

Multicenter survey of physicians' perception of interpretative commenting and reflective testing in Nigeria

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ABSTRACT

Background

Interpretative commenting (IC) and reflective testing have recently generated interest because of their potential for adding value to Clinical laboratory testing. Physicians' perception to this post-testing service in Nigeria is unknown. This study examined the practices and physician's disposition regarding IC and reflective testing.

Methods

This cross-sectional study was conducted among 232 doctors working in public and private hospitals across eight purposively selected states in Nigeria. Doctors

who have worked and/or currently working in a health facility within their state of residence and who consented to participating in this survey were given a structured questionnaire to fill and return.

Results

Paper-based reporting (213; 91.8%) was the most commonly practiced reporting method. One hundred and thirty-three (57.4%) doctors responded that interpretative comments were added to laboratory reports. "Free-handed text" (85/133; 63.9%) was the most commonly practiced form of IC; 184/232 (79.3%) and 166/232 (71.6%) doctors respectively considered comments on "potential implication of results" and "suggestions on further investigation" as the most "helpful" aspect of IC. Also, 192/232 (82.7%) doctors strongly agreed/agreed that IC influences patient's management. Only 125 (53.7%) doctors responded that they welcomed reflective testing. Concerns about cost implications (68/107; 63.6%) and delays in release of result (48/107; 44.9%) were among reasons for not supporting reflective testing.

Conclusion

Nigerian doctors generally have a positive disposition towards addition of interpretative comments but less so concerning reflective testing. However, challenges such as lack of LIS, EQA schemes for IC and gaps in physicians' education should be addressed to improve this aspect of laboratory services in Nigeria.



INTRODUCTION

The principal business of clinical laboratory is to provide data in form of test results that are essential for patient care. The crucial role that laboratory data play in patient management have been previously highlighted [1–3]. Apart from

factors related to the generation of laboratory results, the interpretation and application of these results in patients' care may affect clinical outcome [2,3]. The utility of results generated from the clinical laboratory can be enhanced by addition of interpretative comments to guide the end users in applying the test report to patients' care.

Physicians are trained in the rudiments of interpreting laboratory results in accordance with provisional diagnosis made from history and physical examination. However, the need for added comments and interpretations by laboratorians in reporting of laboratory result has become more evident with the increasing spectrum and complexity of tests in addition to increasing number of platforms and technologies for testing [2,4]. Specialist laboratory professionals possess more comprehensive knowledge of the principles, procedures and limitations of the tests and this places them in a good position to add useful comments to laboratory test.

Clinical practice also presents common scenarios where laboratory test results may be inconclusive and may warrant additional testing before arriving at appropriate diagnosis. In such cases, physicians and other end users may benefit from reflective testing. Reflective testing is a procedure in which the laboratory specialist adds additional tests and/or comments to an original request following inspection and reflection on the results [5,6].

Interpretative commenting (IC) and reflective testing have recently generated interest because of their potential for adding value to the testing services that laboratories were traditionally known to provide [7,8]. Indeed, the relative contributions of these post-testing services in improving patients' outcomes has been reported [1,2].

Despite these, the practice of IC and reflective testing may be perceived in different lights among physicians [9]. The cooperation of the requesting physicians is crucial in the successful implementation of interpretative commenting and reflective testing in clinical laboratories. The careful examination of factors that may affect this practice including physicians' perceptions and concerns is therefore important. Available studies regarding this subject have been predominantly in Western countries with much more advanced laboratory technology with well-established post-analytical services. This may not be practicable in resource-poor settings given that provision of IC vary from one country to another, and between laboratories in the same country [2]. There are unfortunately few studies in Nigeria on the subject of laboratory management that focuses on post laboratory testing phase. Additionally, data regarding the practices and utility of interpretative comments and reflective testing in the context of patients' management in Nigeria are scarce. Equally, the perception of physicians to this post laboratory testing service has not been well explored in this setting. This study is therefore aimed at examining the practices and physicians' perception regarding IC and reflective testing.

