INTERACTIVE SYSTEM DESIGN

FINAL REPORT

Project: Drug to Drug Interaction Knowledge Base (DIKB)

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Phase1: User Study

For the first time of our meeting, we prepared a few questions for our client. It includes the background and details of the project. One person in our group was in charge of asking questions and the other two recorded the client's answers.

Background

- **The purpose of this website**

  Provide drug – drug interaction information from publicity available resource and the database their research team has. His research team spent many years with drug experts for collecting about 70 kinds of drugs. Those accurate drug-drug interactions are mainly for heart diseases and stroke. This website is a part of DIBK program.

- **Who are the real users of this website**

  The pharmacists, clinics and researchers and patients

- **How long does version 1.2 has been used**

  The version 1.2 was created by Dr. Boyce as his PhD dissertation. Because the time limitation, he didn't create a friendly user interface or arrange the data layouts.

- **How do the clients feel about version 1.2**

  He started working on this project after his PhD degree. His team is still doing more research on more drugs. He needs a dynamic user interface for the user to do manipulations and need us to figure out a way to arrange the data.

- **What's their advice**

  We can work with his team, based on everything he has now. But we have learned some new technology, such as the architecture they are using. After we design the user interface, Dr. Hochhesier will discuss with us.

- **Is there any other similar website for the clients**

  No. This is going to be the first drug-drug interaction knowledge base in the world.

Function

- **What kind of interface do client prefer (color, logo, style, how many contents, frame, menu, banner, pictures)**

  The functions are really important. The website has to be simple, easy to manipulate and dynamic. Most of the users are phamisitis, clicnics and patients, they don't have that much knowledge about techonicals. They need to find the information in a short time. The website logo will be designed by us, it has to include"DIKB" sign.

  All the information about interactions are messed up now, we need to redo the data schema and delete the duplications.

- **What are the main functions**

  Search the drug-drug interactions by kinds of categories, such as drug names(generic name or brand name), drug ID or drug class.

  There should be different interfaces for patients or professionals. The patients are able to see the drug name and interactions, however, the professionals are able to check the assertions, evidence and dataset sources. How to sort those interactions and assertions to make them more clear is very important. Maybe we need to design an algorithm for the schema, so we are able to sort the data by various ways.

- **Special Function: searching history**

  It's not necessary.

- **Based on the previous version, what functions do the clients want to keep and what do the clients want to modify**

  They want to rebuild a new one.

- **Do we need to create another admin user for volunteer in the community**

  No, it's going to be a function of the website.

- **Website Language :** HTML5, D3, Python

  Java Library: JQuery

  Architecture: Web2py, MVC

- **Details about information visualization techniques (mapping, graphics)**

  Because the data are dynamic, they phmasists want to know what part has been updated and what part has been changed. This techonoly can make it more clear and easy to figure out.

Phase2: Task Analysis

User Scenario

Before the mock-up, we created this user scenario to help us understand the users. The four users in this scenario represent the main user group of the website.

Because we don't have the opportunity to get to know all the professional users and they are not really close to our life, we did some background researches on professional users. First, we researched some daily work logs about professional users. The logs gave us the details about their work, especially the problems occurred during work period. Second, we integrated that information with Dr. Boyce research report in 2005 and updated new users' information. Last but not least, we tried some drug websites. That helped us get to know the professionals custom of navigating the drug websites. In the meanwhile, we collected all the weakness and strength of the websites.

According to our researches, we had an idea on why those professional users need DIKB, how they like do to use DIKB and what are their expectations about DIKB. Then we came up with this user scenario with Dr. Hochheiser, who has work experience in technical and medical. Dr. Hochheiser is also a leader of DIKB user interface design group.

User 1 – Patients

Mike is a college student. He got flu last week and started taking some medicine. Recently, he has some problems with his sleep. He got some sleeping pills from CVS, but he didn't understand what says on the drug label. Because he was worried

about the drug side effects, he tried to seek information on the safety of the medicines.

He came to DIKB website, typed the drug names and concluded the drugs are safe. On the website, he found a function called "create report" which told him drug interactions with alcohols, food, beverages or tobaccos. He added his drug names, clicked the "create a report" button, and then printed out the report as references.

User2 –Researchers in Drug Development

Sara is a researcher. Her job is to help clinicians guide patients to safe and effective medication therapies. When she creates the medication therapies, she would like to have all the drug names and interactions which will occur with one specific drug. Sometimes, she also needs to know where the interactions resources come from and how reliable they are. If she can save all the resources as electronic version, it's more convenient for her work.

She opened DIKB website, typed in one drug name, then she got a lists of other drugs names and interactions which will occur with this drug. It's alphabetically by default. On the tab, it classified as major interactions, moderate interactions and minor interactions. After she clicked the drug names, the interactions detail popped up. Because those are for patients not professionals, she checked the box" professionals" and got the assertions and evidence for the same drugs.

User3 –Drug- Safety Scientists

Dr. Miller is a professional hospital drug-safety scientist who identifies reports and follows up on adverse effects of drugs for the hospital every day. Then he needs to send the repots to regulatory agencies. He has to check different materials from different places to ensure the products are released safely. Every day he spends a lot of time on going back and forth between different websites or books.

He opened DIKB website and read the website instruction. He typed the drug class names as examples and checked "professionals" box. All the assertions related to the drug showed up. Then he added another drug and got the assertions for those two drugs. According to the instruction, he clicked the dataset tab, all the data sources were listed there, such as drug agencies or drug attributes.

