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VisualDx: A Visual Diagnostic Decision Support Tool

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ONLINE UPDATES: A COLUMN FOR SEARCH ANALYSTS

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ABSTRACT. VisualDx is a clinical decision support tool that uses images and searchable clinical features to assist physicians in the diagnostic decision-making process. VisualDx is a database of more than 24,000 high quality images covering a wide variety of conditions and drug eruptions. In addition, VisualDx integrates within both UpToDate and many electronic medical records and features a mobile version. This column includes a sample search and a review of the features of VisualDx.

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INTRODUCTION

VisualDx is a diagnostic decision support tool that uses images and visual features to facilitate physician diagnosis of skin, eye, oral, and pulmonary conditions; drug interactions; and other public health concerns. Users can either employ the "Differential Builder" and enter patient findings to determine a diagnosis, or they can search for a particular diagnosis or drug eruption differential. As of publication date, VisualDx included 1,212 unique diagnoses and 24,115 unique images. Each of the 1,212 unique diagnoses has a page of concise information designed for the practicing clinician written by subject experts (see sample search for further details). The content is reviewed on a continuous basis and updated quarterly. VisualDx also states that "public health alerts and clinical guidelines can be made available within 24 hours of an outreach, natural disaster, contamination, or other event necessitating an immediate or coordinated medical response,"[1] addressing the importance of current information and emergency preparedness.

VisualDx is designed to be used at the point of care, allowing users to search by diagnosis, build a patient-specific differential, or look up a medication-induced adverse reaction. It aids in the identification of a host of diseases, including dermatologic, infectious, genetic, metabolic, nutritional, and occupational, as well as benign and malignant growths and other injuries. It combines authoritative medical knowledge (contributed by field experts), a robust search engine, and high-quality medical images to deliver information quickly and in an easy-to-digest format.

VisualDx was created by Logical Images, Inc., a company that developed a comprehensive medical image library of 90,000 peer-reviewed images, which serves as the

foundation for VisualDx. The home page of VisualDx (http://www.visualdx.com/) (see Figure 1) includes promotional materials, success stories, links to information about mobile access, and details regarding electronic medical record integration (read more under "Additional Resources"). To get to the diagnostic decision support tool, users can either click "Start VisualDx" in the upper right hand corner or link directly to http://www.visualdx.com/visualdx.
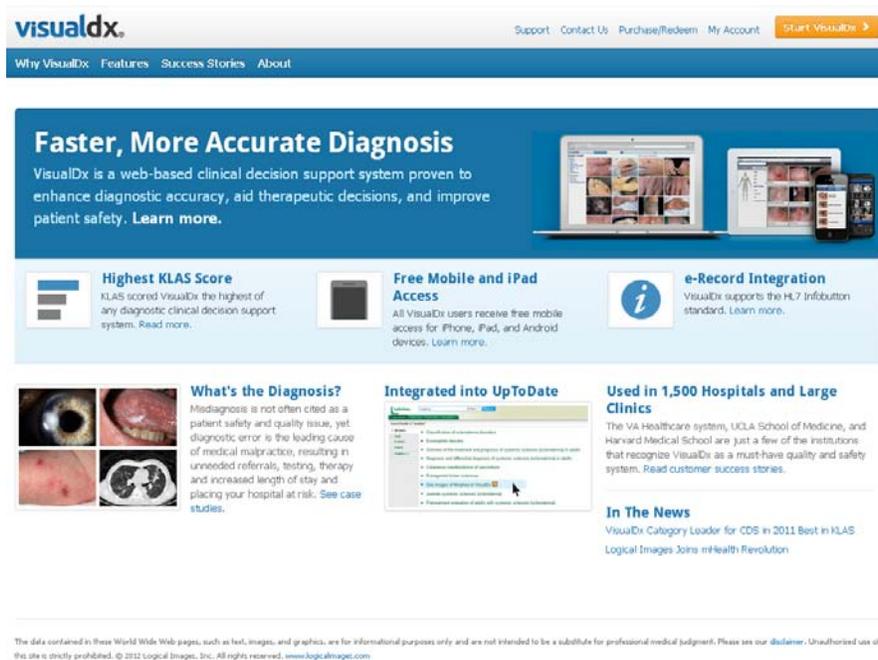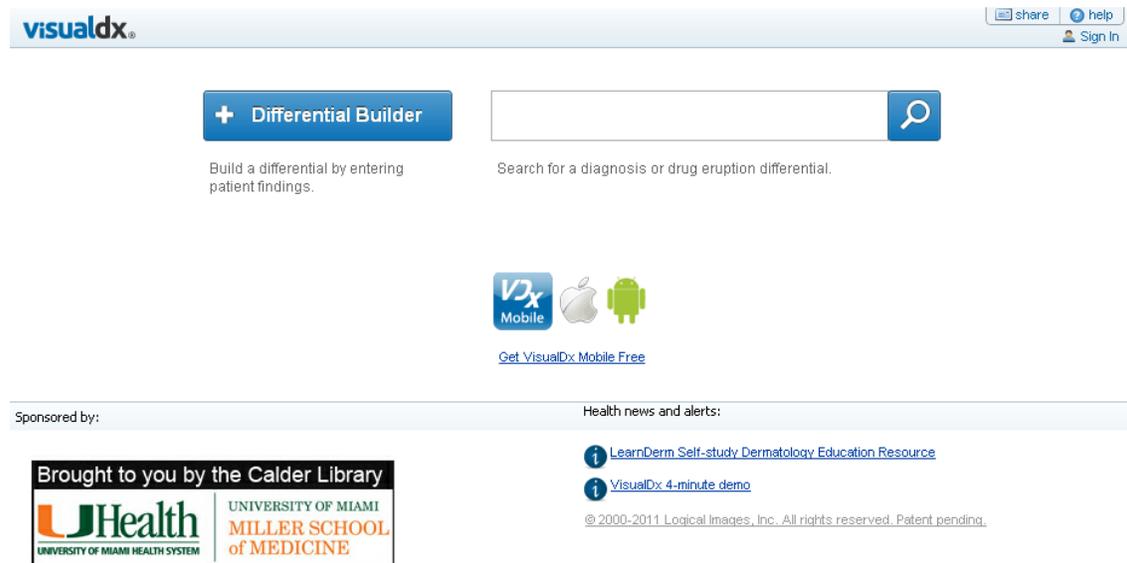