METHODS

This cross-sectional study was conducted over a six months' period among Doctors working in public and private hospitals across eight purposively selected states, four each from Southern and Northern Nigeria including: Anambra, Cross River, Ogun, Rivers, Benue, Nassarawa, Plateau, and Abuja, the Federal Capital Territory. Doctors who had worked or were currently working in a health facility within their state of residence and who consented to participating in this survey were given a structured questionnaire to fill and return.

The questionnaires were administered during daily departmental seminar presentations as well as to doctors who were on duty during the period of the study. The questionnaire explored information regarding demographics, cadre of doctor, speciality and level of experience. We specifically sought for information regarding the practice, perception and acceptance of interpretative commenting and reflective testing for clinical chemistry tests in the respondents' hospital. The questions on interpretative comment addressed: the format of interpretative commenting practiced, providers of interpretative comment, laboratory tests covered by interpretative comment, information contained in the interpretative comment, perception of practice and usefulness of reflective testing and interpretative comment for clinical chemistry tests. The respondents were encouraged to select all options that applied to a particular question and to include other responses wherever necessary. The self-administered questionnaire was pre-tested using response from seven physicians and laboratory specialists who are knowledgeable about the subject. Areas in the questionnaire that could be potentially misinterpreted were identified, modified or removed from the questions included in the study. Care was taken to avoid loosely used laboratory terms that may not be easily understood by physicians or provide a definition of such terms if their use could not be avoided.

Ethical considerations

Ethical approval was obtained from the Health Research and Ethics Committee of the Jos University Teaching Hospital (reference no. JUTH/DCS/ADM/127/XXV/152) in compliance with the ethical principles for medical research involving human subjects, in accordance with the Declaration of Helsinki. Informed consent was obtained from the respondents and confidentiality was ensured.

Statistical analysis

The data collected were compiled in Microsoft Excel® version 2.0 and exported to Statistical Package for Social Sciences (SPSS® Incorporated Chicago Version 18.0) software for analysis. Descriptive statistics were presented as counts, percentages, frequency tables, and charts. Inferential statistics to test associations was conducted using chi-square or Fisher's exact test where appropriate. P-value < 0.05 was regarded as significant.

RESULTS

A total of 232 doctors were surveyed across eight states in the primary, secondary and tertiary health centers distributed equally in the North and South of Nigeria. Majority of the respondents practiced in tertiary healthcare setting, 183 (78.9%) and in Public hospitals 204 (87.9%). Forty-five (19.4%) of the respondents were Intern doctors, 27 (11.6%) and 81 (35%) respectively were Specialists (Consultants) and Specialist in-training (Registrars) from specialties such as Family medicine (21), Internal Medicine (16), Obstetrics and Gynaecology (18), Paediatrics (19), Surgery (14) among others (20), see Table 1.

Doctors responses on the practice regarding interpretative commenting

Reporting format (n=232)

Paper-based reporting (213; 91.8%) was the most practiced reporting method, while 19 (8.2%) and 2 (0.8) doctors indicated that Laboratory Information System and other methods (e.g. telephone, text messages) respectively was practiced in their health facility.

Provision of interpretative comment on laboratory report (n=232)

One hundred and thirty-three (57.4%) doctors responded that interpretative comments were

added to laboratory reports; whereas 88 (37.9%) reported that interpretative comments were not added to laboratory report in their hospital and 11 (4.7%) did not give any response.

Format of interpretative comments (n=133) *

Among doctors who indicated that their Hospital laboratories provided Interpretative Comments, "Free-handed text" (85/133; 63.9%) was the most commonly practiced form of IC, this was followed by "flagging" of "abnormal" results (29/133: 21.8%) and "canned/pre-coded" comments (13/133: 9.8%), see Table 2.

Provider of interpretative comment (n=133) *

The providers of IC as identified by the responding doctors include, Lab Scientist/Technologist (41/133: 30.8%), Pathologist in-training (25/133: 18.8%), Pathologist (65/133; 48.9%) and 8.3% (11/133) gave no response.

* Respondents selected all that apply hence more than one response per respondents may be allowed as applicably in practice.

