DECISION SUPPORT TOOLS IN MEDICINE: EVIDENCE-BASED MEDICINE APPROACH IN TAMALE TEACHING HOSPITAL

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Abstract

***Objective*:** To determine whether laboratory results match the preliminary diagnosis, using a model of malaria diagnosis by clinical staff at Tamale Teaching Hospital (TTH), Ghana.
***Methods*:** Data of outpatients diagnosed with malaria in 2012 were collected retrospectively from clinical notes. Data of the clinicians who provided the preliminary diagnoses were collected by self-reporting questionnaire. Statistical analyses were performed with Epi-Info and SPSS software.
***Results*:** A total of 344 patients were diagnosed with malaria in 2012, consisting of 186 females and 158 males. The age ranges between one month and 80 years. Forty-four clinicians responded to the questionnaire, consisting of 12 females and 32 males with mean ± SD age of 40.2±10.0 years. Respondents included consultants, medical officers, house officers, physician assistants, physician specialists and senior nurses, with mean ± SD years since qualification of 11.6±9.8 (range: 1-40 years). Nearly one-half (49%) of the clinicians reported not normally requesting laboratory investigations for suspected cases of malaria, thus not following an evidence-based approach for preliminary diagnosis. Slightly over one-half (51%) of the preliminary diagnoses of malaria in suspected cases were incorrect. However, statistical assessment of the clinician's preliminary diagnosis and the results from laboratory tests for malaria parasites showed a correlation (p=0.6548 at 95% CI).
***Conclusion*:** Practice of evidence-based medicine and establishment of a technology-based healthcare system can lead to decrease incorrect diagnoses and inappropriate health care management.

Key Words: Clinical Decision Support Tools; Evidence-Based Medicine; Diagnostic Errors, Malaria

INTRODUCTION

Relentless efforts have been put forth to develop effective treatments for the most prominent diseases and to institute management schemes that will allow for their delivery to the patient population. Yet, initiation of any treatment relies exclusively on diagnosis of the condition by the healthcare providers (i.e. clinicians), which is itself based upon a probability approach (i.e. an estimate of the most probable diagnosis among the suspected conditions).

Clinical evidence improves the chance of making an accurate diagnosis, and more importantly for initiating the proper therapeutic intervention. This approach, known as evidence-based medicine, has been a core tenet of Western medicine for ages. The more ancient Eastern medicine, however, employs a more subjective approach, relying on the clinician's wisdom and social traditions and which carries a greater risk of misdiagnosis and delay in appropriate therapy. As such, the 'stasis' of the traditional Chinese and Hindu medical systems reflects the civil and moral orders of their respective cosmologies, while the 'physis' — the Greek term for 'nature' or 'change' from which we get the term 'physics' — of the West's reflects the evidence-based approach [1].

Medical errors are both harmful to the patient and costly to the healthcare system. A report from the United States' Institute of Medicine (1999) ranked medical errors as the eighth leading cause of death nationally, accounting for up to 98,000 annual deaths[2]. Healthcare managers and clinicians are valiant in their ongoing efforts to reduce these numbers. A wide range of improvements have been made to the clinical practice of medicine worldwide, benefiting patient outcomes remarkably[3]. One such improvement is the technology-based clinical decision support system (CDSS), which provides doctors with patient-specific information.

The CDSS has emerged as a useful tool in organized and rapid dissemination of information allowing for a more comprehensive understanding of a patient's condition. It may also, however, represent a tool to improve physicians' compliance with evidence-based medicine practices. The use of decision support tools in a medical facility, such as a hospital, to facilitate the practice of evidence-based medicine promises to substantially improve the overall quality of the healthcare provided to its patient population[4]. Indeed, beneficial outcomes have already been reported

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along a number of dimensions, including compliance with treatment standards, reduced treatment costs, and improved patient outcomes [5].

