Is Google search a useful medical diagnostic tool for third year medical students?

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Introduction: In recent years, the internet has become an increasingly popular tool for people to obtain information due to the overwhelming availability of material. As internet access becomes more readily available, the newer generation of patients, medical students and doctors are starting to prefer the internet as a source of reference to acquire medical knowledge. The main objectives of this study were to determine the accuracy of using Google search in establishing a clinical diagnosis based on information provided from the New England Journal of Medicine (NEJM) and to determine the concordance rate of Google diagnosis with the actual diagnosis from NEJM.

Method: The research design was a cross sectional study of 200 NEJM cases. The research team comprised of four 3rd year medical students and one senior supervisor. Google search engine was used to obtain a diagnosis. The time allocated for a Google search for each case was 20 minutes regardless of the number of websites used. The top two diagnoses were then compared to the actual diagnoses of the NEJM case and the accuracy of Google was then assessed.

Results: The study achieved a congruence of 71.5%. This is considered acceptable and satisfactory as the cases presented in NEJM covered a wide variety of problems and encompassed rare diseases.

Conclusion: From the final results obtained, it can be concluded that with the aid of Google, medical students in their 3rd year of their Bachelor of Medicine and Bachelor of Surgery programme are able to obtain a reasonable clinical diagnosis.

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Introduction

The internet has become an integral part of our daily lives and has risen to be the most convenient source for seeking information.[1,2,3] Its value as a learning aid is well recognised. As access to the internet has become more readily available, it has assisted doctors and medical students in their zest for exploratory approach to acquisition of knowledge. 'Google' is currently ranked as the most widely used search engine worldwide and remains a very popular choice for the simple reason that it is a freely accessible, user friendly search engine offering a breadth of endless amount of information.[4,5]

Although 'Google' is not primarily known to be a medical search engine, healthcare professionals, medical students and patients use it frequently for internet search related to illnesses and health. One of the main disadvantages of internet search is credibility of information raising questions as to its correctness and reliability.

To improve accuracy of information, reliable sources posted in the websites should be used. For example, to obtain information on medical health and illnesses, the New England Journal of Medicine, Lancet and British Medical Journal have continuously updated articles on a wide variety of medical diseases with thorough explanations, all available at the click of a computer mouse. These journals are reputed to contain consistent and trustworthy information for healthcare professionals.

With the Y-generation of medical students being technology dependent and competent, using the internet to obtain information seems to be the more popular choice compared to traditional library books. In order to be aware of the latest updates in the medical field, the internet also seems to be a better choice as information is continuously updated unlike published textbooks that contain information almost five to ten years old.

The main objectives of this study were to determine if 3rd year clinical (medical) students were able to use layman 'Google' search engine (www.google.com) to establish a clinical diagnosis based on cases derived from Massachusetts General Hospital case reports obtained from the New England Journal of Medicine (NEJM)

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and to determine the concordance rate with established diagnoses. This followed a preliminary study by the lead author on a smaller sample, the results of which were published elsewhere in 2010.[6]

Materials and Methods

The study design is shown in Figure I. The sample size consisted of 200 consecutive Case Records of the Massachusetts General Hospital obtained from the New England Journal of Medicine (NEJM) from years 2001 to 2009. Each case was summarised by a pair of 3rd year medical students who were in semester 6.

The four medical students who were assigned to the lead author to perform their research project were paired to work on 100 cases each under the supervision of the senior author. They were paired off so that two students could summarise selected cases while the other pair performed the 'google search'. Summary of each case highlighted the key clinical features without providing the diagnosis, keeping anonymous the NEJM case number or year of publication.

Group A (Figure I) initially summarised 100 cases while Group B was expected to solely use www.google.com search to arrive at the most likely diagnosis by entering important keywords from the summarised case. The time allocated for each case was limited to 20 minutes regardless of the number of websites used. The students were only to access www.google.com without accessing advanced searches like google scholar.

After the completion of 100 cases, roles were switched between the two groups for the remainder 100 NEJM cases. Separation into two groups (Groups A and B) was to eliminate bias towards the search result and to allow each pair the opportunity to learn skills in summarising and establishing a clinical diagnosis.

