10-1-2011

Pillbox: A Solid Dosage Medication Identification Tool

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ONLINE UPDATES: A COLUMN FOR SEARCH ANALYSTS

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ABSTRACT. Pillbox is a tool that can be used to rapidly identify solid dosage medications. The database, created and maintained by the National Library of Medicine with the support of the Food and Drug Administration, seeks to enhance patient safety through the identification of solid dosage medication. Users enter physical characteristics of a medication, possible matches are provided, and links to additional resources are offered. A comparison with comparable resources was conducted and future enhancements to Pillbox are discussed.

KEYWORDS. Drug information services, image databases, online databases, pill identifier, Pillbox

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BACKGROUND

In 2009, Poison Control Centers across the United States answered approximately 4.2 million calls.[1] It is estimated that over one million of these calls were concerned with pill identification.[2] It was out of this need that the database Pillbox was born.

David Hale, Project Manager at the National Library of Medicine (NLM), was the driving force behind this initiative. Discussions with organizations related to drug and drug safety issues, including the National Capital Poison Control Center, led him to believe that there was a need for a system that would make it easier to identify solid dosage medication. He and his team also found that while there was a tremendous need to identify pills, ordinary citizens faced a greater challenge in that the Food and Drug Administration (FDA) Structured Product Label dataset was neither easily accessible nor very intuitive.

It was necessary for the Pillbox team to consult with ordinary citizens, clinicians, and pharmacists to create a resource that would address this demonstrated need. As a result, what started out to be a database of pill images now incorporates federal pharmaceutical data. The goal was to make this data easily accessible while presenting it in a manner of maximum benefit for users.

INTRODUCTION

In its current iteration, Pillbox is designed to be used by citizens, clinicians, first responders, health care personnel, and poison control center staff, to name a few. The database serves as a tool, enabling users to quickly identify solid dosage medications by inputting physical

characteristics. The process is aided by high resolution images and credible information. As of September 2010, there were over 10,000 records in Pillbox. Following an initiative to include records of over-the-counter drugs, homeopathic pills, and veterinary medications, the number of records grew to 15,000 as of June 2011. It is important to note, however, that not all records have accompanying images.

SAMPLE SEARCH: QUICK SEARCH

The home screen of Pillbox features a large box offering a Quick Search and an Advanced Search option for identifying solid dosage pharmaceuticals (see Figure 1). Selecting the Quick Search image opens a new window and (as of the review date, July 2011) a warning pop-up stating that the resource is "currently under development and is not intended for clinical use."[3] It is expected to be available for clinical use very soon. Please see the Limitations and Future Enhancements section of this article for further details.

Legend: FIGURE 1. Pillbox home screen

In this new Quick Search window, a menu at the top offers one-click access to the following search fields: Imprint, Shape, Color, Size, and Scoring. The largest part of the screen features a four-minute video tour that can be accessed for additional information (this is also available in the lower right-hand corner by selecting "Watch Video Tour"). The menu options are differentiated with small images that explain the characteristic (e.g., letters for Imprint, shapes and colors for Shape and Color, various sized pills for Size, and a scored tablet for Scoring). Selecting any of the menu options modifies the screen so that a window is displayed showing search criteria and results. For example, selecting Imprint, the first option in the menu bar, displays the question "What letters or numbers are on the pill?" Users are also given the

option to select a box that says "Pill does not have imprint." An example image is displayed in the window to help users identify where they might find an imprint.

Selecting Shape displays a small, drop-down menu showing some of the most common shapes for pills. Hovering over each of the shapes with a mouse displays additional information about that shape. The next menu option is Color, where users may select from 12 different colors and select a second color if desired. Hovering over a particular color displays two or three different names for the color in question. The menu option Size follows, offering users an interactive, sliding bar that can be modified to select the appropriate size of the pill. A mock pill, which grows larger as one drags the bar to the right, is displayed next to a dime for size comparison. The final menu option is Scoring, wherein users can denote the number of equal size pieces (note: score marks are the straight lines that sometimes are used to divide a tablet or pill into equal sections). Hovering over a scoring option displays sample images of pills with that number of pieces.

