MedWise - Personalized Drug Interaction Alert System

Project Summary:

MedWise is a web application designed to help patients manage their medication safety by analyzing potential **drug-drug** and **drug-food** interactions based on their past prescription history. By integrating Electronic Health Record (EHR) data with standardized drug interaction databases such as **RxNorm, Diet-Drug Interaction Database (DDID), nSIDES Database,** and **DrugBank**, the system will alert users to potential harmful interactions and provide guidance on safe medication and dietary choices.

Application Description:

Individuals consume a wide variety of food, which may cause potentially negative interactions with their medications. Our application addresses this problem by automatically checking a patient's prescription history against professionally verified **drug-drug** and **drug-food** interaction databases. Based on the Electronic Health Records (EHR) of a patient, the application can generate an exhaustive list of food and drugs that are not recommended. This would not only help clinicians inform patients, but also enable patients to appropriately design their own diets.

Many patients take multiple medications without being aware of potential interactions that could affect their health. Our application addresses this problem by automatically checking a patient's prescription history against known **drug-drug** and **drug-food** interaction databases. Users can upload or manually enter their prescription history, and the system will analyze potential risks and suggest safer alternatives.

Creative Component:

An **interactive visualization dashboard** will allow patients to see their medications and potential interactions in an intuitive format (e.g., color-coded risk indicators). Users will be able to see what drugs or food they are advised not to eat/take along with corresponding records of past medications that support such advice.

Usefulness:

This system will benefit patients by improving medication safety, reducing adverse effects, and enabling better self-management. While similar tools exist (e.g., online drug interaction checkers), MedWise differentiates itself by integrating **personalized patient records** and **drug-food interactions**—a feature often missing in standard checkers.

Note: There are somewhat similar applications out there. See the section 'existing works' below for more information.

There exist several web based DDI checking websites, but these only allow the user to check drug-drug pairings or drug-food pairings individually, usually also requiring navigation across different webpages as well. If a person takes many types of medication, then the number of potential interactions to check can quickly grow to be an onerous task. This is where our application will differ from the established ones.

Since a user will be able to input all of their dietary and medication information, our app will automatically run a check against all combinations at the same time and therefore would be more

convenient for the user. Also, if someone were to start taking some new type of medication, then they would be able to use their saved information in the app and simply add the one new medication to their list rather than having to go to individual websites and individually recheck each possible pairing.

Realness:

Data Sources:

- **RxNorm API** (Drug naming standardization~~, drug-drug interactions~~)
- **nSIDES/TwoSIDES project** (Drug-drug interactions, link)
- **DDID** (food-drug interactions, link)
- ~~**Public EHR datasets** (MIMIC-IV, Synthea for patient medication records)~~
- **DrugBank Dataset** (Drug-drug and Drug-food interactions, pending application for free use as part of university work, backup data source for now)

Datasets and data sources:

1. Drug-drug interactions:

https://ddinter.scbdd.com/download/
Explanation to DDI:
https://ddinter.scbdd.com/explanation/

2. Drug-food interactions

Built using MySQL
https://pubmed.ncbi.nlm.nih.gov/37951712/
Dataset:
https://zenodo.org/records/8192515
Other sources:
https://academic.oup.com/database/article/doi/10.1093/database/baad075/7407359

3. Drug knowledge base

https://go.drugbank.com/

Our data is sourced from credible government and peer reviewed sources such as the United States National Library of Medicine (NLM), Oxford Academic's *Briefings in Bioinformatics*, and Elsevier's *Journal of Biomedical Informatics*.

The RxNorm database consists of simple text files with pipe ('|') delimiters between each field value which are meant to be loaded as separate tables into a database management system. The schema structure

of the files can be seen here, but we will focus mostly on RXNCONSO, which contains all of the source-provided drug and ingredient names, as well as the normalized names and RXNSAT which contains drug attributes. The TwoSIDES database is simply a .csv file with every drug pairing and number of reports for side effects when the drugs are taken concurrently. More information on the actual schema can be found here. The DDID database consists of .csv files with a multitude of information on interactions from simultaneous consumption of pairings of drugs, foods, herbs and supplements and even includes information such as dosage levels and links to sources for the trials from which the data was taken.