Cases were then sorted according to their difficulty viz. "EASY", "AVERAGE" and "DIFFICULT". The cases labeled "EASY" involved a recurrent problem, relapse of a similar problem, the diagnosis being revealed through obvious investigations (e.g. gene study, blood culture, antigen-antibody result, tissue biopsy, endoscopy etc.), characteristic signs and symptoms for the problem and problems associated with strong familial link. The case would be considered "AVERAGE" if it had sufficient investigations leading to the diagnosis and suggestive signs and symptoms although not characteristic of the final diagnosis. Lastly, "DIFFICULT" was assigned to cases where the presenting signs, symptoms and investigations were incompletely linked to the final diagnosis, a rare problem seen in other countries, vague and uncommon presentation as well as signs and symptoms suggestive of more than one problem hence complicating the diagnosis (Table I).
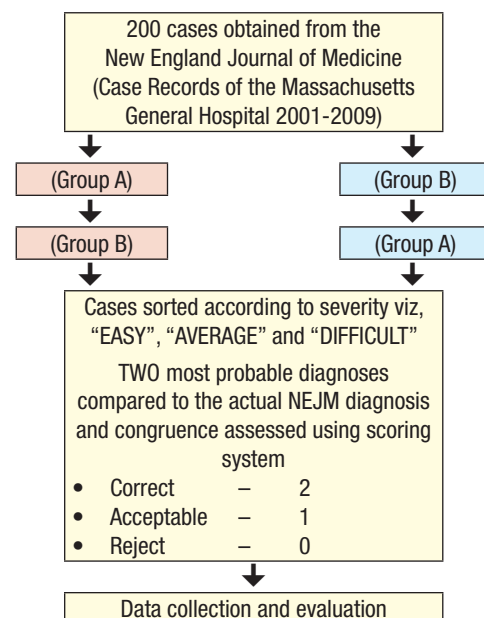

Figure I: Study Design

Table I: Scoring System

Google Diagnosis	Score
Correct	2
Acceptable	1
Rejected	0

At the end of the study, under the guidance of the lead author, both groups met to determine diagnoses that were correct, acceptable or rejected as compared to the actual NEJM diagnosis using a scoring system as shown in Table II. A total score of both diagnoses made by the pair of students amounting to 1 or higher would indicate a positive concordance rate ("YES") while a score of 0 (i.e. both diagnoses were rejected) would indicate a negative concordance rate ("NO"). Statistical analysis was done using a statistical analysis software, SPSS Version 11.5.

Chi square test was used to determine significance of differences in performance between Groups A and B.

Table II: Examples of categorisation of cases by difficulty and scoring

Case No / Year	Category of Difficulty	NEJM Actual Diagnosis	"Google Diagnosis'		Score assigned	Concordance
Case 34 – 2001	Easy – recurrent problem	Subcutaneous panniculitis-like T-cell lymphoma of γ/δ T-cell derivation.	1.	Recurrent panniculitis	2	YES
			2.	Erythema Induratum	0	
Case 1 – 2002	Easy – organism given	Infection with Loa loa	1.	Schistosomiasis	2	YES
			2.	Milroy disease	0	
Case 4 – 2002	Average – similar presentation	Glomerulonephritis mediated by anti-glomerular-basement-membrane antibodies.	1.	Acute kidney failure secondary to bacterial sepsis	0	YES
			2.	Acute nephritic syndrome secondary to infective endocarditis	1	
Case 19 – 2003	Difficult – pediatric case	Transient myeloproliferative disorder with trisomy 21 mosaicism	1.	Neonatal Herpes Simplex virus infection	0	NO
			2.	Transient Neonatal Pustular Melanosis	0	
Case 7 – 2003	Difficult – uncommon	Pneumococcal sepsis with endocarditis Endogenous endophthalmitis due to metastatic infection with Streptococcus pneumoniae.	1.	Optic neuritis secondary to respiratory infection (Streptococcus pneumonia)	0	NO
			2.	Bacterial keratitis secondary to respiratory infection (Strep pneumonia)	0	

Results

The concordance of NEJM diagnosis with diagnosis made from Google search obtained by Group A and Group B is shown in Figure II. Group A achieved 72% congruence whereas Group B obtained 71% congruence from 100 NEJM cases. With chi-squared value of 0.025 and degree of freedom of 1, p -value 0.876, there is no difference in performance between the two groups.

This showed that students were mostly able to make at least one acceptable diagnosis for most of the cases. One hundred and forty three (71.5%) scored one and above while 57 (28.5%) scored zero. The crude congruence rate was 71.5%.

Sub-analysis of the results was done by sorting the 200 cases into "EASY", "AVERAGE" and "DIFFICULT" (Figure II). There was an obvious downward trend in the congruence rate with increasing complexity of the cases. Among the "EASY" cases congruence rate of 99% (95/96) was obtained, whereas among "AVERAGE" it was 71.7% (38/53). Of the 51 "DIFFICULT" cases, students could only achieve a congruence of 19.6% (10/51). There was a large difference of 79.4% in the congruence rate between "EASY" and "DIFFICULT" NEJM cases.