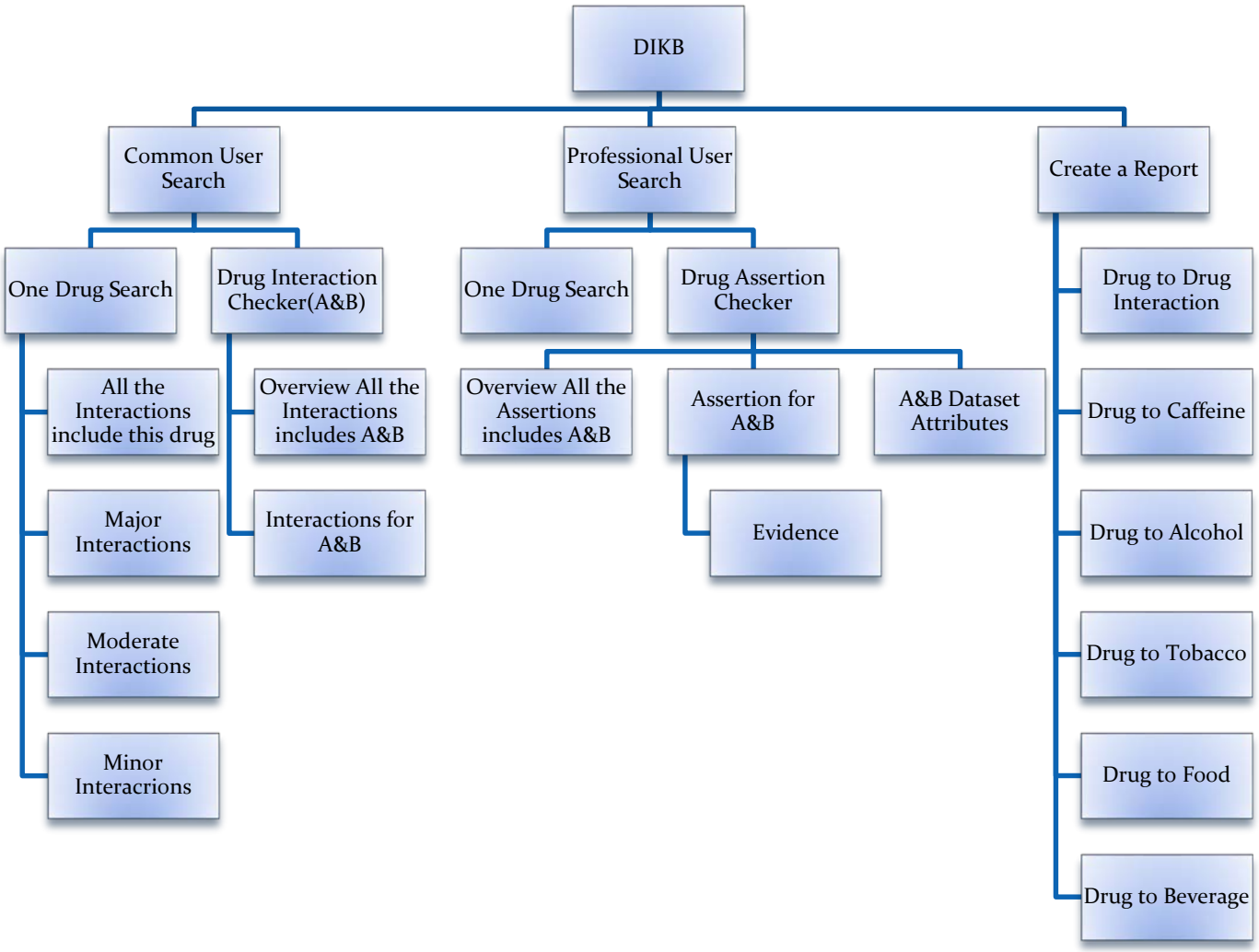
User4 – Clinicians

Dr. Juicy prescribes a large range of medications every day. When she looks after patients who are taking medications prescribed by other doctors (specialized doctors), she needs to know the effects of all the medications in a short time. However, some of prescribed drugs are not belong to her field which means she is not always familiar with. It will be too much information for her if she has to remember them all. She hopes to find a tool to help her find all the reliable sources in a reliable way and gives the patients some suggestions on drugs. Because of her major, she prefers to use trade names (class name) to search.

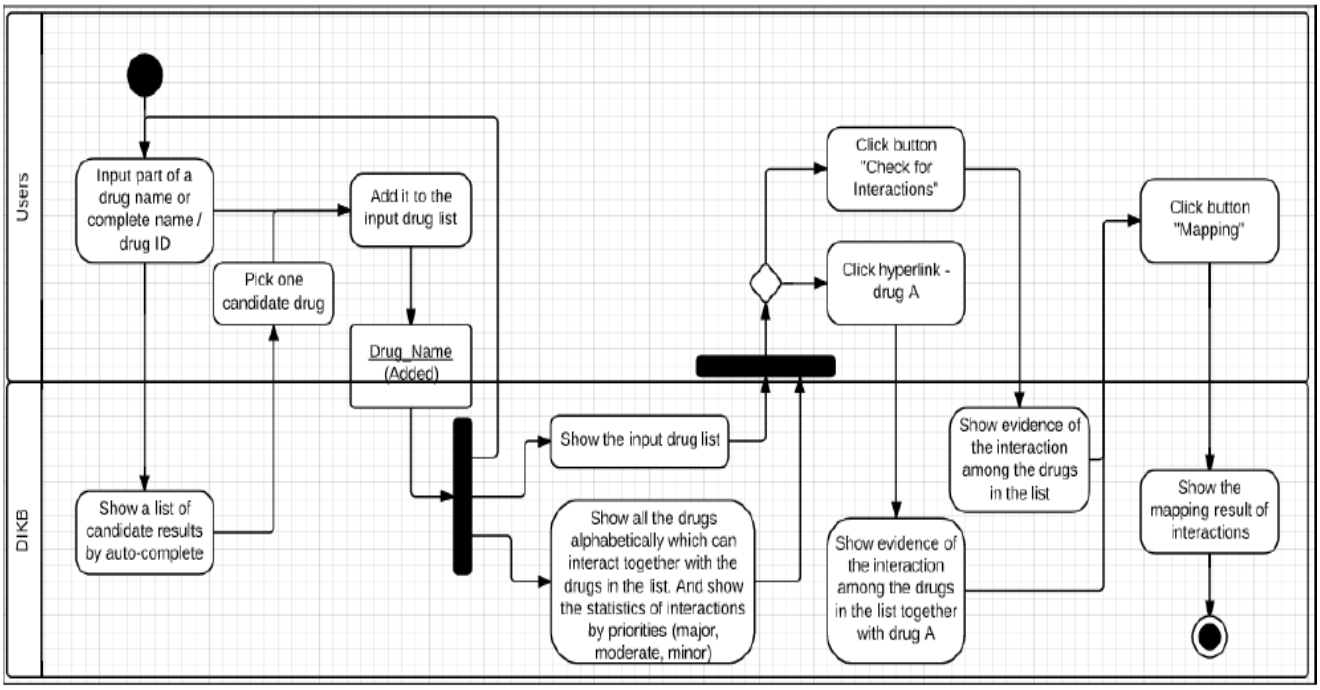
She came to DIKB website and clicked “how it works" which offers the instruction of the website first. Then she checked “professionals" box, typed in the drug class names and got the assertions. Under the assertion, there were four evidences listed which helped her to offer a better prescription to her patient. Then she created a report for the patient, including those drugs interaction with food, beverages, alcohols and caffeine. She clicked the pint button and attached the repot with prescription.

Hierarchical Task Analysis

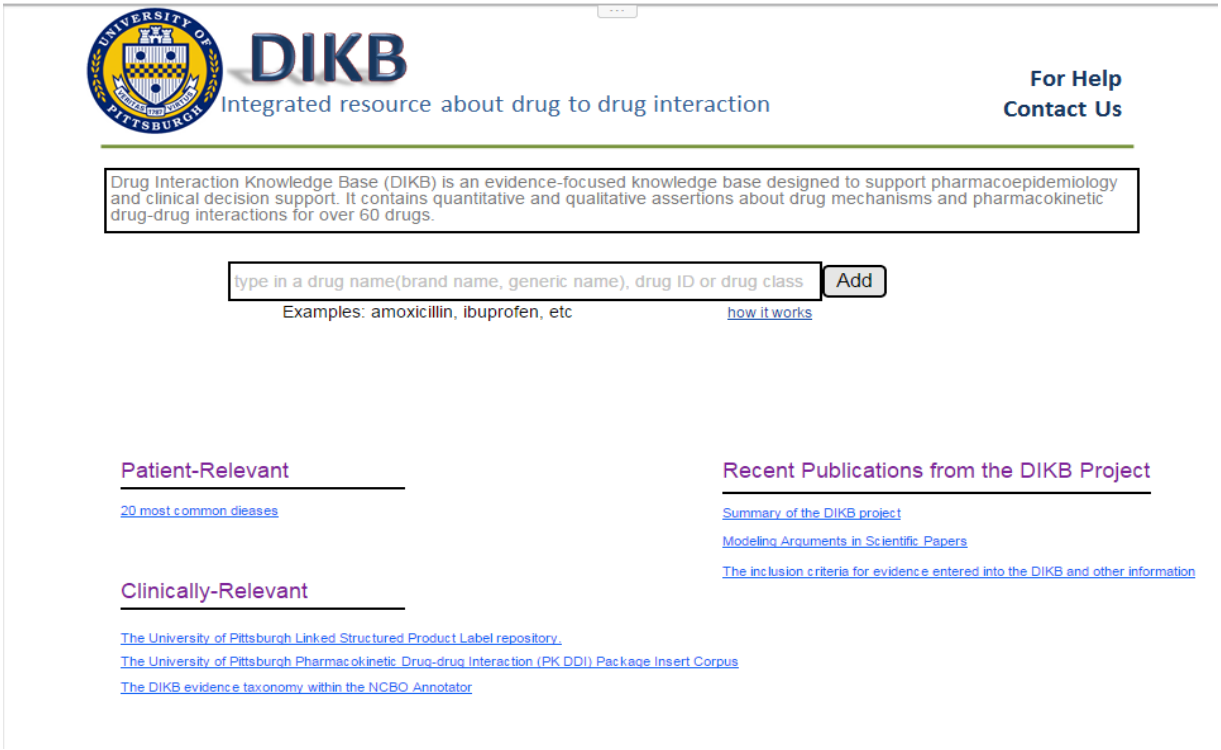
Below is the hierarchical task analysis we made, based on the information we got from our client (Dr. Boyce).