Aspects of interpretative comment considered helpful

Regarding the aspect of IC considered helpful to the doctors, 184/232 (79.3%) considered comments on potential implication of results helpful, 166/232 (71.6%) doctors selected "suggestions on further investigation", 116/232 (50%) doctors appreciated comments on "suggested interventions" while 110/232 (47%) and 102 (44%) doctors selected comments on "pre-analytical factors" and "analytical factors" respectively, see Figure 1.

Perceptions on interpretative commenting

Furthermore, 192/232 (82.7%) doctors "strongly agreed/agreed" that IC will indeed influence patient's management, 143/232 (61.3%) said it will help to prevent misdiagnosis; 91/232 (39.2%)

Table 1 General characteristics of respondents

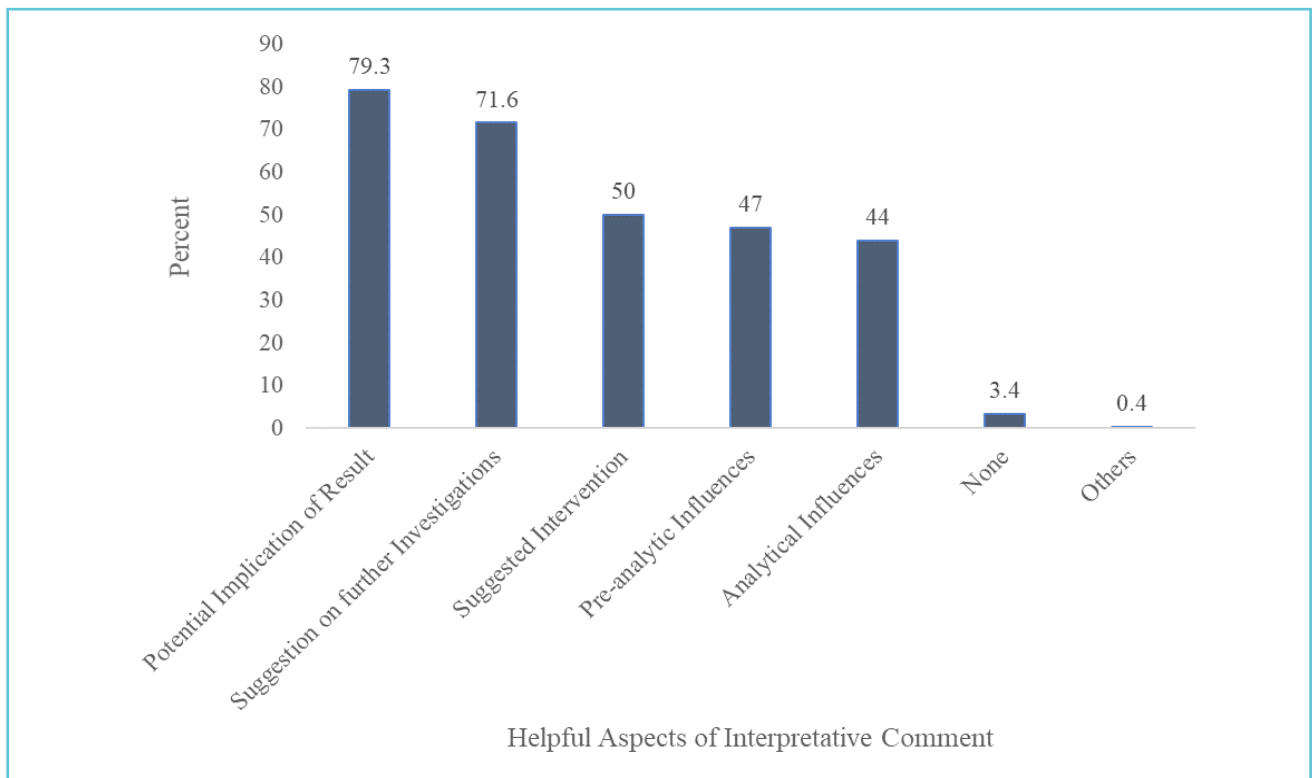
Variable	Frequency	Percent
Hospital category		
Faith-Based Mission	15	6.5
Government/Public	204	87.9
Private	13	5.6
Region		
North	116	50
South	116	50
Level of hospital		
Primary	6	2.6
Secondary	43	18.5
Tertiary	183	78.9
Cadre of doctor		
Intern Doctors	45	19.4
Non-specialist Medical Officers	68	29.3
Specialist in-training (Registrars)	81	35.0
Specialists (Consultant)	27	11.6
Others	11	4.7
Available pathology specialty*		
Chemical Pathology	111	47.8
Hematology	123	53.0
Microbiology	113	54.7
Histopathology	121	67.7