In Ghana, the healthcare governing and other funding agencies have exerted extensive efforts and resources towards controlling and treating malaria and HIV/AIDS. These efforts have extended beyond the healthcare facilities, and out into the daily living environment; for example, widespread media campaigns have been launched to educate the citizenry on behaviours and practices that protect against contraction or transmission of communicable diseases.

Besides the effects on human health, communicable diseases have serious impact on a country's economy, slowing or halting growth and bringing about severe cycles of poverty. For malaria, in particular, it has been estimated that up to 10–12 billion US dollars of domestic product are lost every year in Africa alone[6]. Accurate diagnosis and timely initiation of appropriate therapy are crucial aspects of any effective healthcare treatment program. Unfortunately, the late adoption of Western medicine practices in many African nations poses a challenge.

This study was designed to determine the extent of cases of preliminary diagnosis of malaria in a representative tertiary hospital that match with the subsequent laboratory findings. The findings indicate the relevancy of laboratory findings to medical decision-making and provide insight into the current approach taken by clinicians to evaluate care against a pre-set standard and how to improve such to benefit both patient outcome and healthcare costs.

Background

Development of a country's healthcare industry is non-linear and dynamic[7]. Ghana is no exception, and is persistently challenged by increasing costs of care and scarce logistics for healthcare providers. Efforts by the Ghanaian government to provide good quality healthcare have included publication of the Information and Communication Technology (ICT) in 2005[8], wherein ICT is promoted for its ability to improve the organization and administration of hospitals and management of patients, especially for those afflicted by the most common ailments affecting the local population.

Malaria represents an important threat to public health in Ghana. Of the four different species of malaria that infect humans, *Plasmodium falciparum* is the most lethal and accounts for the majority of infections in Ghana. The non-specific symptoms of malaria further complicate diagnosis and highlight the importance of using clinical evidence, such as that from a blood test[6] for accurate clinical management.

In the outpatient department of Ghanaian hospitals, most cases of malaria are diagnosed on the basis of clinical symptoms, so that treatment is presumptive rather than based on laboratory confirmation. Moreover, malaria parasitaemia is common among endemic areas, so that a positive laboratory result does not necessarily mean that the tested patient has developed the malaria condition. The main clinical symptoms of malaria — fever and general weaknesses are non-specific and may be due to any other infections[9].

The mission of the TTH is to promote quality and affordable tertiary healthcare that is delivered by well-trained, highly motivated and customer-friendly professional health staff. The hospital abides by a mandate to provide advanced clinical health services in support of tertiary care while serving as a training ground for undergraduate and postgraduate medical professionals. Part of this mandate includes research efforts to advance understanding of the particular health issues of the population of patients served for the purpose of improving the conditions of people's health in the region (i.e. northern Ghana) for possible expansion throughout the entire country.

Materials and Methods

Study Design

Malaria was chosen as the focus of this study since it represents a disease condition that demands most of the clinical care given by Ghanaian hospitals, accounting for nearly 50% of all admissions and outpatient visits. Since the clinical data of the TTH does not deviate from the nationwide data generated by the Ghana Health Service, we used it to conduct our study. The TTH was also selected because of its high rate of outpatient attendance due to its roles as a teaching hospital and as a tertiary health service provider serving nearly 5 million patients in northern Ghana. It also offers healthcare services to the neighbouring countries of Burkina-Faso and Togo, and as a healthcare facility that is conveniently accessible to a wide variety of patients.

Data Collection

We sort out data of patients with preliminary diagnosis of malaria, given by any member of the clinical staff in 2012 at the outpatient (OPD). For the purposes of investigating the rate of diagnoses based on evidence, the rate of usage of decision tools by the clinical staff and the rate of preliminary diagnosis matched to clinical evidence.

Patient data was collected retrospectively from the clinical notes from patients' records at the hospital. First, the complete collection of paper records (books) from 2012 for all 7 consulting rooms of the TTH, which operate simultaneously, were targeted for random selection to search for patients who received preliminary diagnosis of and treatment for malaria.

The total number of patients was 344.