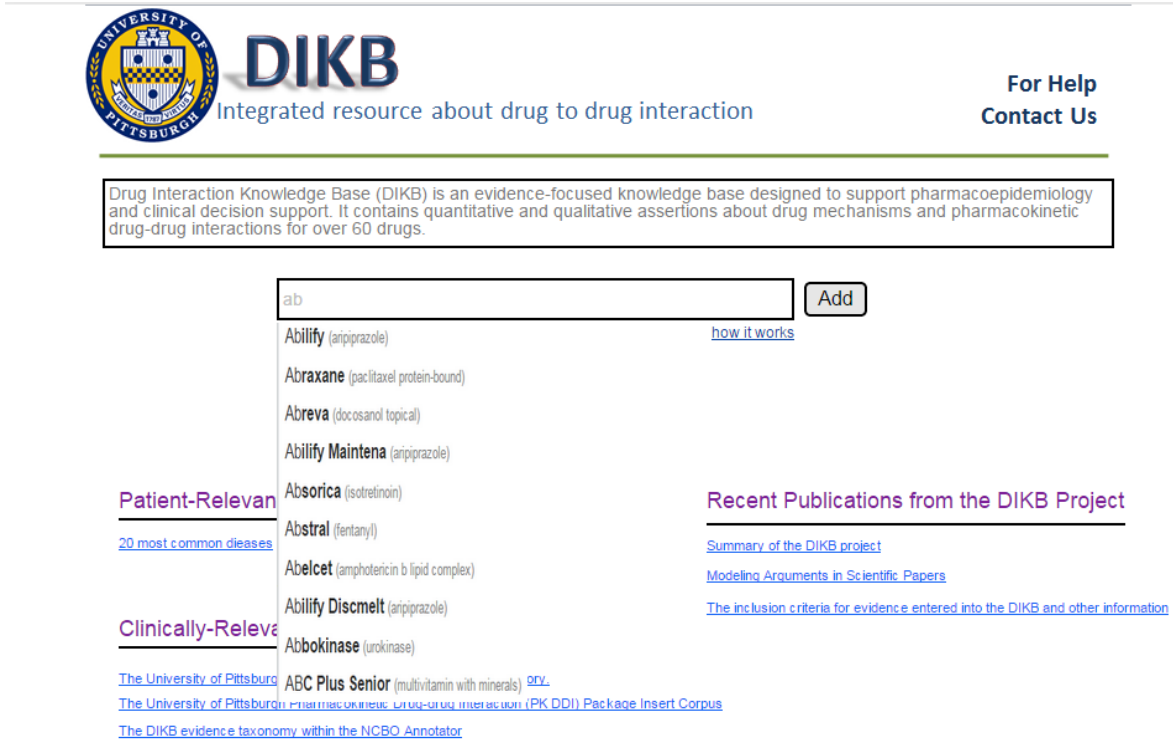

DIKB
Common User Search
Professional User Search
Create a Report
One Drug Search
Drug Interaction Checker(A&B)
One Drug Search
Drug Assertion Checker
Drug to Drug Interaction
All the Interactions include this drug
Overview All the Interactions includes A&B
Overview All the Assertions includes A&B
Assertion for A&B
A&B Dataset Attributes
Drug to Caffeine
Major Interactions
Interactions for A&B
Evidence
Drug to Alcohol
Moderate Interactions
Drug to Tobacco
Minor Interacrions
Drug to Food
Drug to Beverage

