;

Submit your manuscript here: <http://www.dovepress.com/clinical-audit-journal>

Dovepress

Practical tips on how to do audits and to avoid pitfalls; How audits have changed patient care; Calls and justifications for new audits. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.