Elimination of 96 "EASY" cases resulted in reduction of the total number of cases to 104, showing a corrected congruence rate of 41.2%.
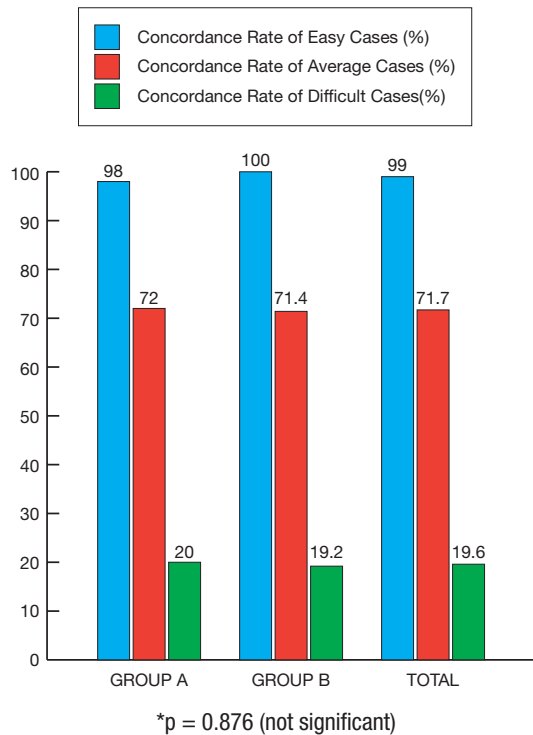
Figure II: Concordance rate by difficulty

*p = 0.876 (not significant)

Discussion

Medical training today encourages knowledge gathering and data mining using the internet. While medical students are provided skills learning and fundamentals of basic science in their formative years, they need to go through contextual learning in the clinical field to enable them to apply knowledge to practice.

This study of 200 Case Records from Massachusetts General Hospital initially had a crude congruency rate of 71.5%, with a corrected congruency rate of 46% after elimination of "EASY" cases. This is similar to a previous study done by the senior author (Nalliah S) using a smaller sample of 47 cases (concordance of 44.7%) without categorisation by difficulty.[6] Other factors contributing to the minor difference in congruence rate between the two studies are the different sample sizes, number of students involved, type of cases selected from NEJM and the length of time spent on each case. A pioneering study by Tang & Ng in 2006 using Google as a diagnostic aid with a sample size of 25 NEJM cases obtained a congruency rate of 57.7%.[7] In that study physicians were involved in internet search.

A difference of 25.5% from initial and corrected congruence is due to the fact that majority of the cases that were concordant and correctly diagnosed were "EASY" cases. Most "EASY" cases (89 / 200) had a total score of two, six cases had a score of three and two cases had a perfect score of four.

This is firstly attributed to the ease of availability of medical information on the internet combined with cognitive skills of third year medical students. Secondly, there were several NEJM cases which had very typical symptoms which were specific for certain diseases. Furthermore, there were some cases in which the patient had underlying disorders which led students to think that the current symptoms could be due to a manifestation of those disorders and other cases in which there was an obvious diagnosis from a history of a chronic, recurrent problem.

These results could be due to the value of medical training in the first three years of the MBBS programme that permits students to apply basic science in pathology to clinical medicine.

There were 57/200 NEJM cases with a score of zero indicating both diagnoses made by each student were wrong. This was due to the complexity and unfamiliarity of certain cases that required knowledge and skills that had yet to be developed by a third year medical students who had only completed three hospital postings (rotations) namely, internal medicine, general surgery and family medicine. They had not been exposed to other specialised disciplines like O&G and Paediatrics. Fifteen out of 200 NEJM cases were from Paediatrics and students were unable to come up with a diagnosis in four of those cases.

Among the difficult cases, there were ambiguous clinical symptoms where students were unsure of the diagnosis. A concordance rate of about 19.6% for the difficult cases is commendable considering the complexity of cases in NEJM and unfamiliarity of cases as they are derived from hospitals in USA.

Increasing the sample size to 200 permitted a cross over between groups so as permit evaluation of Google search skills of all the four students. There was no significant difference in the performance of both groups alluding to similar traits and levels of clinical competence in problem solving and establishing a clinical diagnosis.

Limitations:

Several limitations were identified throughout the course of the study. As the four medical students were only in their third year of their MBBS programme there was some deficit in knowledge and clinical ability to diagnose cases that required added knowledge. There was no dedicated research time allocated for the study within the MBBS course, hence students were expected to do the research concurrently with ongoing clinical rotations. All four students were in different clinical rotations. This made meet-ups for discussion and brain storming more difficult. Nevertheless, a weekly update on the progress of the study was done to ensure all students and mentor were aware of the progress. However, one of the strengths from this study was that the four students learnt the importance of group interaction and communication skills when working in a group.

Conclusion

There is a crude congruence of 71.5% for the total of 200 NEJM cases. Using a larger sample size with the possibility of cross-over of subjects resulted in higher crude congruency rate compared to a previous study by the lead author (44.7%; n= 47 NEJM cases).

Differentiating the cases according to severity and eliminating "EASY" cases, a congruence rate of 46% was achieved for a total of 104 NEJM cases. This produced a narrower difference in congruence to the aforementioned study. This study also proved that, given fundamental clinical contextual learning in the 3rd year of the MBBS programme and a strong foundation in basic sciences, students are able to perform problem solving even for complex cases with the assistance of Google search. The research further concludes that there is no significant difference between the knowledge of 3rd year medical students who are in the first year of the clinical phase in the MBBS programme. Furthermore, this research establishes that with the easy availability of information online together with a reasonable level of cognitive skills, Google is a valuable tool to aid and guide medical professionals in clinical problem solving.

Acknowledgement

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