Visual Informatics: Real-time Visual Decision Support

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Text-Based Image Reference

- Versus -

Software Decision Support

Abstract

Searchable image databases can provide access to medical photographs, but until now they have not been designed to support the diagnostic evaluation. VisualDx is a JAVA based decision support application focusing on visually diagnosable diseases. Generalist physicians and dermatologists participated in a randomized trial of the software tool in comparison to text based resources. Accuracy of differential diagnosis was found to be significantly higher among non-dermatologist physicians using the software intervention in comparison to standard textbooks.

Background

It has been estimated that 10-20% of all primary care physician visits include at least one skin complaint. Yet, there is evidence that generalist physicians frequently order the wrong tests and misdiagnose dermatologic and other visually diagnosable problems, increasing the cost of health care delivery and delaying appropriate treatment. Though photographs of skin disease contained in textbooks and atlases have been used for well over a century to assist diagnosis, computer based resources offer unique advantages.

Study Design

Training study assistant followed 4 minute script to demonstrate the basic software functionality. Physician self-test of the software followed. Physicians were randomized to “Cases mix groups” (see below). After reading a “case” and before using a reference, subjects were asked to write preliminary diagnoses ranked by 1st choice, 2nd choice and 3rd choice. Responses were collected, and then depending upon randomization, the subject used either the textbooks or the software intervention. The participant then provided their 1st choice, 2nd choice and 3rd diagnostic choices as they did prior to using the intervention reference. Depending upon the randomization of the case mixes, subjects either began with 2 computer-assisted cases, or with 2 textbook assisted cases. Scoring: 3 points for 1st choice, 2 points 2nd choice, 1 point 3rd choice, 0 points wrong answer

Case Mix Groups

1. Books with Cases 1 & 2 followed by Software with Cases 3 & 4
2. Software with Cases 1 & 2 followed by Books with Cases 3 & 4
3. Books with Cases 3 & 4 followed by Software with Cases 1 & 2
4. Software with Cases 3 & 4 followed by Books with Cases 1 & 2

Discussion

Is there a particular software functionality responsible for the increase in accuracy? There may be many. Possibilities include:

-ability to search by animated graphical icons of skin lesion morphologies and distributions
-semantic based diagnosis within the software
-large number and high quality images
-combinatorial searching with dynamic redisplay of diagnosis image stacks

Subjective data suggested the physician subjects favored the morphology and distribution combinational approach to searching as compared to the use of an index in the back of a text. The graphical searching, and variety, depth and quality of images were all seen as strengths.

If a problem-oriented text existed for the same problem domain could it perform as well as the software?

Conceptually, any text-based reference would be limited in the number of images, and would have little or no searchability beyond a standard index. No such text exists today to conduct a comparison study. Future work will include comparing the software with the images removed (the user will view text-based differentials), to a system that contained images associated with diagnoses in lists but without a database.

In addition the system will be deployed within an emergency department and users will be randomized to the software-versus-textbooks as they evaluate actual patients with fever and a rash.

Conclusion

- Correct diagnoses more than doubled among the non-dermatologists and was statistically significant.
- Physicians subjectively preferred the software system as contrasted to textbooks.
- With minimal training, physicians learned to effectively use the tool.