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Original Research Article

Pilot Study on the Effectiveness of e-Laboratory Services in a Poor-Resource Setting: Implications in Drug Therapy

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Abstract

Objectives: Laboratory services are poorly run in many low-income countries, severely constraining their input to patient care and disease surveillance. A pilot study on effectiveness of e-Laboratory services with modern packages that will carry out a range of individual component of tests facilitating delivery of results to the clinic through internet system was conducted in district and private hospital laboratories in a typical metropolitan city in eastern part of Nigeria, West Africa.

Methods: Data were collected using a structured questionnaire administered to respondents (n=26) to determine the range of tests performed by the laboratories and the clinical demands from both district and private hospitals. Data were documented, analysed and presented in tabular and graphical forms.

Results: Revealed that detection of malaria parasite accounted for the highest proportion of baseline tests performed given as 15.6% as compared to 6.3% reported for VDRL (venereal disease research laboratory) test and serum electrolytes respectively accounting for the least proportion. Fertility test given as 29.4% accounted for the highest proportion of special tests as compared to 5.9% reported for CD4 cell count and human papilloma virus respectively accounting for the least. Consequently, a significant number of clinical demands were not met by the existing laboratories impacting negatively on the outcome of drug treatment.

Conclusion: In conclusion, the outcome of present study lends credence to the fact that e-laboratory systems may be considered better diagnostic approach in ensuring effective drug therapy of disease conditions.

Keywords: Drug therapy, e-Laboratory service, poor-resource setting, pilot study.

1.Introduction

It is self-evident that technology innovation and genetic advances in science are linked automatically to improvements in health care. These innovations can take the form of molecular biology techniques giving rise to new vaccines, diagnostics and bioinformatics; simplifying information flow, promoting the concept of e-health and quality processes that affect how hospitals are managed. Precise and strong health systems are fundamental if we are to improve health outcomes and accelerate progress towards realization of the health-related millennium development goals of reducing infant mortality by two-thirds, reducing maternal mortality by three-quarters and combating HIV/AIDS, malaria and other diseases. Efficient e-laboratory service is the cornerstone of modern healthcare systems contributing towards 70% of medical diagnosis and treatment[1]. Laboratory test should be used to monitor individual patient's improvement and to provide health information[2]. In tropical Africa, Nigeria inclusive, where many diseases such as malaria, anemia, HIV infection and tuberculosis are endemic, timely and accurate diagnosis of these diseases are vital for early institution of appropriate therapeutic management and treatment. Laboratory services are integral component of health systems, therefore reliable and accurate results are the only panacea for proper and effective management and treatment of these diseases. Treatment of malaria based on diagnosis using microscopy or rapid diagnostic immunoassay-based tests in out-patients compared with presumptive diagnosis of uncomplicated malaria has the potential to save money on unnecessary drug treatment[3,4]. The purpose of this study, therefore, was to get baseline information for the establishment of efficient laboratory package that can provide a range of integrated tests that can adequately service both local

clinical and public health needs and impact positively on outcome of drug treatment.

2. Materials and Methods
2.1 Study Area and Subjects

This is a pilot study conducted between March and September 2011, at Onitsha metropolitan city, Nigeria. This metropolitan town is a commercial gateway serving all other major commercial centres in the country. Onitsha metropolitan city is a large urban town traversed by tarred roads that enter the eastern part of the country, Nigeria. It is on the coastal line of River Niger, 85km west of Enugu, the administrative centre of eastern Nigeria. The human population density is quite high. Socio-economic status of the inhabitants is high, predominantly traders at national and international levels. Onitsha was selected for the study because it was typical; in form of population, disease profile and health facilities. The area has one district hospital and a lot of private hospitals serving the crowded population.

2.2 Survey Procedure

A structured interview questionnaire composed of open–ended questions using pair wise-ranking and scoring method on effectiveness of laboratory delivery services and the desire to patronize e-Laboratory services in order to facilitate early and prompt delivery of results was administered to respondents. This was done using the sampling frame of all the hospitals (n=26) in Onitsha metropolitan city. A list of the possible diagnostic tests was enumerated and provision made for inclusion in the already prepared list. Twenty-six respondents representing the selected hospitals were interviewed. Respondents were mainly medical directors of the selected hospitals or their representatives. The interview process involved a moderator and an assistant whose duty was to take down notes during the interview.

2.3 Statistical Analysis

Epi-Info^{TM} version 6.04 was employed in creation of appropriate questionnaire template for data documentation, analysis and presentation in tabular and graphical forms.