Legend: FIGURE 1. Home page of VisualDx

[Note to publisher -- place this statement under the figure: Images provided by VisualDx.]

SEARCH OPTIONS

There are multiple options for searching this visual database, and users can go easily from one search option to the other until they find the information that they need. From the VisualDx

search home page (see Figure 2), users may select to search the "Differential Builder" or search directly for a diagnosis or drug eruption differential by typing in the large search box. (Note: this page can be customized for an institution, as seen in Figure 2.)

Legend: FIGURE 2. Search home page of VisualDx

[Note to publisher -- place this statement under the figure: Images provided by VisualDx.]

The Differential Builder allows users to enter patient findings to target their search. After selecting "Differential Builder," users are invited to "Choose a Clinical Scenario" and select from the following options: Pediatric Skin, Adult Skin, Drug Reactions, Eye, Oral, Pulmonary, and Public Health/Education. There are additional selections under each category (e.g., age groups, specialized content, and clinical scenarios). Under each category, users can explore information on multiple or single lesion(s), rashes, or growths, as well as specific clinical scenarios of common complaints such as fever and rash; immunocompromised; international

travel; bites, stings, and infestations; marine exposures; male anogenital; female anogenital; nail and distal digit; hair and scalp; and cellulitis.

SAMPLE SEARCH

When searching for a drug reaction where the causative medication is unknown, for example, users can select "Differential Builder," then select Drug Eruptions under "Drug Reactions." Once on the Drug Eruptions page, users are prompted to "build a differential diagnosis by entering your patient's findings," offering the opportunity to add more specific information to target search results. By clicking on "Add Medication Findings" users can select their medication name from an alphabetical list and also indicate the timing of the eruption (e.g., 0-5 days after drug, 6-30 days after drug, etc.). If a user selects "0-5 days after drug," a list of 27 potential diagnoses are displayed with pictures of the different rashes/eruptions.

Users can further streamline their search by selecting a "Lesion Type" from nine images of potential lesion types (e.g., scaly papule/plaque, eschar, purpura/petechiae, erosion/ulcer/atrophy, smooth papule/plaque, etc.). After selecting smooth papule/plaque, the database displays further options and allows users to denote if the lesion is a smooth nodule, a smooth papule, smooth plaque, or a cyst. When smooth plaque was selected for the sample search, the search results were further narrowed down. The results are displayed according to relevance, with one diagnosis matching two of the findings (drug eruption date and lesion type) in the sample search and 34 diagnoses matching one of the two supplied findings.