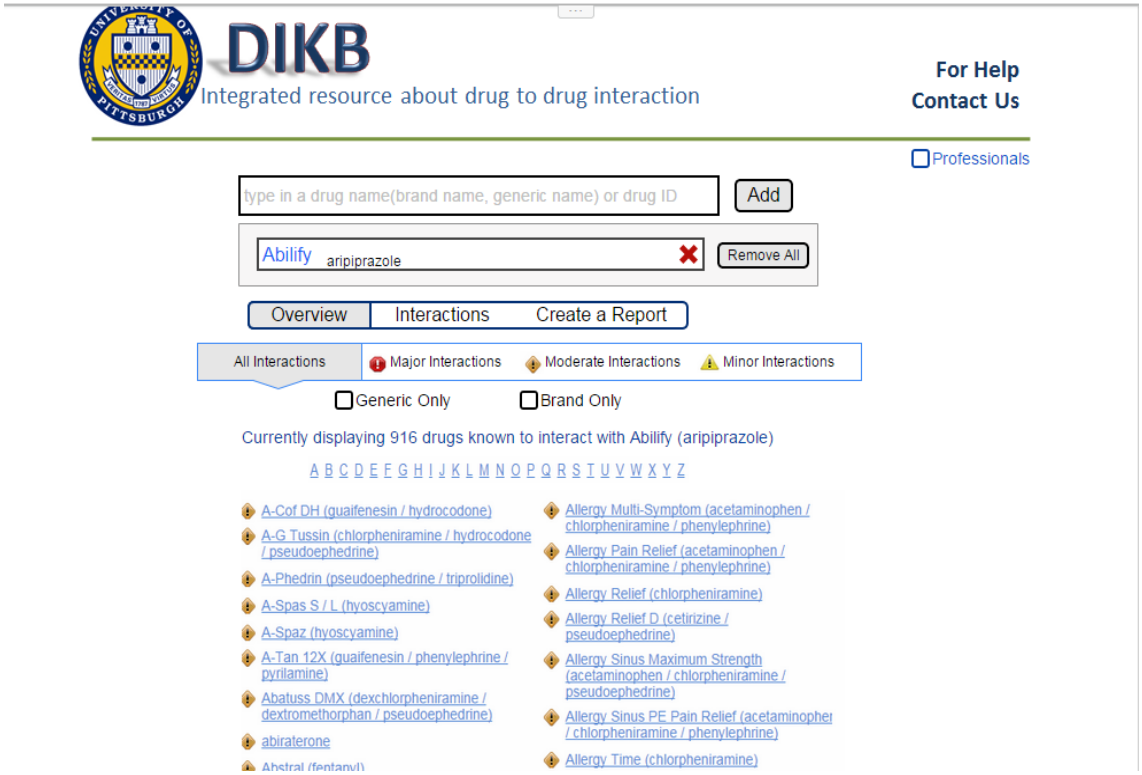
Phase3: Work-Flow

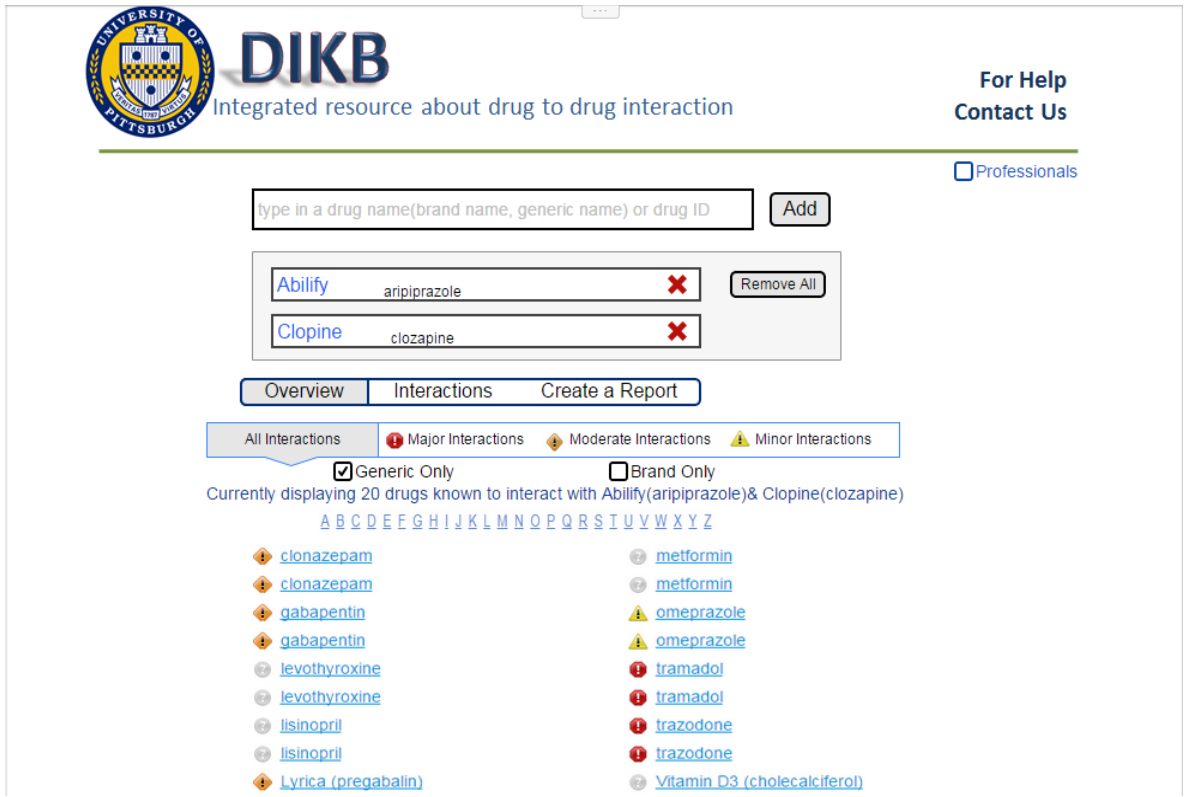


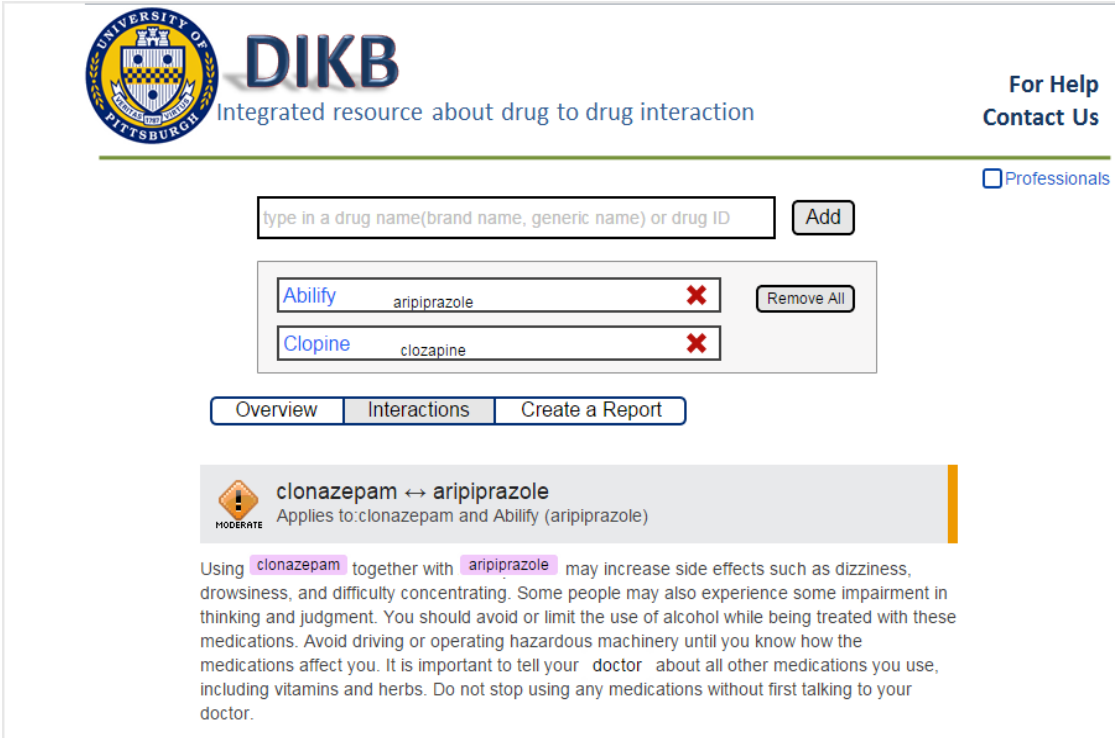
Phase4: Mock-Up

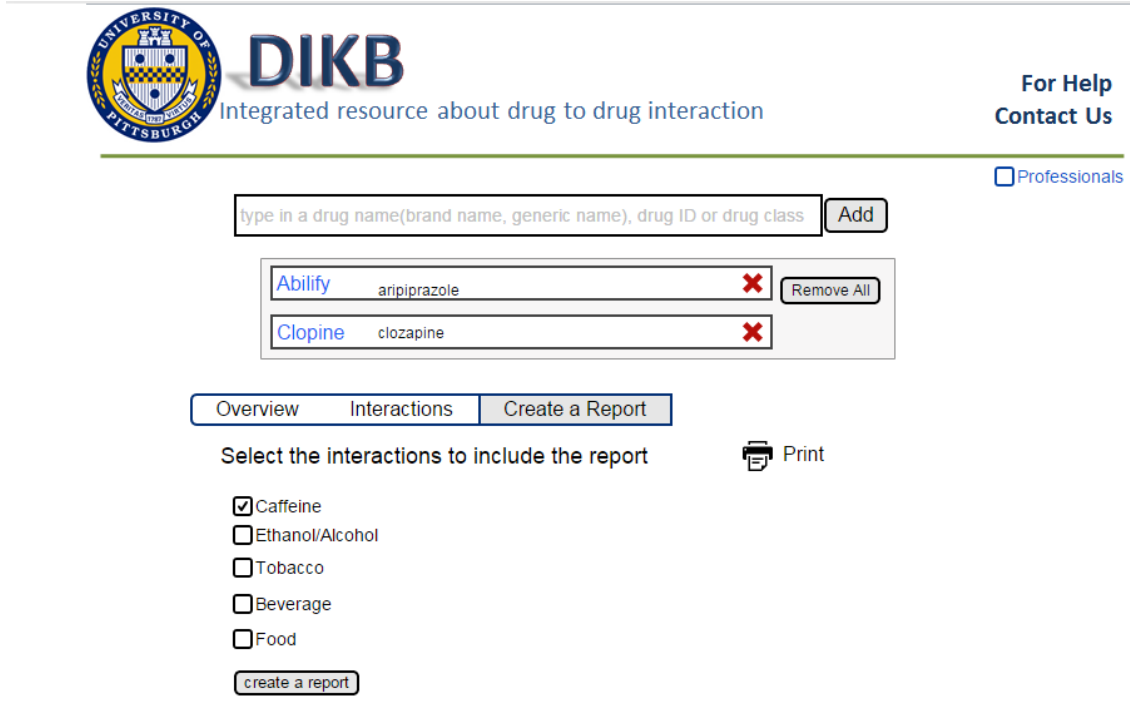


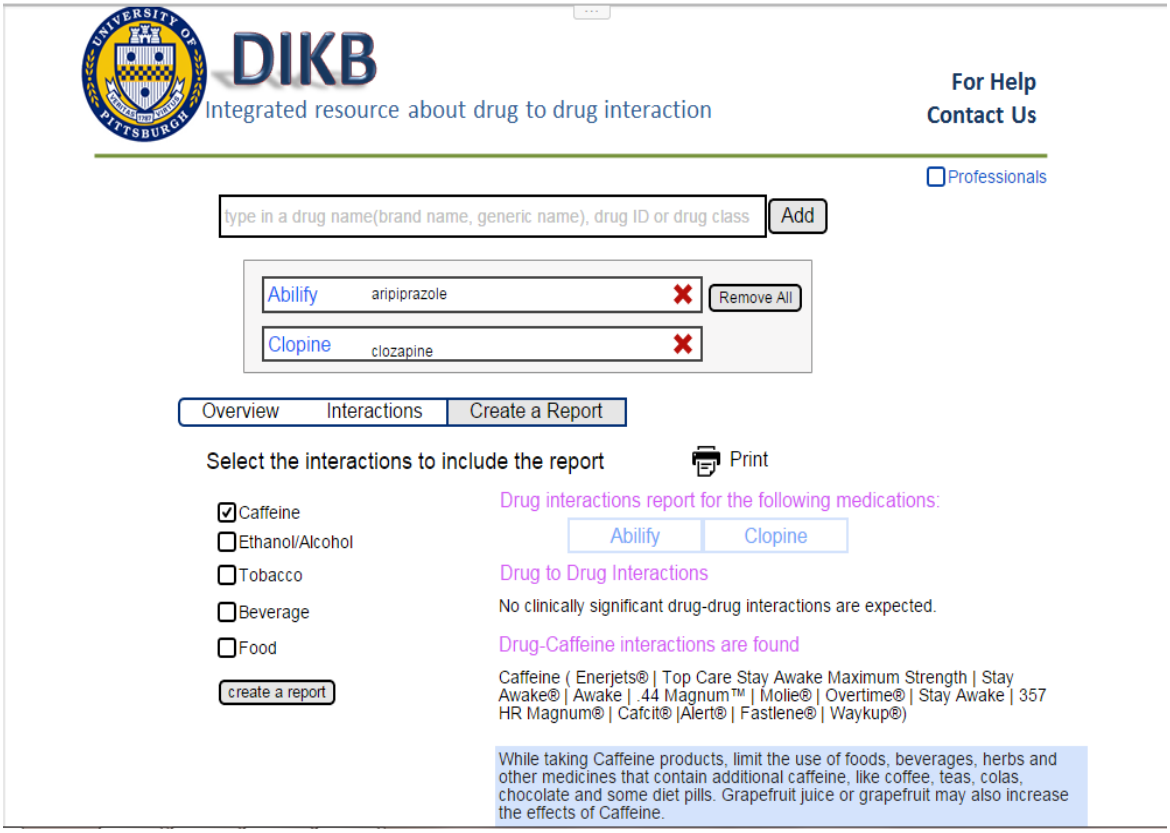

DIKB
Integrated resource about drug to drug interaction
For Help
Contact Us
Drug Interaction Knowledge Base (DIKB) is an evidence-focused knowledge base designed to support pharmacoepidemiology and clinical decision support. It contains quantitative and qualitative assertions about drug mechanisms and pharmacokinetic drug-drug interactions for over 60 drugs.
ab
Add
how it works
Abilify (aripiprazole)
Abraxane (paclitaxel protein-bound)
Abreva (docosanol topical)
Abilify Maintena (aripiprazole)
Absorica (isotretinoin)
Abstral (fentanyl)
Abelcet (amphotericin b lipid complex)
Abilify Discmelt (aripiprazole)
Abbokinase (urokinase)
ABC Plus Senior (multivitamin with minerals)
Patient-Relevan
20 most common dieases
Clinically-Releva
The University of Pittsburg
The DIKB evidence taxonomy within the NCBO Annotator
Recent Publications from the DIKB Project
Summary of the DIKB project
Modeling Arguments in Scientific Papers
The inclusion criteria for evidence entered into the DIKB and other information

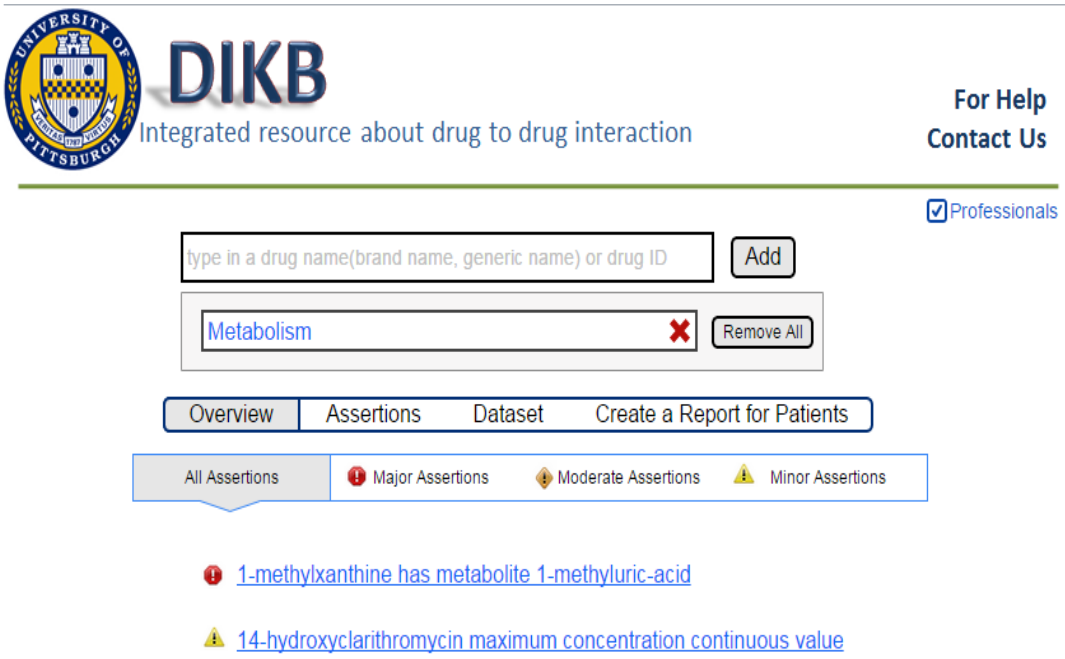

DIKB
Integrated resource about drug to drug interaction
For Help
Contact Us
Professionals
type in a drug name(brand name, generic name) or drug ID
Add
Abilify aripiprazole
Remove All
Overview
Interactions
Create a Report
All Interactions
Major Interactions
Moderate Interactions
Minor Interactions
Generic Only
Brand Only