Functionality:

- **For CRUD:**
    - Create: Create a new User instance. If a prescription is manually filled, then add the prescription information to the user's attribute. If the prescription is uploaded, then need to parse it first then associate with user's attribute
    - Read:
        - Need to read user's info and fetch corresponding information (Food that should not be consumed, medication that should not be taken etc.)
    - Update:
        - When a user updates a prescription, they need to update the database attribute and do a read in the medication database to fetch the new results.
        - If a new drug interaction is discovered or an existing interaction is disproved, the internal medication database must be updated to reflect it.
    - Delete: The user should be able to delete their account and corresponding data.
    - Search: A user should be able to search if a food/drug is harmful or not combined with their current medication
- **Drug-Drug & Drug-Food Interaction Analysis**
- **Alert & Notification System for Risk Warnings**
- **Searchable Database of Safe Medication Alternatives**

Low-Fidelity UI Mockup:

A simple UI with sections for medication entry, an interaction alert panel, and a visualization dashboard.

UI design prototype:
https://www.figma.com/design/zKSSNGl3IHypmJtHCdLHmh/MedWise?node-id=0-1&t=bCFo3PwDwKGHEgBr-1

Project Work Distribution:

- Jason Chen - Backend API and Frontend
- Daniel Shevchuk - API implementation, data pre/post processing and analysis
- Hank Tang - Database design and integration (MySQL for drug-food interactions), user authentication and data management, CRUD operations for user prescriptions
- Pranjal Chaitanya - N/A, member didn't respond for this part

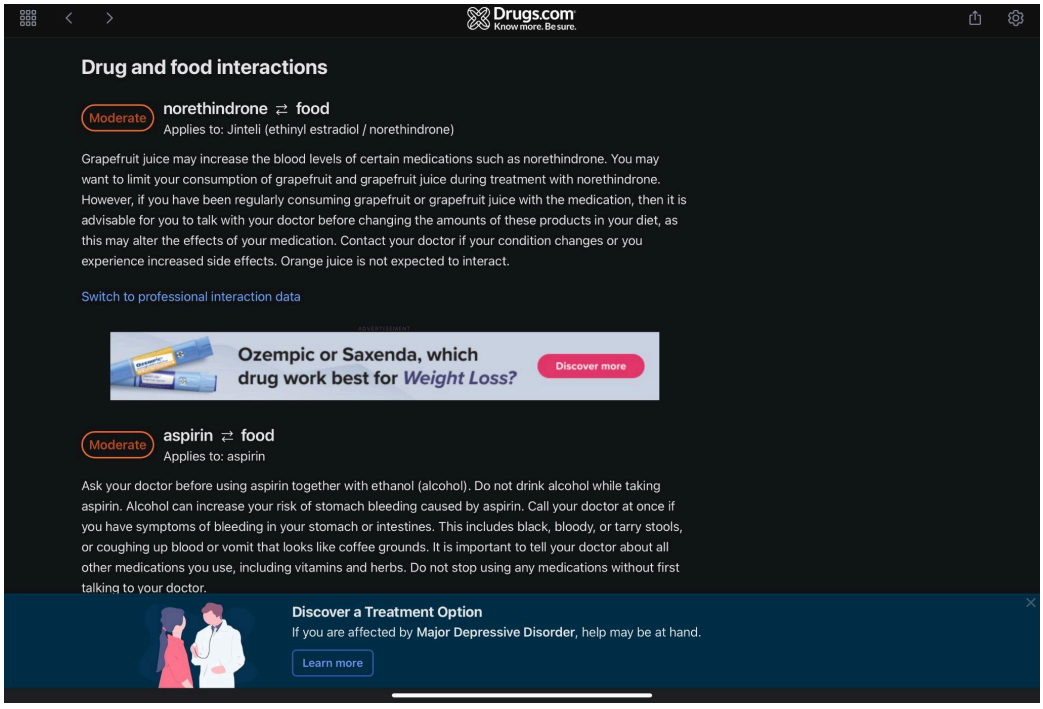
Appendix:

Existing works:

Drug-Food Interaction

It is said that this one is the best drug-food interaction so far. Can anyone using Android device have a look at this? Pill Reminder & Health Tracker: https://play.google.com/store/apps/details?id=xyz.rtrvr.pillo&hl=en&gl=US&pli=1

This one is from Drugs.com. It does give back certain advice. But it is not precise.



Looks like purely doing drug-drug interaction is not novel at all. Big pharmas and healthcare companies have done it before.

Drug-Drug Interaction

Medisafe Launches Feature to Alert Users of Potentially Harmful Drug Interactions

https://www.medisafe.com/medisafe-launches-feature-to-alert-users-of-potentially-harmful-drug-interactions/#:~:text=ORLANDO%2C%20FL%20%E2%80%94%20February%2021%2C,a%20patient%20has%20been%20prescribed.

Epocrates (for physician's use)

https://www.epocrates.com/online/results?query=Augmentin

Pocket Pharmacist