* Respondents selected all that apply hence more than one response per respondents may be allowed as applicably in practice.

Table 2 Doctors perceptions on interpretative commenting

Variable	Strongly agree	Agree	Indifferent	Disagree	Strongly disagree
Influences Patients' Management	103 (44.4)	89 (38.3)	24 (13.8)	2 (0.9)	6 (2.6)
Cause Delay in releasing lab results	18 (7.8)	63 (27.1)	62 (26.7)	71 (30.6)	18 (7.8)
Reduces time to diagnosis	20 (8.6)	71 (30.6)	57 (24.6)	58 (25)	26 (11.2)
Reduces number of needless tests that would be performed	21 (9)	67 (28.9)	60 (25.9)	59 (25.4)	25 (10.8)
Prevents misdiagnosis	50 (21.6)	93 (40.1)	56 (24.1)	26 (11.2)	7 (3)
Concerned about the competency of the staff adding comments on results	85 (36.6)	58 (25)	51 (22)	31 (13.4)	7 (3)

Figure 1 Physicians' response on aspects of interpretative comment they consider helpful



and 88/232 (37.9%) considered IC reduces time to diagnosis and number of needless tests that would be performed. However, 81/232 (34.9%) believed that IC causes delays in releasing laboratory results while 143/232 (61.3%) doctors are concerned about the competency of the staff that provide the interpretative comments, see Table 2.

Perception of usefulness of interpretative comments

The doctors who had used or currently used listed biochemical tests were asked which tests they considered IC to be "very useful"/ "useful". All tests listed had more than 80% of doctors indicating that IC was useful in interpreting the tests.

The greatest approval was for tests such as Thyroid function tests, fertility hormones and endocrine tests, tumour markers, Electrolytes including Na, K, Cl, Mg, PO₄²⁻ and Mg, Lipid profile, Therapeutic Drug Monitoring (TDM), Liver function tests, Blood gases and HbA1c with more than 90% of doctors indicating the usefulness of IC.

Perception on reflective testing

Only 125 (53.7%) doctors responded that they welcomed reflective testing by the testing laboratory. Fifty-three (22.8%) doctors did not agree to reflective testing while 54 (23.3%) were unsure. The reasons given for not supporting reflective testing include: Concerns about cost implications (68/107;63.6%), Concerns about delays in release of result (48/107; 44.9%) and "No added value to test report' (43/107; 43.0%).

Factors associated with provision of interpretative comment and support for reflective testing

Regarding factors associated with provision of IC, IC was more likely to be provided in Tertiary health facilities (P<0.001) and availability of specialists in Chemical pathology, Hematology, Microbiology and Histopathology was significantly associated with provision of IC (p < 0.05). Support for reflective testing was not associated with the type of Health facility, level of care of the facilities, practice of IC or availability of specialists in Chemical pathology, Hematology, Microbiology and Histopathology, p >0.05, see Table 3.