3. Results

A number of baseline and specialized tests were performed by the laboratories during the study period. The distribution and proportion of baseline tests performed are as shown in Table 1 and Figure 1 respectively. Microscopy for detection of malaria parasite accounted for the highest proportion of baseline tests performed given as 15.6% as compared to 6.3% reported for VDRL (venereal disease research laboratory test) and serum electrolytes respectively which accounted for the least proportion. Similarly, the distribution and proportion of special tests done are as depicted in Table 2 and Figure 2 respectively. Fertility test given as 29.4% accounted for the highest proportion of special tests as compared to 5.9% reported for CD4 cell count and human papilloma virus respectively which accounted for the least. Analysis of the questionnaire showed that most of the specialized tests were performed by few laboratories located outside Onitsha, in other parts of the country or abroad due to lack of functionally up-to-date equipment and technical man-power to handle them. Most of the time results arrived late in the clinic as a result of either inefficient operational procedure or delay on transit. Information given by the respondents revealed that they relied more on their clinical judgment than on the laboratory results owing to late arrival of results to the clinic and inefficient laboratory service to meet up with their clinical demands.

Table 1: Frequency of Distribution of Some Baseline Tests in Hospital Laboratories

| Laboratory Tests	Hospitals	In-Patients	Out-Patients
Malaria Parasite	26	13	17
Urinalysis	26	13	23
AFB x 3	10	5	8
HIV (I & II) Screening	20	9	15
Hemogobin	26	23	12
Blood Sugar	15	12	13
Liver Function Test	10	4	11
Cultures	20	8	21
Blood Group	20	12	14
VDRL	5	2	7
Serum Electrolytes	10	13	11

Table 2: Frequency of Distribution of Some Special Tests in Hospital Laboratories

Laboratory Tests	Hospitals	In-Patients	Out-Patients
Lipid Profile	15	4	14
Hormonal Assay	2	3	1
Prostatic Specific Antigen (PSA)	3	7	1
Human Papilloma Virus	1	2	0
Fertility Test	10	8	12
CD4 Cell Count	1	2	0

Fig. 1: Percentage (%) Distribution of Some Baseline Tests in Hospital Laboratories
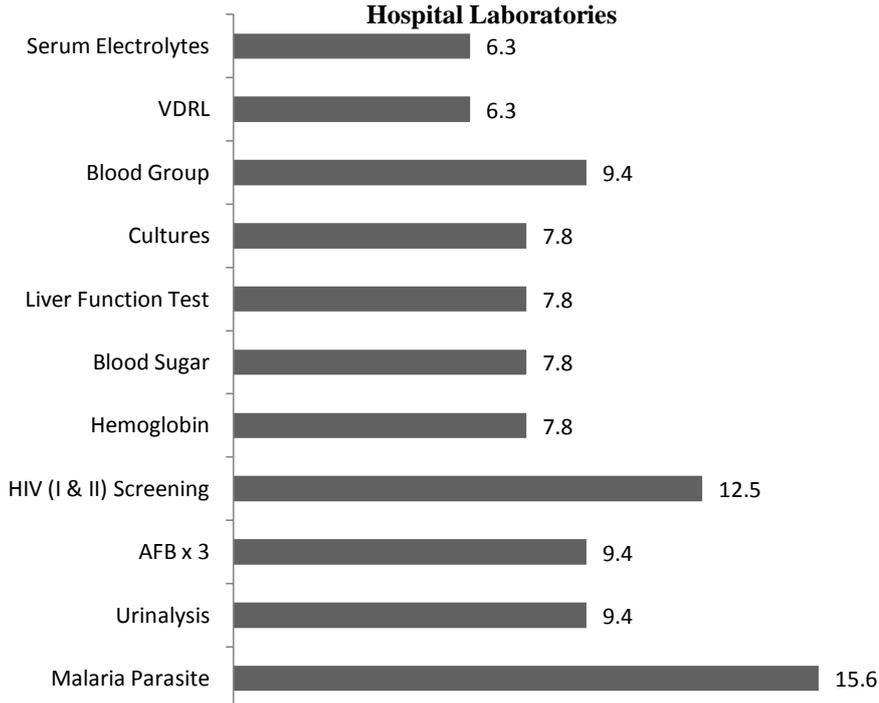
Fig. 2: Percentage (%) Distribution of Some Special Tests in Hospital Laboratories
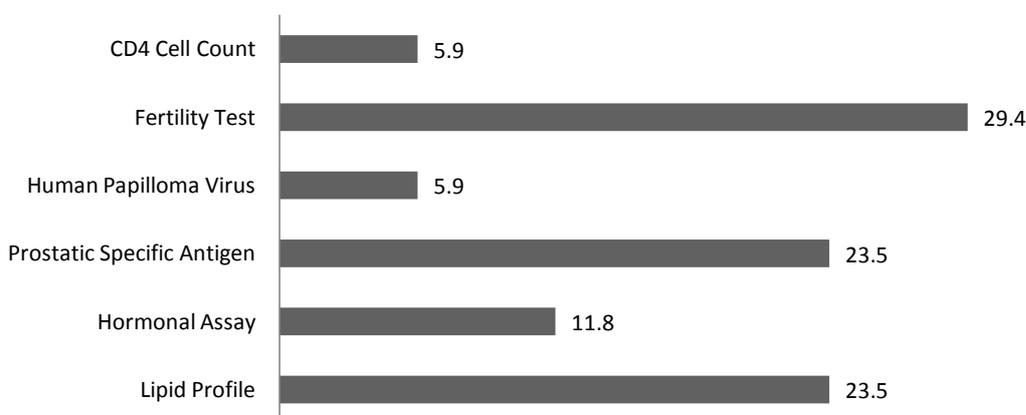
4. Discussion