Currently displaying 916 drugs known to interact with Abilify (aripiprazole)
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
A-Cof DH (guaifenesin / hydrocodone)
A-G Tussin (chlorpheniramine / hydrocodone / pseudoephedrine)
A-Phedrin (pseudoephedrine / triprolidine)
A-Spas S / L (hyoscyamine)
A-Spaz (hyoscyamine)
A-Tan 12X (guaifenesin / phenylephrine / pyrilamine)
Abatuss DMX (dexchlorpheniramine / dextromethorphan / pseudoephedrine)
abiraterone
Abstral (fentanyl)
Allergy Multi-Symptom (acetaminophen / chlorpheniramine / phenylephrine)
Allergy Pain Relief (acetaminophen / chlorpheniramine / phenylephrine)
Allergy Relief (chlorpheniramine)
Allergy Relief D (cetirizine / pseudoephedrine)
Allergy Sinus Maximum Strength (acetaminophen / chlorpheniramine / pseudoephedrine)
Allergy Sinus PE Pain Relief (acetaminopher / chlorpheniramine / phenylephrine)
Allergy Time (chlorpheniramine)

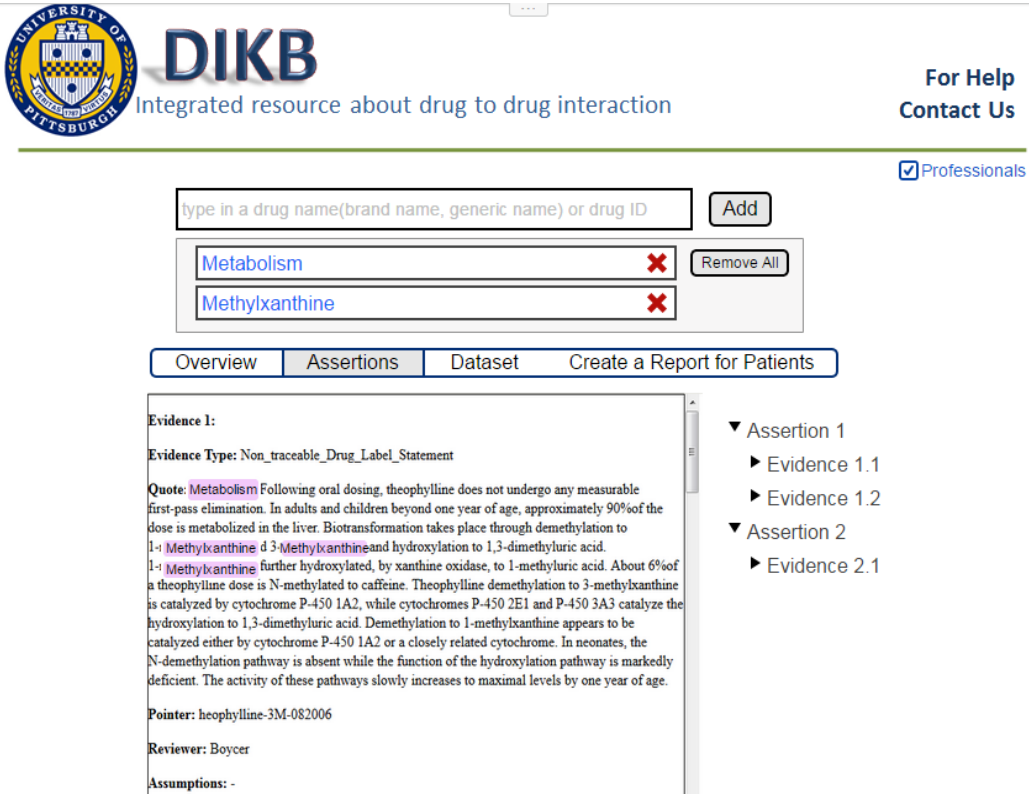

DIKB
Integrated resource about drug to drug interaction
For Help
Contact Us
Professionals
type in a drug name(brand name, generic name) or drug ID
Add
Abilify aripiprazole
Clopine clozapine
Remove All
Overview
Interactions
Create a Report
All Interactions
Major Interactions
Moderate Interactions
Minor Interactions
Generic Only
Brand Only
Currently displaying 20 drugs known to interact with Abilify(aripiprazole)& Clopine(clozapine)
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
clonazepam
clonazepam
gabapentin
gabapentin
levothyroxine
levothyroxine
lisinopril
lisinopril
Lyrica (pregabalin)
metformin
metformin
omeprazole
omeprazole
tramadol
tramadol
trazodone
trazodone
Vitamin D3 (cholecalciferol)