The next option is to select the body location, and the choices are detailed and visually displayed on an image of a generic patient, with the option to select either a male and female

figure. Users can indicate exactly where the eruption is located, by selecting location in the body

(e.g., scalp, face, neck, arm, etc) or distribution (e.g., widespread, scattered haphazard,

photodistributed, etc.). Since the eruption was in a female's upper back in the sample search, the

"trunk" category was expanded, then "upper back" was selected (see Figure 3). Users at this

point have seven diagnoses that match two of the three findings entered, with images to match

each of the diagnoses. Additional images for each potential diagnosis can be viewed by selecting

"All Images" under the image box or by clicking through the images using the blue arrows to the
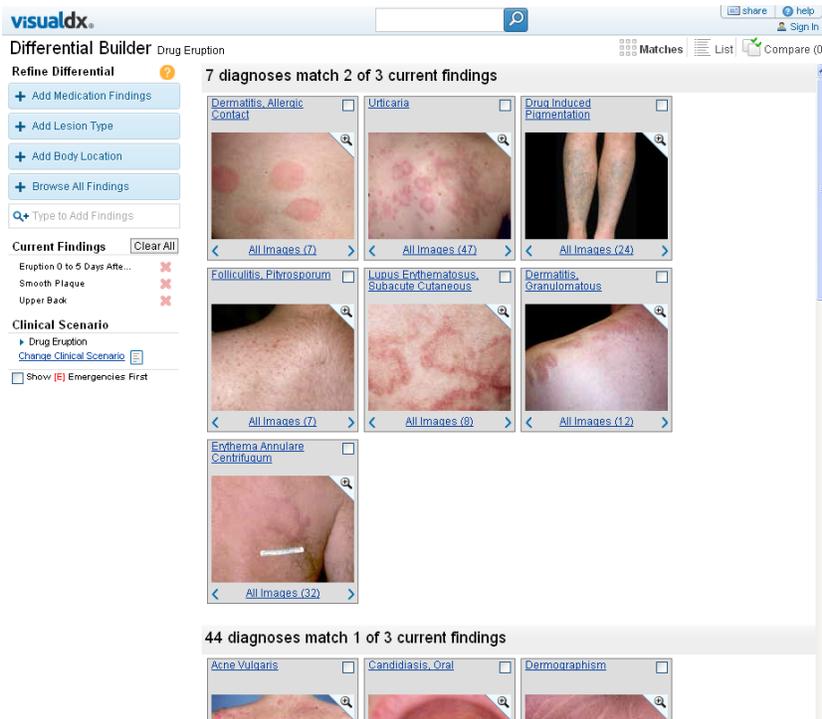
left and right of "All Images."

Legend: FIGURE 3. Add body location options

[Note to publisher -- place this statement under the figure: Images provided by VisualDx.]

In the sample search, the first results option displayed was "Allergic Contact Dermatitis";

other diagnoses included Urticaria, Drug Induced Pigmentation, Pityrosporum Folliculitis,

Subactute Cutaneous Lupus Erythematosus, Granulomatous Dermatitis, and Erythema Annulare

Centrifuqum (see Figure 4). Images for 44 other possible diagnoses were included below the top

choices. At this point in the search process, the health care professional can then compare the

patient's physical presentation with the sample images for each potential diagnosis.

Legend: FIGURE 4. VisualDx search results page

[Note to publisher -- place this statement under the figure: Images provided by VisualDx.]

To find more information about a possible diagnosis, a user can select the name of the

diagnosis; for the sample search, "Dermatitis, Allergic Contact" was selected. This displays a

new page with curated information about this specific diagnosis (see Figure 5), including the

ICD-9 Codes, Synopsis, Look For (which alerts health care professionals to the symptoms they

should pay special attention to), Diagnostic Pearls (containing advice from the subject experts),

Differential Diagnosis and Pitfalls (which link to pages on related diagnoses), Best Tests,

Management Pearls, Therapy, References (providing links to relevant PubMed articles),

Associated Medications (with direct links to PubMed articles on the use of the medication to

treat that condition), and Associated Findings (including appearance, body location,

configuration, distribution, exposures, lesion, occupations, signs and symptoms, social history,

and temporal, many of which directly relate to the VisualDx search options). In the right-hand

column, users can select "view all 83 images" to visualize larger thumbnails of all applicative

images and can toggle back and forth between the two display options by either selecting "Text

and Images" or "All Images" in the upper right-hand corner.