The clinicians who provided the preliminary diagnosis for each of the 344 patients were offered a self-report questionnaire to obtain study-relevant data. In addition, some of the clinicians were interviewed in-person, with the aim of determining opinions on topics

such as efficiency of the relevant laboratory equipment. Statistical analyses were performed with Epi-Info and SPSS software.

Results

The 344 patients selected for study consisted of 186 females and 158 males with average age of 22±22.5 years (reported as mean ± SD; range: 1 month - 80 years, and mode: 1 year).

The 44 clinicians consisted of 32 males and 12 females with average age of 40.2±10.0 years (range: 26 - 73 years). The clinicians represented consultants (20.5%), medical officers (41.0%), house officers (4.5%), physician assistants (6.8%) and physician specialists (22.7%), as well as senior nurses (4.5%) including nurse in-charges and a deputy director of nursing services. The clinicians had an average of qualified years of 11.6±9.8 (range: 1 - 40 years).

Fig. 1. A Chart Showing the Demand for Laboratory Request by Clinicians

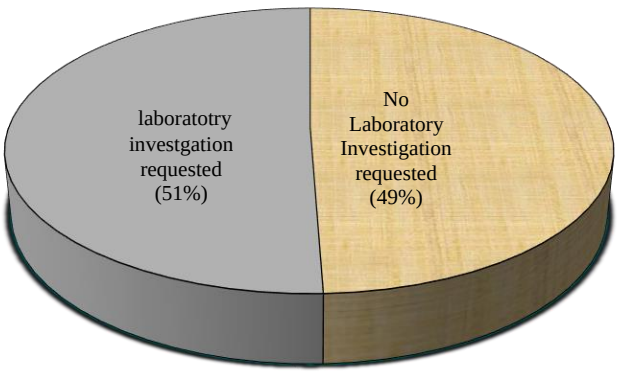

Fig 1. Chart showing the demand for laboratory request by clinicians

Nearly one-half (49%) of the clinicians who treated the patients with suspected malaria did not request laboratory investigation, thus the evidence-based approach was not followed in these instances. A little over one-half (51%) of the preliminary diagnoses of malaria did not match the true infection status of these patients.

Ninety-eight percent of the clinicians expressed interest in working with computers for their healthcare practice. Less than one-half (43.2%) of the clinicians reported a moderate level of familiarity with clinical information technology; much fewer reported a high level or very high level of familiarity with clinical information technology (22.7% or 15.9%, respectively).

Most (68.2%) of the clinicians reported that they considered evidence-based medicine as highly relevant to their professional practice of medicine. A very small portion (2.3%) of the clinicians reported not knowing what evidence-based medicine is.

Table1. Clinicians' self-reported responses to having conflicting thoughts when giving preliminary diagnosis (without clinical evidence)

Response	Frequency	Percent
Sometimes	30	68.2
Never	11	25.0
Always	3	6.8
Total	**44**	**100.0**

Source: Field survey, 2013

More than one-half (68.2%) of the clinicians reported sometimes having conflicting thoughts when giving a preliminary diagnosis (without clinical evidence). Only one-fourth of the clinicians reported feeling confident (no conflicting thoughts) when giving their patients preliminary diagnoses. Very few (6.8%) of the clinicians reported being indecisive about the preliminary diagnosis.