For a sample search, the oval shaped outline was selected. Next, the color yellow (also labeled lemon and canary) was selected, and the scoring option of two was selected. With these three search criteria displayed at the top of the page (oval, yellow, score: 2), 60 matches were found. To further target the search, the imprint 100 was entered (note: if there are different imprints on each side of the pill, the Imprint menu suggests users enter the two sets of numbers/letters with a space in between to denote the different sides). This resulted in 12 matches found, two of which (at the time of publication) featured images (see Figure 2).
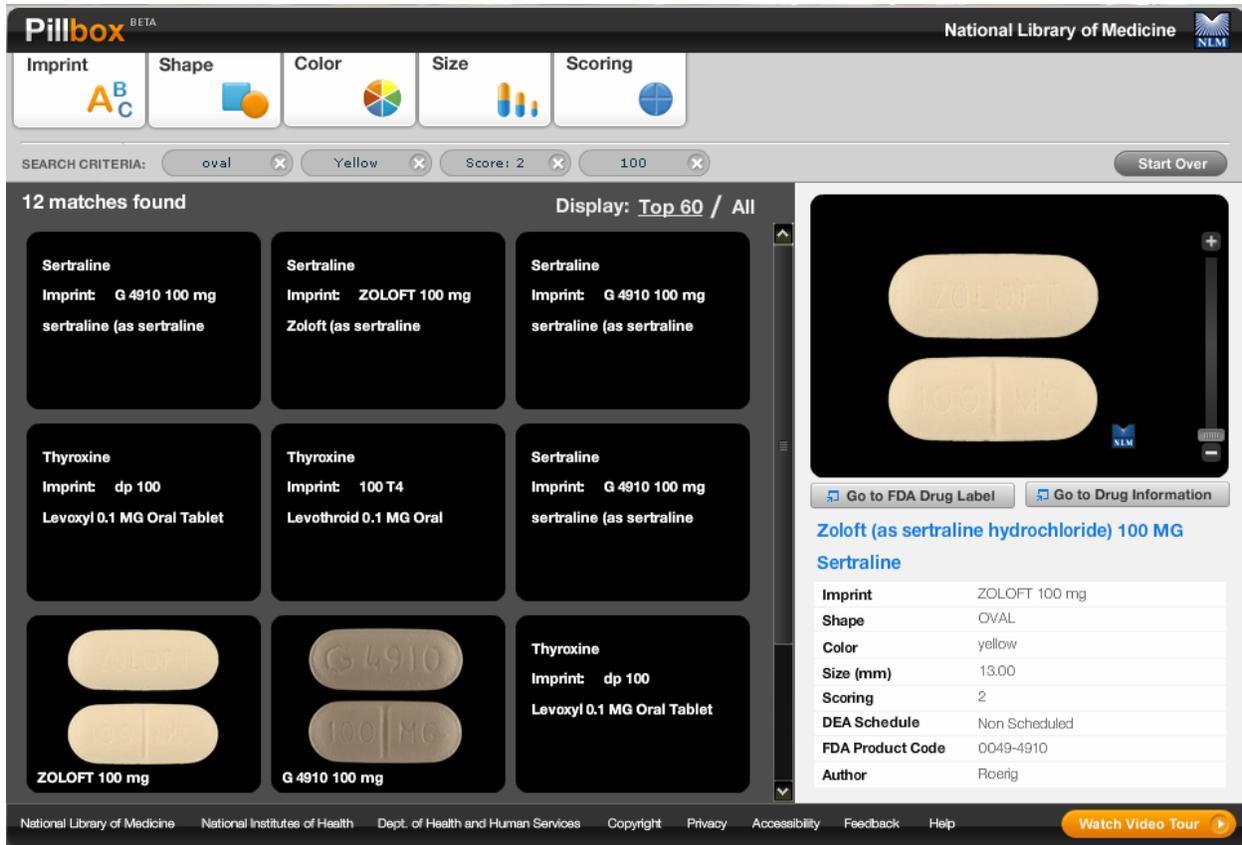
Legend: FIGURE 2. Sample search results.

A user can select one of the possible match boxes, which display either an image,
name/imprint and dosage of a pill when an image is available or the name of the medication,
imprint, and any additional information when an image is not available. Selecting a possible
match box displays additional information in the right-hand side of the screen (see also Figure 2).
In the sample search, Zoloft 100 MG was a potential match. When an image is available, it is
displayed in the upper right-hand corner. A sliding bar allows users to zoom in on an image for a
closer look. The imprint, shape, color, size, scoring, DEA schedule (a system used to identify the
potential for abuse and addictive nature of a particular drug), FDA product code, and author (i.e.,
manufacturer) are all displayed in text form below the image, brand name (if applicable), and

generic name. Between the image and the text are two quick links: "Go to FDA Drug Label" and "Go to Drug Information."

Selecting the first of the links opens a new window in DailyMed (an NLM resource with information about drugs), which displays the FDA label for that medication. Clicking on the second link opens a new window displaying the information for that medication that is available in the Drug Information Portal (an NLM gateway that gathers information from a multitude of sources), including links to MedlinePlus, LactMed, DailyMed, ClinicalTrials.gov, and others.