Legend: FIGURE 5. Allergic Contact Dermatitis overview page

[Note to publisher -- place this statement under the figure: Images provided by VisualDx.]

The information provided in the overview pages is exhaustive, and the visual images represent the condition in different levels, from very mild to the extreme. Each of the sections can be directly toggled to by selecting its title in the left-hand column. Additional targeted visuals can be viewed by selecting links under "Clinical Scenario" also in the left-hand column. For allergic contact dermatitis, specific images can be displayed by selecting "Adult Rash," "Dark Skin Rash," "Female Adult Anogenital," or "More Clinical Scenarios" (which opens a list of more than 20 options).

These overview pages are created by subject experts who are listed at the bottom of the page under "Authors." Librarians and others interested in the authority of the information will appreciate that direct links to PubMed are available within the text of the overview. In addition, the overview pages may be accessed directly. For example, if the causative medication in a drug eruption is known, users can type the name of the medication, such as Actonel, directly into the large text box on the home page. VisualDx's auto-suggest feature makes it easier for those searching for particular drugs or diseases. An image of a pill and an icon with the letters "Dx" allow users to quickly differentiate between drug and disease auto-suggestions.

IMAGE SHARING AND PERMISSIONS

Users have the option to share links to images from their search results with others, including those who are not VisualDx subscribers. If a user finds an image he or she would like to share, the user can simply select the "Share" icon in the upper right-hand corner. A single image can be shared, as well as a group of images for a particular diagnosis. If a user sends an image to a non-subscriber, the non-subscriber will be set up with a temporary trial of the database.

Images from VisualDx may also be used for educational purposes. A user can copy the link for a particular image and insert the link in a presentation (this would require Internet connection at the presentation site). A user may also perform a screen capture on an image in VisualDx and paste it within a presentation; however, VisualDx requires that the Logical Images watermark be visible within the image.

COMPARISON WITH ISABEL

VisualDx can be most closely compared to the diagnostic decision support tool Isabel, profiled in a previous Online Updates column.[2] Both databases allow health care professionals to enter diagnostic findings and then supply users with a list of differential diagnoses. VisualDx, however, is the only diagnostic decision support tool that allows users to use images to confirm or reject possible diagnoses. The ability for users to view multiple images of a particular disease is a unique feature in VisualDx. Isabel, on the other hand, offers Knowledge Windows which bring multiple resources (e.g., BMJ Best Practice, Oxford Textbook of Medicine, DynaMed, etc.) on a particular topic all together in one overview page.[2] This contrasts starkly with the expert opinion overview pages in VisualDx and makes Isabel a more evidence-based tool.

ADDITIONAL RESOURCES: VISUALDX MOBILE

All users at an institution that subscribes to VisualDx may download a mobile version of the database on their handheld device. To obtain access to the mobile version, users must simply go to "Get VisualDx Mobile Free" from the VisualDx home page and enter in his or her

information. Once the user completes the small form, he or she will receive an e-mail with a username (his or her email address) and a password.

The mobile interface (see Figure 6) is very streamlined, with three options: "Differential Builder," "Diagnosis Lookup," and "My Account." From the "Differential Builder," users will see a menu that looks similar to the desktop version, with the prompt to select a clinical scenario from the following options: adult skin, pediatric skin, external eye, oral mucosal lesion, acute pulmonary infection, drug eruption, and public health. The rest of the search process is similar to the desktop version (see Sample Search). The image quality is very high in the mobile version, and the search options are quite robust. The interface is somewhat different, however, between the iPhone and Android versions. The interface of the Android version appears to be slightly more similar to the desktop version; however, both versions have the same content and functionalities.
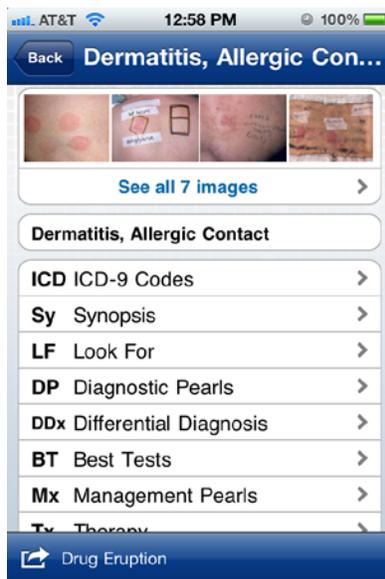
Legend: FIGURE 6. VisualDx Mobile

[Note to publisher -- place this statement under the figure: Images provided by VisualDx.]