Table 3 Factors associated with provision of Interpretative comments and acceptance of reflective testing

Variable	Provide interpretative comment		X ²	P-value	Welcome reflective testing		X ²	P-value
	Yes (%)	No (%)			Yes (%)	No (%)		
Hospital category								
Faith-Based Mission	5 (35.7)	9 (64.3)	4.05	0.132	9 (60)	6 (40)	0.539	0.764
Government/Public	119 (61.3)	75 (38.7)			110 (53.9)	94 (46.1)		
Private	9 (69.2)	4 (30.8)			6 (46.2)	7 (53.8)		

Level of hospital								
Primary	2 (33.3)	4 (66.7)	13.2	0.001	3 (50)	3 (50)	0.043	0.979
Secondary	16 (38.1)	26 (61.9)			23 (53.5)	20 (46.5)		
Tertiary	115 (66.5)	58 (33.5)			99 (54.1)	84 (45.9)		
LIS								
Yes	12 (70.6)	5 (29.4)	0.832	0.362	11 (57.9)	8 (42.1)	0.134	0.714
No	121 (59.3)	83 (40.7)			114 (53.5)	99 (46.5)		
Paper-based								
Yes	124 (60.5)	81 (39.5)	0.111	0.731	115 (54)	98 (46)	0.013	0.909
No	9 (56.3)	7 (43.8)			10 (52.6)	9 (47.4)		
Available specialists								
Chemical Pathology								
Yes	79 (70.5)	33 (29.5)	10.16	0.001	64 (54.7)	53 (45.3)	0.064	0.800
No	54 (49.5)	55 (50.5)			61 (53)	54 (47)		
Hematology								
Yes	99 (69.2)	44 (30.8)	13.85	<0.001	81 (54.7)	67 (45.3)	0.119	0.730
No	34 (43.6)	44 (56.4)			44 (52.4)	40 (47.6)		
Microbiology								
Yes	85 (68.5)	39 (31.5)	8.25	0.004	69 (54.3)	58 (45.7)	0.023	0.879
No	48 (49.5)	49 (50.5)			56 (53.3)	49 (46.7)		
Histopathology								
Yes	96 (64.9)	52 (35.1)	4.1	0.043	89 (56.7)	68 (43.3)	1.54	0.214
No	37 (50.7)	36 (49.3)			36 (48)	39 (52)		

DISCUSSION

Post analytic activities such as Interpretative commenting and Reflective testing are essential to adding value in laboratory medicine practice [7,8], and their impact on patients' treatment outcomes is increasingly under focus especially in Europe, Asia and America [2,10]. Our findings show that unlike these regions, post-analytic service in clinical laboratories in resource-poor settings like Nigeria is mainly driven by paper-based reporting systems which is bedeviled by several problems (such as missing data or request forms and improperly filled data) that hamper the goal of translating laboratory test results into clinical outcome. The most appropriate interpretation of a test will often be provided when the results are correlated with the clinical context of the patient. Unavailable or inaccurately provided relevant clinical information may therefore hinder or mislead the provision of comments [5]. Zemlin et al, reported that incorrectly completed request forms for thyroid function tests limited pathologists' ability to provide meaningful advice to clinicians leading to potentially serious medical errors [11].

Adding interpretative comments to routine test results even in settings aided by automation and laboratory information system (LIS) is daunting given the sheer volume of testing and the expectation on turnaround time [5,12,13]. This task becomes almost unrealistic in high workload laboratories practicing paper-based reporting. Although it could be argued that IC need not be provided for all test categories, nearly half of the doctors surveyed did not receive IC in reports provided by their hospital laboratories. Interpretative Comments were more likely to be provided in tertiary health facilities especially where specialists in pathology disciplines are available. In addition to the infrastructural deficit, it is clear that availability of specialists in the pathology disciplines is a crucial factor

if IC would be practiced satisfactorily in clinical laboratories across Nigeria. With only about 500 pathologists to serve nearly 200 million people, the number of pathologists in Nigeria is grossly inadequate [14]. This is in keeping with the submission of Laposata who suggested that availability of sufficient specialists in the clinical laboratory constitute the "largest barrier" to more widespread implementation of interpretative comment programs [15]. Kappelmayer et al, proposed that in order to maximize the available manpower, expert laboratorian's attention would be most needed for interpretative comments in specialized testing and subspecialties such as several flow cytometric analyses, genetic and molecular diagnostics and autoantibody testing [16]. Other tests that would nearly always require interpretative comments include: coagulation disorders, hemoglobin and anemia evaluations, serum protein analysis, immunophenotyping analysis, endocrinology, toxicology and new tests or complex panel tests [17].