It is possible to refine a search by adding additional characteristics (as executed above by adding the imprint), removing search criteria (click the X in the box with the undesired search criteria), or by selecting "Start Over" in the upper right-hand corner. To return to the original screen that offers the Quick Search as well as the Advanced Search options, click on "Pillbox" in the upper left-hand corner.

SAMPLE SEARCH: ADVANCED SEARCH

The second search option in Pillbox is Advanced Search. Perhaps counter-intuitively, the interface of the Advanced Search option is more simplified than the Quick Search. In the Advanced Search option, users are presented with text boxes where they may enter any of the physical characteristics of the medication that are available along with the drug name, the active and inactive ingredients, the Drug Label author (i.e., manufacturer), and the DEA Schedule if known (see Figure 3).

Legend: FIGURE 3. Advanced Search screen.

Whereas with the Quick Search a user can only search based on the physical characteristics of a pill, the added benefits of the Advanced Search options are that it allows users to search by drug name, inactive ingredients, and other features such as DEA schedule. For example, if a patient has been taking hydrochlorothiazide for many years and is accustomed to receiving a pink pill, the patient may be surprised when a pharmacist fills the prescription with a turquoise pill. The patient can enter "Hydrochlorothiazide" in the advanced search option and will see that the medication comes in multiple colors, depending on the manufacturer. If a patient misspells a medication, Pillbox offers suggestions of possible medication(s) that the user may intend. Pillbox also automatically displays possible drug names while a user is typing in the search box. One limitation observed is that a user cannot add the dosage in addition to the name

of the drug in a search (for example Hydrochlorothiazide 12.5 MG is not a valid search entry).

The search results can be further refined by adding additional information in the search box.

In the list of search results (see Figure 4), the user is presented with additional information for each drug such as brand and/or generic name, active and inactive ingredients, Drug Label author (i.e., manufacturer), and other identifying characteristics. A user can click on the hyperlinked name next to ingredient(s) to view information about the drug in the Drug Information Portal. The medication's entry in DailyMed is available by clicking "Drug Label" from the search results. Additional inactive ingredients can be displayed by selecting "Show" in the list of search results.

Legend: FIGURE 4. Advanced Search results.

COMPARISON WITH OTHER DATABASES

The information Pillbox provides is resourceful, but the authors were interested to see if there

were any other products which provided similar information. In order to find other resources, the

term "pill identifier" was searched in Google, where the first four search results connected the

searcher to Drugs.com. Drugs.com is an online, commercial site which also has a pill identifier

feature. The information in the Drugs.com pill identifier is compiled by Multum (a commercial,

clinical decision support system from CERNER), Micromedex, and Drugs.com. Pill images are

also available in PDR.net, the online version of *Physicians' Desk Reference*, but it is not possible

to search by description of the pill, as is possible with Pillbox, Drugs.com, and Micromedex. The

pain medication Excedrin Tension Headache was searched in Pillbox, Drugs.com, and

Micromedex for a comparison (see Figure 5).

Database	Pillbox	Drugs.com	Micromedex
Imprint	May enter two sides by adding a space between imprints	May enter two sides by adding a space between imprints	May enter two sides, one on each line
Shape	18 options	32 options	13 options
Color	12 color options (12 secondary colors also available)	17 single-color options and 57 two-color combinations	15 options, multiple selections allowed
Size	0-25mm	*Not available*	*Not available*
Scoring	1-4 pieces	*Not available*	*Not available*
Pattern	*Not available*	*Not available*	Six pattern options
Links to Resources	DailyMed, Drug Information Portal	Runs a Google Search	Tox & Drug and Martindale within Micromedex

Legend: FIGURE 5. Comparison between Pillbox, Drugs.com, and Micromedex.

Drugs.com

There are three identifiers provided in the system by Drugs.com (Imprint, Color, and Shape) as opposed to the five options for the basic search and the nine options for the advanced search which Pillbox provides. In the pill identifier system from Drugs.com, the imprint for Excedrin Tension Headache, ETH, was not recognized. When the color was entered as "red" and the shape was labeled "capsule," none of the nine options presented were Excedrin Tension Headache. Using the Advanced Search option in the Pillbox system, however, the medicine was correctly identified after inputting the imprint, shape, and color of the medication.

If the medication is found in Drugs.com, then information is provided in a convenient tab form, listing the Imprint, Strength, Manufacturer, Color, Drug Class, Pregnancy Category (if it is not advisable to take when you are pregnant), and CSA Schedule and availability (prescription or over-the-counter). At the bottom of the page is a "View Drug Details" box and a "Print Page" box. The "View Drug Details" option takes users to a Google search on the drug. This is not as definitive as Pillbox, which links to authoritative drug information provided by the federal government either in the Drug Information Portal or in DailyMed.