The content in the overview pages for a particular diagnosis, for example Allergic Contact Dermatitis, appear to be identical in the mobile and desktop version. The gallery of images for a particular diagnosis, however, is smaller in number in the mobile version (i.e., seven images for Allergic Contact Dermatitis in the mobile version in comparison to 83 in the desktop version). Given the search options and the high quality of the images, health care professionals will most likely enjoy having mobile access to this decision support tool.

ADDITIONAL RESOURCES: INTEGRATION WITH ELECTRONIC MEDICAL RECORD

VisualDx may also be integrated within an institution's electronic medical record. VisualDx supports the Health Level 7 (HL7) Infobutton standard, which allows users to view educational materials regarding the evaluation and treatment of a specific disease without having to leave the electronic health record or having to retype data from the record. The development of the Infobutton standard delivers relevant clinical knowledge at the point of care as well as enables the integration of relevant, patient-specific knowledge resources into clinical information systems, helping providers meet their patient care knowledge needs so they can be enabled partners in the decision-making process.[3] The HL7 standard is already used within the Epic electronic medical record and other e-record systems, such as Cerner (wherein customers can use Cerner MPages to access VisualDx content).[4]

ADDITIONAL RESOURCES: INTEGRATION WITH UPTODATE

VisualDx is the only diagnostic clinical decision support system seamlessly integrated with

UpToDate (see Figure 7). VisualDx allows UpToDate users to enter patient findings to build a

visual differential diagnosis, confirm a diagnosis, and/or view images to aid patient education.

The high-quality images detail disease variation in age, stage, and skin type. When searching in

UpToDate, all VisualDx results are highlighted with an orange "VDx" icon.
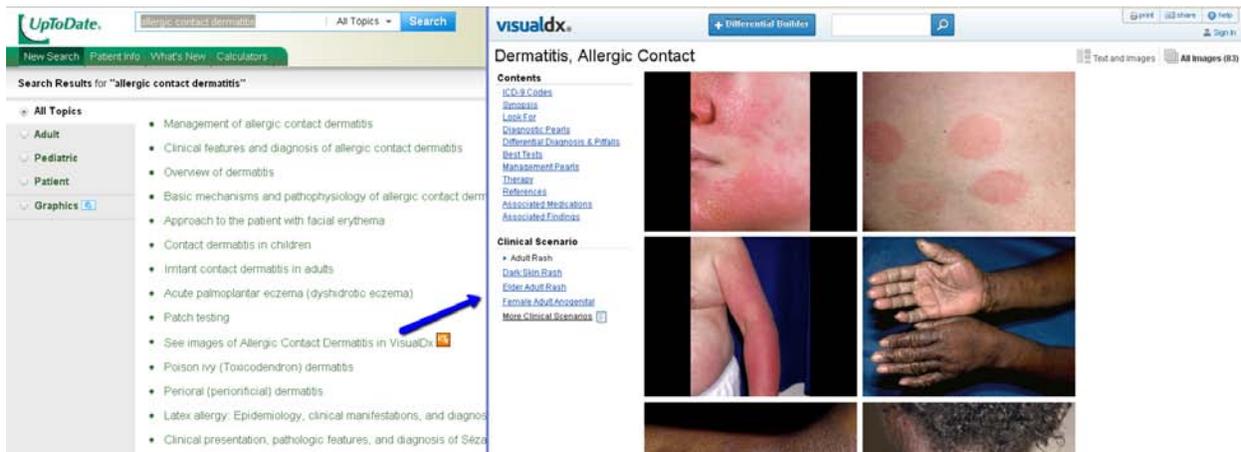
Legend: FIGURE 7. VisualDx integration within UpToDate

[Note to publisher -- place this statement under the figure: Images provided by VisualDx.]

For example, when VisualDx subscribers search for "Dermatitis" in UptoDate, one of the

topics in the search results list is labeled "See images of Atopic Dermatitis in VisualDx."

Clicking this link displays 26 images of the disease and can be expanded to show the complete

text of the VisualDx overview page on Atopic Dermatitis. Since clicking on the VDx icon within

UpToDate opens a new page with the VisualDx material, exiting the VisualDx site directs users

back to the UptoDate site with their list of search results. This integration of VisualDx within

UpToDate makes it easier for health care professionals to access this visual content at the point of care.

FOR MORE INFORMATION

For more information on Statistical Insight, please direct queries to:

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