According to our survey, IC is mainly provided by pathologist, pathologist-in-training and in almost one-third of the cases, they can be obtained from laboratory scientist and technologist. This variation probably reflects the availability of appropriate manpower in different tiers of health facilities. Pathologists and pathologist-in-training for instance are more likely to be available in teaching hospitals and tertiary health facilities.

"Free-handed text" was the most commonly practiced form of IC in this study. Use of canned comments was not very common. This is not surprising as these forms of IC would often require robust IT infrastructure which are not readily available in most of the hospitals surveyed. Canned comments are often "standardized" on the basis of agreed criteria or rules in many cases generated by the LIS softwares [5].

Unlike canned comments, free handed text provides flexible opportunity for laboratories to attend to patient-specific issues that may impact the lab result. Patient-specific interpretation requires extensive cross-referencing to other information contained in the patients' record such as previous test results, other related tests, and clinical history [12].

This information will be difficult to access in most Nigerian health facilities in the absence of functional electronic based information system. Free handed text IC typically contains one or more distinct ideas such as suggesting a probable diagnosis; suggesting which diagnoses can be excluded; and suggesting additional investigations [18]. Other aspects of IC include potential pre- and post-analytical variables that affect the test, variables relating to performance characteristics of the test e.g. reference intervals, decision limits, limit of detection, error estimates etc. Nonetheless, free handed text IC is often non-standardized and therefore run the risk of inclusion of inappropriate and sometimes misleading comments [4,15].

The most useful aspect of IC according to 80% of doctors was comments relating to the potential implications of the results. This was followed by suggestions on further investigations to consider. This finding agrees with earlier studies that showed that physicians increasingly welcomed IC which provided advice on what to do next [2,3]. The usefulness of adding an interpretative comment depends on the knowledge of the recipient of the test result [5]. It had been suggested that test reports being returned to requesters who specialize in the condition being investigated are less likely to require comments other than those related to the pre-analytical and analytical phase [5]. In this study however, more than half of the doctors did not consider comments relating to pre-analytical and analytical factors that could impact on the test result helpful. A possible explanation could be that a

substantial number of physicians do not appreciate the impact that numerous factors in the pre-analytic and analytic phase of testing could have on the test result. With increasingly lesser exposure to diagnostic medicine in most medical schools, the physician's knowledge gap on these aspects of testing is widening [8].

It has been reported that many physicians acknowledge the clinical value of the interpretative services and perceive that the interpretations improved clinical care by saving them time, helping prevent misdiagnoses, and shortening the time to diagnosis [2,9,19,20]. A similar perception towards IC was observed in this study. The majority of doctors in this survey judged that IC influences patient's management and helped to prevent misdiagnosis. Regarding specific biochemical tests, more than 80% of doctors acknowledged that interpretative comments were useful for all biochemical tests they were asked about.

On the other hand, some negative perceptions towards IC were reported by some doctors in this study. About one third of the doctors believed that IC causes delays in releasing laboratory results. This may not be unrelated to long turnaround time for routine test which is already a concern for clinical laboratories especially in resource-poor settings [21]. Notably, more than sixty percent of the doctors expressed concern regarding the competencies of the staff that provide the interpretative comments. This concern has been echoed by several experts in this subject [3,4,8]. It is therefore critical that input in the form of interpretative comments and reflective testing is provided by competent laboratory staff. Generally, desirable qualities of such laboratory personnel would include; requisite medical experience and knowledge of the pathophysiology and clinical correlates, understanding of the analytical processes involved in generating the results, and knowledge of performance characteristics

of the test methodology [3,4,15]. Interpretation also requires recognition of potential pre- and post-analytical variables as well as astute communication skills [18].