Drugs.com provides free information, but their pages are filled with advertisements for pharmaceuticals, pharmacies, and other organizations. Pillbox is also freely available, but since it was created by the government, it is free of advertisements and pop-ups.

Micromedex

Micromedex, a leading, subscription-based database, also includes a drug identification resource. To access the pill identifier function, a user must select "Drug Identification" at the top of the page. On this page, the options are to "Search by Imprint Code" or to click on the link labeled "No Imprint Code? Click here to search by description."

If a user enters an imprint code, a list of drugs with that imprint is presented. If an imprint code is not available, the user is taken to a new page with three categories: Color, Shape, and Pattern. Micromedex lists fifteen different colors as check-boxes and nine shape categories including an "other" category, paralleling the Freeform option in Pillbox. In this section there is also a check-box where users can select for images to be displayed with their search. The results of a Micromedex search may also be sorted by either Imprint or by Drug Name. In searching for the same Excedrin Tension Headache medication, the correct result was presented when looking with the Imprint, but did not yield the desired drug when searching with other physical characteristics. This can be attributed to the fact that pharmaceutical companies often package the same medication in different shapes (i.e., Micromedex located a circle-shaped Excedrin Tension Headache pill, but did not locate the capsule-shaped version). The various pill forms present a challenge to these systems. In addition, these systems are limited by the fact that they rely on the user's subjective identification of physical characteristics such as color and shape.

Micromedex links to additional resources within the database, including the Martindale drug product look up and the Tox & Drug product information (including information from Poisindex). Pillbox provides information which appears as accurate as Micromedex and is free to consumers. Micromedex has a text-based interface and provides more options within each of the categories than Pillbox. Micromedex also includes additional resources beyond a pill identifier.

SPECIAL FEATURES: PILLBOX API

The Pillbox team has made the Application Programming Interface (API) available to all interested Health Information Technology (IT) developers. The benefits of an open API include the development of third-party applications using Pillbox's data to foster innovation both internally and externally and to facilitate easy dissemination of knowledge. The API's documentation can be found on Github for interested Health IT developers.[4]

A few applications have already been developed using the API. The Facebook game PharmvilleRx was in development but was suspended due to the fact that members of the programming team were not able to commit the necessary time to further develop and maintain the application. However the source code for the game has been made freely available on Github to other developers, who could build on the foundation that is already there.

Applications for the iPhone, iPad, and Android-based mobile devices are currently in development.[5] Another application being developed is Pillbox by Phone (voice-activated pill identification); no release date has been given. The fact that the open API is stimulating innovation and community involvement is evidence that the decision to make it available was the right one.

LIMITATIONS AND FUTURE ENHANCEMENTS

The images available in Pillbox as of June 2011 were created through an FDA-supported photography research and development program at the National Library of Medicine. The medications photographed were selected and purchased through a partnership with Florida A&M

University College of Pharmacy and Pharmaceutical Sciences and, therefore, have not been

verified by the pharmaceutical companies who manufacture the particular medications. NLM

freely admits on their Pillbox FAQ site that not all imprints, shapes, colors, sizes, and score

values are 100 percent accurate.[6] However, NLM does indicate that a concerted effort is made to

have the records corrected through close collaboration with the FDA and manufacturers.

On May 23, 2011, a Federal Register notice was sent out to invite the pharmaceutical

industry to submit samples of their solid, oral dosage form medications sold in the United States

to NLM.[7] NLM is offering to create public domain images of these products and send the images

back to the companies, who in turn will submit the images to the FDA to be included in the drug

label of that medication. Since the images currently contained within Pillbox are not part of the

FDA-approved Structured Product Label (i.e., the drug label), NLM cannot guarantee the

accuracy of the images within this database. The open platform that NLM has created with the

Pillbox site serves as a space where the FDA and pharmaceutical companies can partner to

provide certified information about medications.

Due to the fact that the images are unverified, users of the current version of Pillbox must

accept a disclaimer which states that Pillbox is not intended for clinical use. It is hoped that once

the images have been submitted and/or approved by the individual manufacturers, this disclaimer

would be removed. Collaboration amongst the various stakeholders is ongoing, and Hale and his

team affirm their commitment to ensuring that Pillbox remains a credible and viable source of

information.

LONG-TERM OUTLOOK

The most significant development in the coming months will be the transition of Pillbox from beta to full production. The intent of taking Pillbox out of beta was to encourage independent development of applications that would use the dataset. The NLM team envisions that in the future it may be able to assist researchers in making their datasets available to developers and innovators. The hope here is to reach a wider audience through innovation thereby increasing value to end users. They are also planning to make upgrades to the API and seek greater participation from developers and interested parties who would add value to Pillbox.

FOR MORE INFORMATION

For more information on Pillbox, please direct queries to:

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