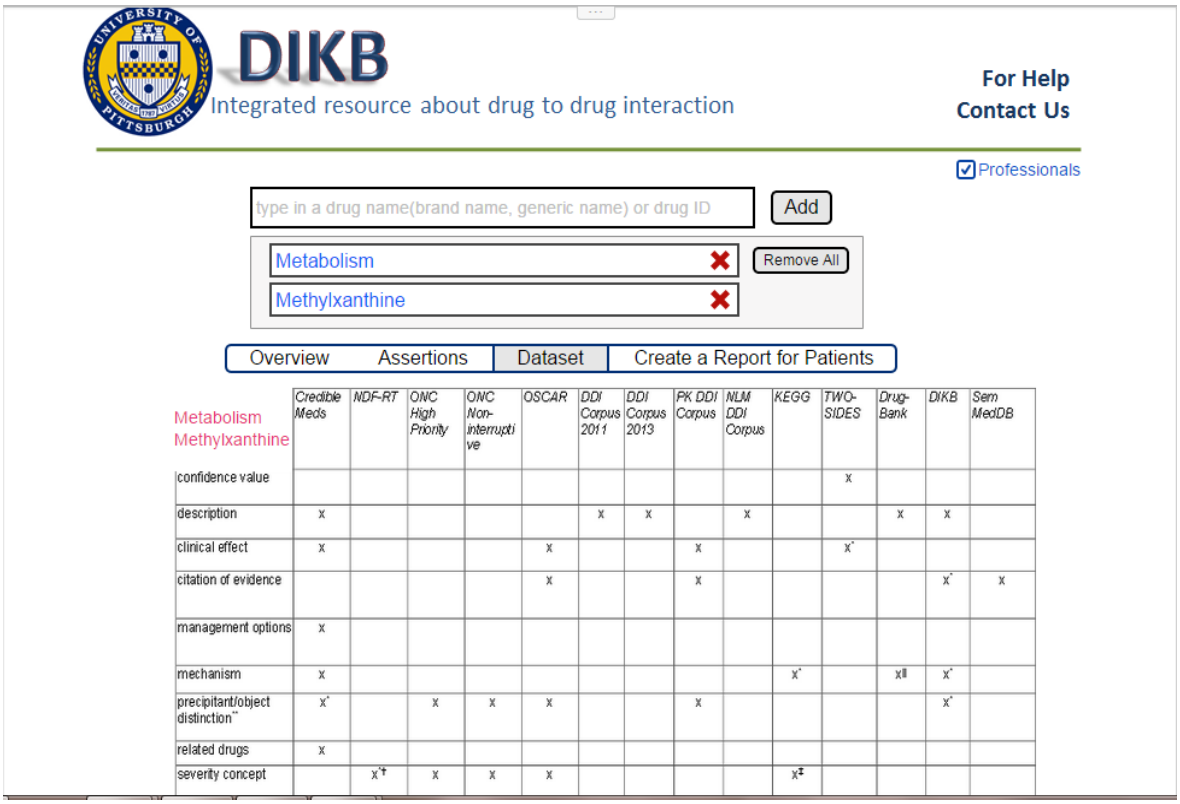

DIKB
Integrated resource about drug to drug interaction
For Help
Contact Us
Professionals
type in a drug name(brand name, generic name) or drug ID
Add
Abilify aripiprazole
Clopine clozapine
Remove All
Overview
Interactions
Create a Report
MODERATE
clonazepam ↔ aripiprazole
Applies to:clonazepam and Abilify (aripiprazole)
Using clonazepam together with aripiprazole may increase side effects such as dizziness, drowsiness, and difficulty concentrating. Some people may also experience some impairment in thinking and judgment. You should avoid or limit the use of alcohol while being treated with these medications. Avoid driving or operating hazardous machinery until you know how the medications affect you. It is important to tell your doctor about all other medications you use, including vitamins and herbs. Do not stop using any medications without first talking to your doctor.


DIKB
Integrated resource about drug to drug interaction
For Help
Contact Us
Professionals
type in a drug name(brand name, generic name), drug ID or drug class
Add
Abilify aripiprazole
Clopine clozapine
Remove All
Overview
Interactions
Create a Report
Select the interactions to include the report
Print
Caffeine
Ethanol/Alcohol
Tobacco
Beverage
Food
create a report


DIKB
Integrated resource about drug to drug interaction
For Help
Contact Us
Professionals
type in a drug name(brand name, generic name), drug ID or drug class
Add
Abilify aripiprazole
Clopine clozapine
Remove All
Overview
Interactions
Create a Report
Select the interactions to include the report
Print
Caffeine
Ethanol/Alcohol
Tobacco
Beverage
Food
create a report
Drug interactions report for the following medications:
Abilify
Clopine
Drug to Drug Interactions
No clinically significant drug-drug interactions are expected.
Drug-Caffeine interactions are found
Caffeine (Enerjets® | Top Care Stay Awake Maximum Strength | Stay Awake® | Awake | .44 Magnum™ | Molie® | Overtime® | Stay Awake | 357 HR Magnum® | Cafcit® |Alert® | Fastlene® | Waykup®)
While taking Caffeine products, limit the use of foods, beverages, herbs and other medicines that contain additional caffeine, like coffee, teas, colas, chocolate and some diet pills. Grapefruit juice or grapefruit may also increase the effects of Caffeine.


DIKB
Integrated resource about drug to drug interaction
For Help
Contact Us
Professionals
type in a drug name(brand name, generic name) or drug ID
Add
Metabolism
Remove All
Overview
Assertions
Dataset
Create a Report for Patients
All Assertions
Major Assertions
Moderate Assertions
Minor Assertions
1-methylxanthine has metabolite 1-methyluric-acid
14-hydroxyclarithromycin maximum concentration continuous value