Reliable laboratory test results play a very key role in improving disease management. Poor income countries lag behind the rest of the world in this, relying heavily on clinical suspicion rather than laboratory based diagnosis[5]. However, if the quality of laboratory tests is poor, resources will be wasted on repeat tests or there will be inappropriate management of cases which might result to morbidity and/or mortality. It has been shown that errors still persist in laboratory testing procedures despite attempts at improving analytical quality[6,7]. A recent study recommended institution of quality assessment programs to reduce analytical errors in the laboratory[8]. Lack of access to quality–assured rapid diagnostic tests can kill just as unwholesome drugs or lack of access to drugs. The few test materials that are available in developing countries are often sold and used with little evidence of their effectiveness, due to lack of regulatory standard. Effective diagnostic testing is the best way to ensure proper treatment and care. But with a plethora of test materials in the market, practitioners and clinics need substantive evidence on which one is most effective and for what setting. Urgent and accurate laboratory test delivery services are panacea to proper and prompt life-saving treatment approach in our hospitals and clinics and obviate unnecessary time and resource wasted on presumptive treatment. Laboratory tests are an expensive component of health care systems[9]. Studies of individual tests have highlighted operational difficulties in ensuring

the efficient use of resources for basic laboratory services in Africa. Therefore, good knowledge of these difficulties will assist in providing adequate information about test priorities needed for planning, upgrading and proper resource allocation. Inappropriate laboratory test ordering is a wide-spread problem[10]. It does not only harm patients but is also a waste of resources. HIV/AIDS, malaria and cancer remain the leading causes of death in the most productive age group (20-49 years) in Nigeria. The effects have overburdened the health care services in the country to such an extent that laboratories are increasingly unable to deliver quality results and on time too[11]. Anemia caused by malaria is a major cause of infant mortality in the country, therefore, efficient and effective laboratory services are necessary to meet the urgent demand for blood transfusions. There are few data about the efficiency and effectiveness of district laboratory services in the country. Recent advances in our understanding of the pathogenesis of some of the disease entities will impact tremendosly on early and prompt diagnosis[12]. The description of the pathophysiology of these disease conditions challenge established diagnostic and treatment strategies and therefore demand newer diagnostic methods where the focus will be on the differential diagnosis and early release of results to the clinic. Clinical laboratory services are critical, yet much neglected component of health system in resource–poor countries. They are crucial in public and private health facilities, disease control and surveillance, an indispensable guide for patient prognoses and care, but yet their key role is often not recognized by government or donor agencies. This study carried out in a metropolitan city, which has one district hospital and many private hospitals provided an in-depth analysis of all tests performed by laboratories in a poor-resource setting.

Although, laboratory workload varies from hospital to hospital, local clinical demands are typical reflections of the type of disease prevalent in a poor-resource country. Observation from this study showed that clinicians relied more on their clinical judgment than on the laboratory test results to guide their practice. Majority of the tests were performed manually thereby delaying the results for 1 to 2 days or even more. The high prevalence of tropical diseases and emerging new ones make it imperative to improve the quality of test delivery procedures and overall result delivery system. The majority of blood transfusions are given to children aged<5, in areas with high prevalence of malaria such as Nigeria. Most of such cases come as emergencies and the blood may not be screened for blood-borne diseases

before being transfused. The validation and implementation of better methods for carrying out laboratory investigations and faster means of delivering results to the clinics are priorities in ensuring improved e-laboratory services. The present study, therefore, strengthens our belief that implementation of e-laboratory systems may be considered to be better diagnostic approach in the management and drug treatment of diseases.

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