In order to better develop the skill for IC, adequate training for those who provide IC has been advocated [5,8]. In addition, there is need for regular assessment for providers of IC to ensure best practices in the provision of this post-testing interpretative service [5]. Experts have suggested that this can be done in the form of educative External Quality Assessment (EQA) programme for IC and several ways of effectively achieving this have been proposed [4,22]. Nevertheless, there is yet no consensus on the modality of this EQA schemes although efforts are ongoing in this regard [8,23,24]. National laboratory societies have been called upon to facilitate these schemes [10]. To our knowledge there are no streamlined EQA schemes for IC in Nigeria although efforts have been made through individual pathology disciplines in collaboration with foreign partners to provide some form of educative IC assessment programmes for their members. Also, pathologists and other laboratory professional groups take advantage of social medial platforms to provide informal educative assessment on IC although these forms of assessment lack some key tenants of formal EQA schemes and their effectiveness have not been ascertained. The need for formal structured EQA programmes in Nigeria and sub-Saharan Africa is thus glaring and could benefit from support from more advanced countries with well-established IC EQA schemes.

In this study we found that about half of the responding doctors do not welcome reflective testing. This is at variance with reports from other climes where reflective testing has been considered a useful way of improving patients' outcome by different general practitioners or other clinicians [8,25]. In the present study

support for reflective testing was not associated with the type of health facility, level of care of the facilities, practice of IC or availability of specialists. Doctors who did not approve of reflective testing were mainly concerned about the added cost that this may place on their patients. Besides the financial implications of adding tests, the doctors were also concerned that adding further tests would lead to overall delays in the reporting of the result of the requested tests. Furthermore, some doctors were not convinced that adding further tests will add value to the reports. Although there has been debates as to whether reflective testing positively influence patient management, studies have shown that reflective testing as well as narrative interpretation of results may aid to reduce medical error [26,27].

Reflective testing may assist the requesting clinician to help exclude a diagnosis, expedite a diagnosis that is fairly obvious, or obtain a diagnosis when the original set of results is equivocal [6]. It had previously been reported that adding magnesium results suggestive of hypokalemia with $K^+ \leq 2.5$ mmol/L increased the incidence of the diagnosis of hypomagnesaemia [27]. Despite these advantages, the practicality of reflective testing will be limited if appropriate data is not available to the laboratory specialists. Furthermore, there is no consensus regarding when reflective testing is indicated, for which tests, and for what type of results. Also there are no quality indicators (QIs) or performance criteria that have been set for added testing [8,10,28].

LIMITATIONS AND CONCLUSIONS

This study had some limitations. The study was conducted among physicians at different level of experience and specialties which is likely to influence their perceptions on adding comments on tests results as well as reflective

testing although inferential statistics did not show this to be so. A probability-based sampling would have been better representative although majority of the health facilities in this study serviced cosmopolitan cities. Also, this study did assess the types of reflective test or comments frequently conveyed to the clinicians. Furthermore, this study did not cover interpretative service by telephone. The extent of this form of consultation that may have been included in the response provided by the physicians is unknown. Despite these limitations, this study has provided rare data about the provision of post-analytical services in the form of interpretative comments and reflective testing in a resource-poor setting. It is obvious that physicians in Nigeria have a positive disposition towards addition of interpretative comments, though less so for reflective testing. This study has also highlighted challenges such as lack of LIS across health facilities, lack of EQA schemes for IC as well as gaps in physicians' education that should be addressed to improve this aspect of clinical laboratory services in Nigeria.



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Availability of data and materials

All relevant data supporting the conclusion are within the paper. The datasets used for this

manuscript are available from the corresponding author on reasonable request.

Authors' contributions

Authors Contribution: LCI served as the lead investigator; LCI, CPO, KOI, AOA and CDT, contributed to study conception/design and data acquisition, LCI, CPO, KOI, AOA, CDT, IYM and MAK contributed to data analysis and interpretation, and writing of article; LCI, CPO, KOI, AOA, CDT, IYM and MAK contributed to editing, reviewing and final approval of article. All authors read and approved the final version of the manuscript.

Conflicts of interest

The authors declared that there is no competing interest.

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