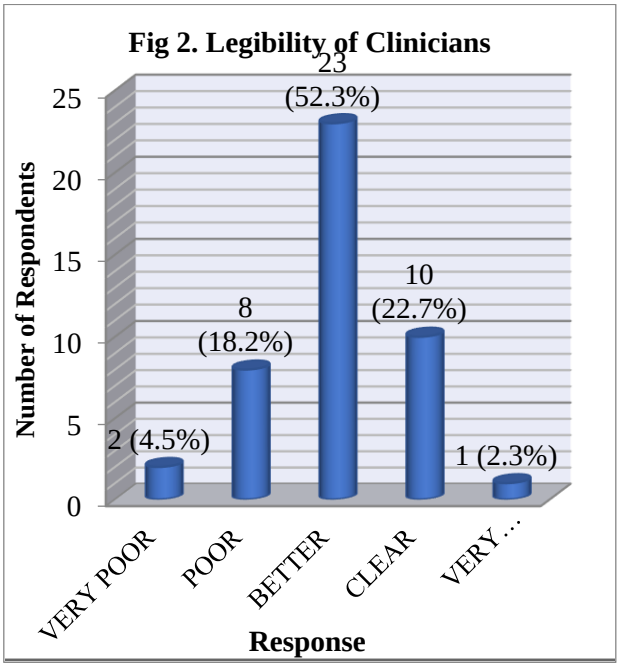

Fig 2. Legibility of Clinicians

Since the patient records were hand-written, we queried the clinicians as to whether the handwriting of their colleagues may have hindered their ability to assess the patients' notes. Slightly more than one-half (52.3%) of the clinicians reported that the handwriting was not legible. Only 18.2% of the clinicians reported

the legibility of their colleagues' writing to be poor and 4.5% reported it to be very poor. Similarly, 22.7% and 2.3% of the clinicians reported the legibility of their colleagues' handwriting to be *clear* and *very clear* respectively. Overall, the clinicians' preliminary diagnoses of malaria involved 98.3% (338) of the 344 medical records of all cases initially classified as malaria from the outpatient register. Of the patients who received a preliminary diagnosis of malaria, only 166 underwent laboratory testing to confirm the diagnosis. Among those, 60 received positive confirmation of the malaria diagnosis and 66 received negative results that refuted the preliminary diagnosis; the remaining 40 patients had no laboratory results available in the medical records.

Statistical analysis showed no significant difference in the clinician's preliminary diagnosis of malaria and the corresponding laboratory results of malaria parasites (p=0.6548 at 95% CI).

Discussion

This research study was designed based on the following formulated objectives for investigation.

First, the generally accepted theory is that there is a positive association between a clinician's preliminary diagnosis of malaria and the corresponding laboratory test's detection of malaria parasites. This theory was confirmed in the current study, as the statistical analysis indicated no significant differences between the TTH clinicians' preliminary diagnosis and the corresponding laboratory findings of malaria. Thus, the number of cases with discrepancies between the preliminary diagnosis and the clinical evidence are acceptable.

The second key objective of this study was to determine the need for decision support tools in healthcare delivery at the TTH. The clinicians in this study indicated a prevalent problem of experiencing conflicting thoughts when coming up with a preliminary diagnosis (without clinical evidence) and of being able to easily read the hand-written notes on patients written previously by their colleagues. These two problems represent challenges to provision of continuous and accurate medical care. In addition, the clinicians also indicated being unable to follow a patient's progress over time due to inadequate recording or loss of records for that patient. Having medical records in an electronic format and organized in a central database, such as facilitated by the use of ICT and decision support tools, will not only allow for the ready availability but also more comprehensive and accurate recording and interpretation, thereby reducing the risk of medical error and the cost of healthcare.

The overall attitude of the clinicians in this study was promising, with a near complete expression of interest in working with computers in the professional healthcare setting. Even though the majority of the clinicians indicated that they do not know what CDSS is precisely, they still viewed it as a potentially beneficial tool to improve their medical decision-making.

The fourth objective of the research was to investigate the attitudes towards evidence-based medicine among the clinicians. The 49% of clinicians who did not request any laboratory testing to confirm their preliminary diagnosis indicated a corresponding attitude of indifference towards adopting evidence-based practices. Ultimately, instituting evidence-based practices may be a challenge in this environment.

Limitations

Research of this magnitude cannot be conducted without some limitations, particularly those related to the time and effort involved and to the financial resources required to support them. Hence, our small-scale study was as a result of these limitations, and we attempted to overcome them by performing the sampling of medical records and giving of the self-report questionnaire in a single facility.