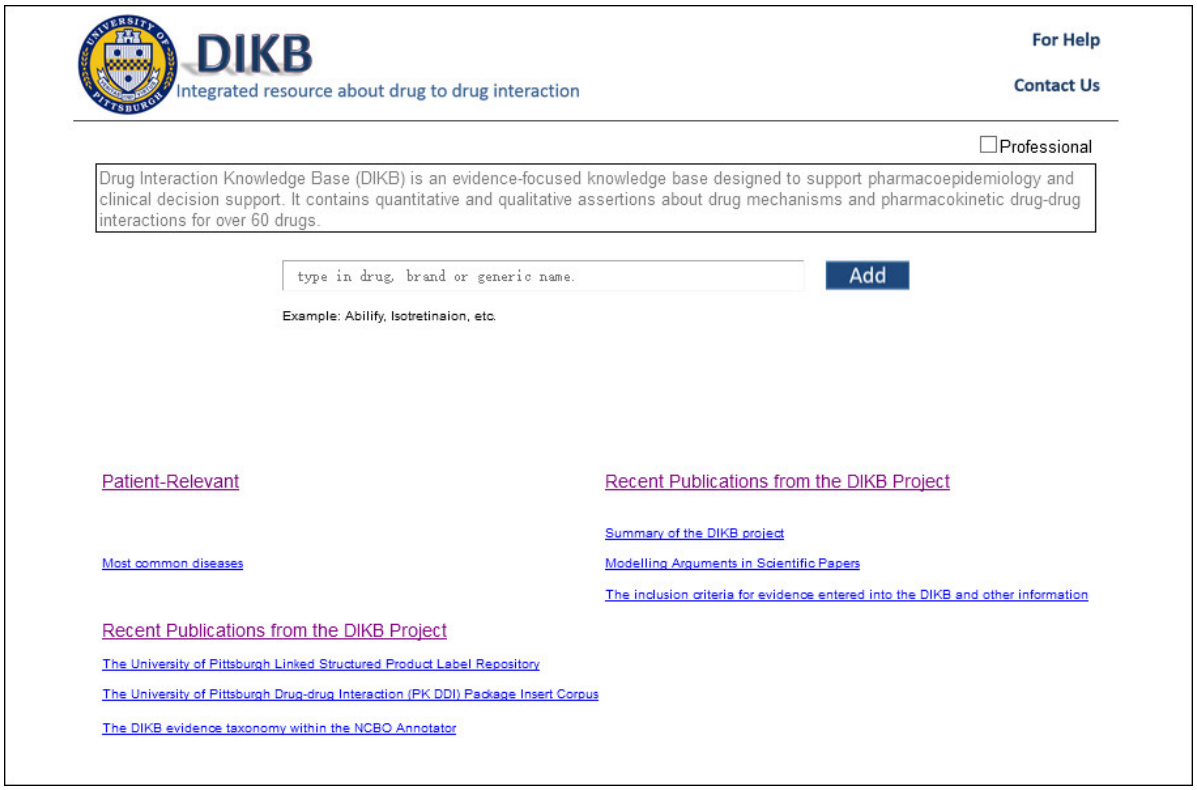

DIKB
Integrated resource about drug to drug interaction
For Help
Contact Us
Professionals
type in a drug name(brand name, generic name) or drug ID
Add
Metabolism
Methylxanthine
Remove All
Overview
Assertions
Dataset
Create a Report for Patients
Evidence 1:
Evidence Type: Non_traceable_Drug_Label_Statement
Quote: Metabolism Following oral dosing, theophylline does not undergo any measurable first-pass elimination. In adults and children beyond one year of age, approximately 90%of the dose is metabolized in the liver. Biotransformation takes place through demethylation to 1-Methylxanthine and 3-Methylxanthine and hydroxylation to 1,3-dimethyluric acid. 1-Methylxanthine further hydroxylated, by xanthine oxidase, to 1-methyluric acid. About 6%of a theophylline dose is N-methylated to caffeine. Theophylline demethylation to 3-methylxanthine is catalyzed by cytochrome P-450 1A2, while cytochromes P-450 2E1 and P-450 3A3 catalyze the hydroxylation to 1,3-dimethyluric acid. Demethylation to 1-methylxanthine appears to be catalyzed either by cytochrome P-450 1A2 or a closely related cytochrome. In neonates, the N-demethylation pathway is absent while the function of the hydroxylation pathway is markedly deficient. The activity of these pathways slowly increases to maximal levels by one year of age.
Pointer: heophylline-3M-082006
Reviewer: Boycer
Assumptions: -
Assertion 1
Evidence 1.1
Evidence 1.2
Assertion 2
Evidence 2.1

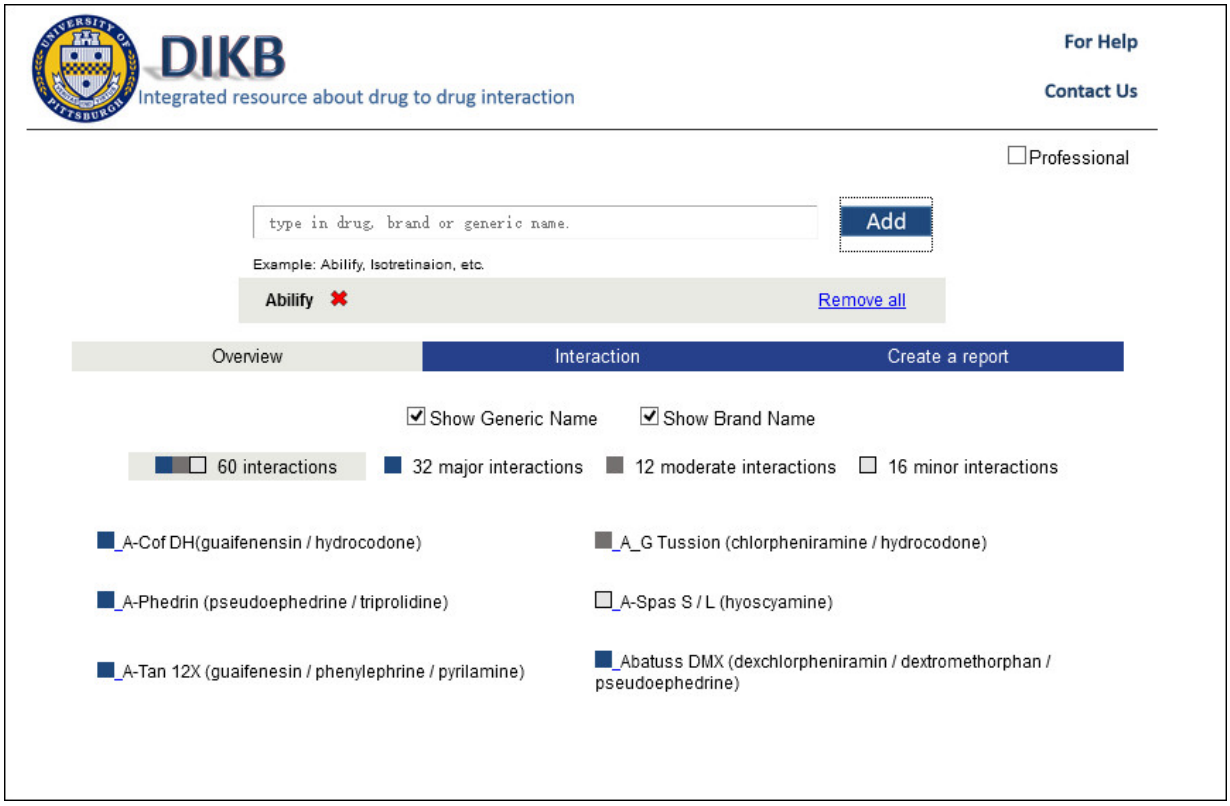


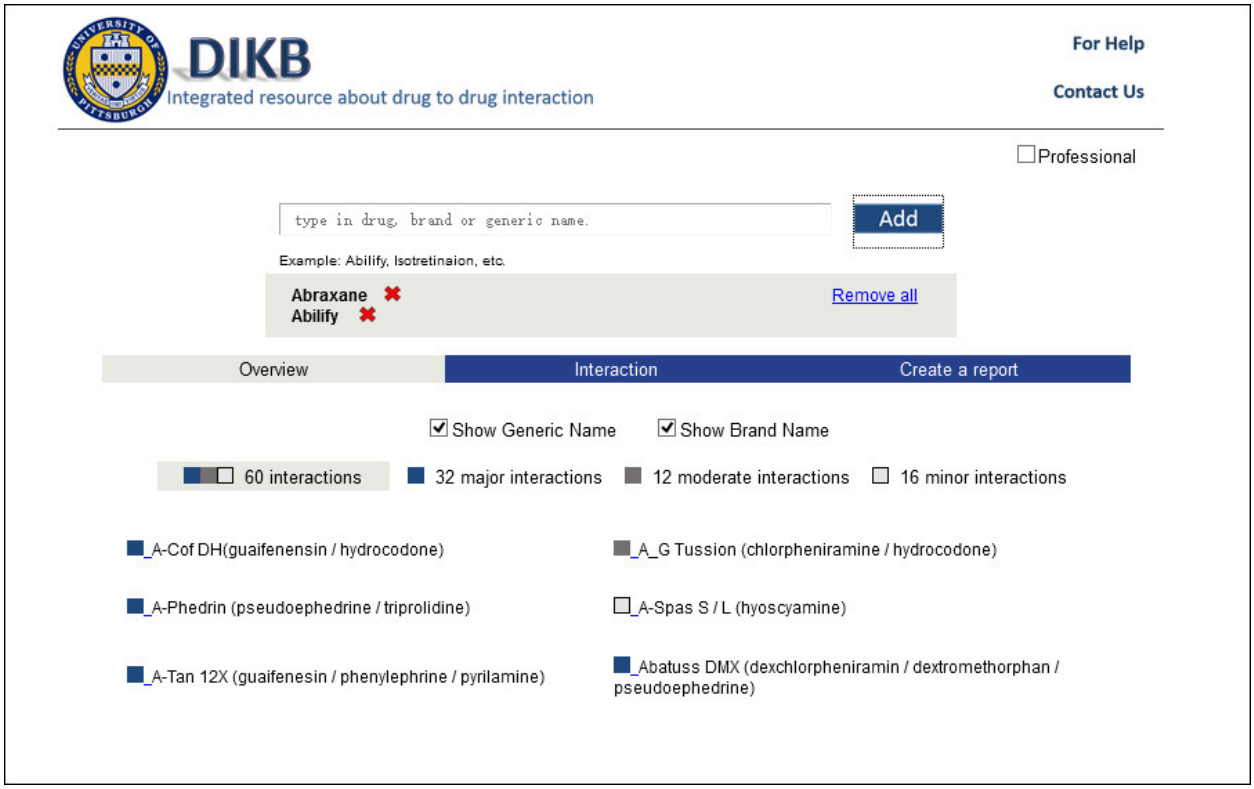
Metabolism
Methylxanthine

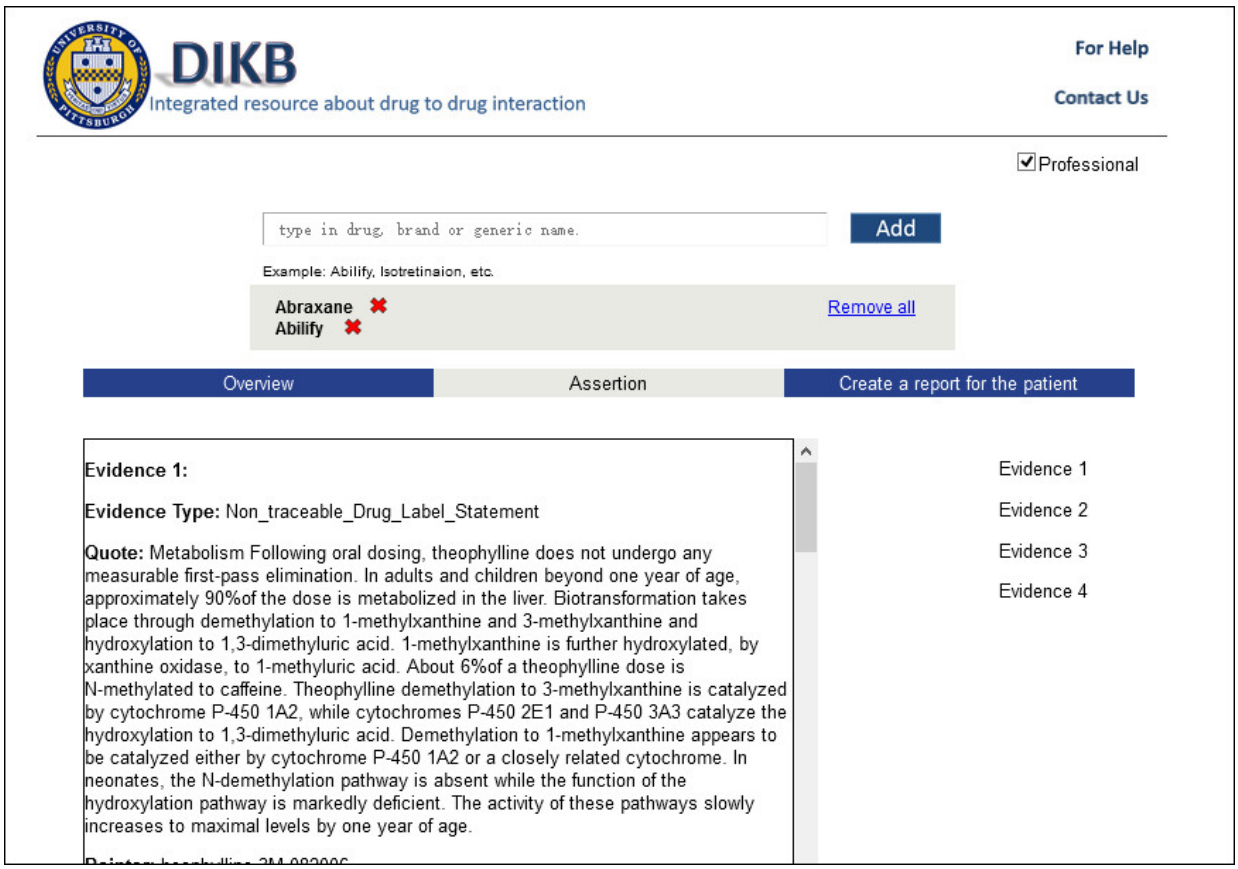
	Credible Meds	NDF-RT	ONC High Priority	ONC Non-Interruptive	OSCAR	DDI Corpus 2011	DDI Corpus 2013	PK DDI Corpus	NLM DDI Corpus	KEGG	TWO-SIDES	Drug-Bank	DIKB	Sem MedDB
confidence value											x			
description	x					x	x		x			x	x	
clinical effect	x				x			x			x*			
citation of evidence					x			x					x*	x
management options	x													
mechanism	x									x*		x‖	x*	
precipitant/object distinction**	x*		x	x	x			x					x*	
related drugs	x													
severity concept		x*†	x	x	x					x‡				

Phase5: Final Version




DIKB
Integrated resource about drug to drug interaction
For Help
Contact Us
Professional
type in drug, brand or generic name.
Add
Example: Abilify, Isotretinaion, etc.
Abilify
Remove all
Overview
Interaction
Create a report
Show Generic Name
Show Brand Name
60 interactions
32 major interactions
12 moderate interactions
16 minor interactions
_A-Cof DH(guaifenensin / hydrocodone)
_A_G Tussion (chlorpheniramine / hydrocodone)
_A-Phedrin (pseudoephedrine / triprolidine)
_A-Spas S / L (hyoscyamine)
_A-Tan 12X (guaifenesin / phenylephrine / pyrilamine)
_Abatuss DMX (dexchlorpheniramin / dextromethorphan / pseudoephedrine)


DIKB
Integrated resource about drug to drug interaction
For Help
Contact Us
Professional
type in drug, brand or generic name.
Add
Example: Abilify, Isotretinaion, etc.
Abraxane
Abilify
Remove all
Overview
Interaction
Create a report
Show Generic Name
Show Brand Name
60 interactions
32 major interactions
12 moderate interactions
16 minor interactions
_A-Cof DH(guaifenensin / hydrocodone)
_A_G Tussion (chlorpheniramine / hydrocodone)
_A-Phedrin (pseudoephedrine / triprolidine)
_A-Spas S / L (hyoscyamine)
_A-Tan 12X (guaifenesin / phenylephrine / pyrilamine)
_Abatuss DMX (dexchlorpheniramin / dextromethorphan / pseudoephedrine)



Phase6: Summary of DIKB Project

In the design part, we start with a good understanding of users. The understanding comes about primarily through researches, previous documentations and people who are often aware of the users' true needs and difficulties. We provide instructions, help button and error checking on all pages. In case something goes wrong, the website will take the proper actions or guide the users what to do.

In the demo website, we implemented what we planned except applying D3 on the dataset page. The user interface design parts took us longer than we thought. We had 5 meetings to discuss about the functions and designs with Dr. Boyce and Dr. Hochheiser. The website is a part of the whole DIKB project, we try to finalize the website design and creates more functions, so that they are able to process it later.

It's a really nice opportunity that we could work with real client for a real project. We set up every Tuesday as our meeting time with Dr. Boyce and Dr. Hochheiser to update our progress and modify our designs and website. We had a great time working as team with each other and professionals.

Even though it's only a month, we practiced a lot what we learn from class and acknowledged some professional skills on user design and website design. Thank you very much for the interesting subject and the opportunity offered by Dr. Brusilovsky in his class. It's the best final we've had.