Another important limiting condition of the current study is the diversity of interventions that were used for each of the 344 patients' records included in the study. The interventions were tailored to the clinicians' expert opinions of the needs for each clinical situation, such as individualized protocols designed for specific work-up pathways.

In addition, the sensitivity and specificity of various forms of laboratory analyzer devices for the malaria parasites were not considered in this study either, which could be a source for other errors in diagnosis. In spite of all these challenges, however, the research provides useful insights into clinician attitudes and areas for improvement in clinical management of patients in Ghana.

Conclusion

The study gave insights into how some errors in misdiagnosis may be remedied by the use of CPOE, namely by eliminating confusion caused by illegible writing in patients' medical records and lost or missing records. Hence, Practice of evidence-based medicine and establishment of a technology-based healthcare system can lead to decrease incorrect diagnoses and inappropriate health care management.

Recommendations

1. Health information technology certainly has great potential to improve patient safety, especially when the strategy of computerized provider order entry (CPOE) is employed. Yet, the potential of health information technology remains unrealized in Africa.
2. Optimal use of decision support tools in medicine requires the complete harmonization of multiple hospital and ambulatory information systems, including those of the clinical laboratory,

radiology, medical recordkeeping, pharmacy and, possibly, health claim management.

3. The enthusiasm cited by the clinicians in the present study for use of information technology in their practice of medicine is promising. It is therefore recommended that the Ghanaian government and other stakeholders adopt the clinical decision support system in the TTH, in particular, and consider it for adoption in healthcare facilities across the entire country of Ghana.
4. The range of patient disease outcomes assessed in this study reveal the known lack of medical investigations for clinical interventions, which would otherwise be used with the aim of decreasing diagnostic errors and subsequent initiation of inappropriate medical interventions.
5. Additional work is needed to determine how to promote and firmly establish evidence- based approaches so that the rate of medical diagnostic errors is minimized to the greatest extent possible. It is expected that with heightened awareness of this problem, more studies will be conducted, even privately within individual healthcare facilities or as large-scale cross-country studies, such as randomized controlled trials to test different approaches.

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References

1. Bates, D. (ed.) (1995). *Knowledge and the Scholarly Tradition.* Cambridge University Press: pp. xvii
2. Kohn, L. T., Corrigan, J. M. and Donaldson, M. S. (November 29, 1999). *To err is human: Building a safer health system*. Washington, Institute of Medicine (U.S.) Committee on Quality of Healthcare in America, National Academies Press.
3. Andrew D Oxman, Mary Ann Thomson, David A Davis, and R Brian Haynes. *No Magic Bullets: A Systematic Review of 102 Trials of Interventions to Improve Professional Practice*. Canadian Medical Association Journal, 153(10):1423{1431, November 1995}
4. Sim, P. Gorman, R. A. Greenes, R. B. Haynes, B. Kaplan, H. Lehmann, and P. C. Tang, (2001), *Clinical decision support systems for the practice of evidence-based medicine*, Journal of the American Medical Informatics Association, vol 8 pp. 527–534.
5. Lloyd, And J. P. Burke, (1998). A computer-assisted management program for antibiotics and other anti-infective agents, The New England Journal of Medicine, vol 338 pp. 232–238.
6. Chuks, J. Mba, Irene, K. Aboh (2004). *Prevalence and Management of Malaria in Ghana: A Case Study of Volta Region.* African Population Studies. Vol.22 no.1, PP 141
7. Osheroff, J. A., Teich, J., Middleton, B., Steen, E., Wright, A., and Detmer, D. (2007). *A Roadmap for National Action on Clinical Decision Support.* Journal of the American Medical Informatics Association, vol. 14, no. 2, pp. 141 – 145.
8. Ministry of Health, Ghana (July 2005). *Health Sector ICT Policy and Strategy*. Executive summary P. VII
9. Carol Bellamy (2003). *Africa Malaria Report.* Executive Director United Nations Children's Fund (UNICEF), World Health Organization. P. 20