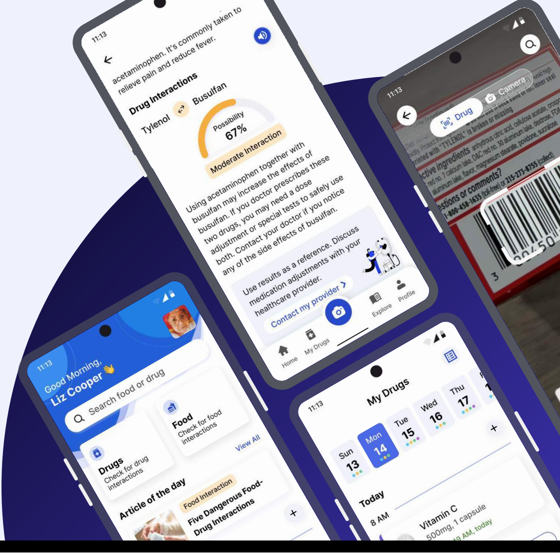
EasyMed

A mobile application that utilizes AI deep learning to predict interactions based on drug and food compounds.



acetaminophen. It's commonly taken to relieve pain and reduce fever.

Using acetaminophen together with busulfan may increase the effects of busulfan. If you doctor prescribes these two drugs, you may need a dose adjustment or special tests to safely use both. Contact your doctor if you notice any of the side effects of busulfan.

Use results as a reference. Discuss medication adjustments with your healthcare provider.

11:13
Drug Interactions
Tylenol
Busulfan
Possibility
67%
Moderate Interaction
Contact my provider
Home
My Drugs
Explore
Profile
Good Morning,
Liz Cooper
Search food or drug
Drugs
Check for drug interactions
Food
Check for food interactions
Article of the day
View All
Food Interaction
Five Dangerous Food-Drug Interactions
My Drugs
Sun 13
Mon 14
Tue 15
Wed 16
Thu 17
Today
8 AM
Vitamin C
500mg, 1 capsule
Drug
Camera

CONTEXT

Table of Content

Click to navigating to specific sections

01 **Context**
02 **Research**
03 **Ideate**
04 **Use of AI**
05 **Prototype**
06 **User Testing**
07 **Final Product**

Estimated reading time
8 - 12mins
Watch the Video if you only have 3 mins

Slides
37 slides in total

EasyMed

Context

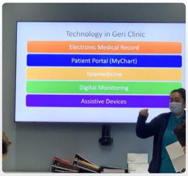
Why did we want to create EasyMed in the first place?

CONTEXT

It all started with a visit to the UCSD Senior Medicine Center

During our visit to the UCSD Senior Medicine Center, healthcare professionals highlighted **the widespread occurrence of polypharmacy among elderly patients**. Polypharmacy involves the simultaneous use of multiple prescribed and non-prescribed medications, often with limited awareness of potential side effects and drug-food interactions. This issue is further complicated by factors such as an aging population, the prevalence of multiple chronic conditions, and a fragmented healthcare system, collectively contributing to the challenges in medication management.

Considerations in the Care of Older Adults
Healthcare Decision Makers
Mobility Issues
End-of-Life Matters
Visual/Hearing Impairment
Dependency on Caregivers or Care Facilities
Complex Chronic Medical Conditions


Technology in Geri Clinic
Electronic Medical Record
Patient Portal (MyChart)
Telemedicine
Digital Monitoring
Assistive Devices

CONTEXT

Problem

❓ The problem is...

Elder adults express concerns about potential adverse interactions when taking multiple drugs concurrently. However, medical practitioners often lack sufficient time and resources to thoroughly address this issue.

GOAL

Empower elder adults to make well-informed medical decisions

We aim to...

Create a platform for users, particularly older adults managing multiple medications, to check and educate themselves about potential interactions among these drugs. The aim is to empower users to make informed decisions, preventing harm to their health caused by poly-drug interactions.

EasyMed

Research

Understanding users pain points and needs in-depth

RESEARCH

Research Process

50+ Secondary Research
Web, Research Paper

10+ Competitors analysis
Rx Websites, other apps

6+ Interviews
Elder Adults, Medical Professionals, General users

RESEARCH

Many older adults face a high risk of major interactions with limited medical resources

To understand the current landscape of the problem, I researched extensively online and found that many adults mixed drugs together and the problem is even worse for older adults since they are often taking more than 5 drugs for various medical complications.

Yet, medical professionals often lack the time and resources to provide comprehensive explanations and consider all aspects of a patient's medical history

3.2 million
Americans mixed and abused medications.

1 in 25 older adults
were at risk for a major potential drug-drug interaction.

5+ medications
can increase the risk of adverse drug interaction by 50%, and 8+ medications can increase the risk by 100%

PRIMARY RESEARCH

Identifying gaps through interviews

To collect qualitative data on how different stakeholders perceive adverse drug interactions, we conduct **6 in-depth interviews** with 2 older adults, 1 adults with multi-drug use and 1 without, and 2 healthcare practitioners and here are the key insights:

Older adults are highly concerned yet it's hard for them to learn

Healthcare professional doesn't have time to explain to every patient

Not enough medical knowledge to understand all the drug interactions

"When I read the instructions on the back, it takes too much time to understand the terms and the text is often too small."

-Mary, Retired, 84 years old

"Checking drug-drug interactions is very important for patients yet we don't have the time to inform and remind every patient with everything"

-Vanessa, Registered Nurse, 34 years old

"I am aware of drug interactions but it takes too much time to learn them."

-Manqing, College Student, 23 years old

SECONDARY RESEARCH

Analyzing how can we gain a competitive advantage

After evaluating 5 websites and 5 mobile competitors, it's evident that most of them exhibit usability issues such as **information overload, poor UI design, and limited functionality**. Recognizing the importance of this, the inclusion of severity levels and explanations for these interactions would greatly enhance usability and user experience.

All competitors rely heavily on manual data entry, leading to limited interaction coverage and no competitors address drug-food interactions in a personalized and user-friendly manner.

RxList

WebMD

Drugs.com
Know more. Be sure.

DRUGBANK

Medscape

KnowYourMeds

PERSONA

Prioritize on the needs of elder adults while catering to the broader public

Given the vulnerability and minority status of older adults, we strive to prioritize their needs while also considering the needs of healthcare professionals and the general public.

Emily

Registered Nurse at UCSD Geriatrics department

About

Emily uses MyChart to remind her patients regularly about what medicine they need to take and what to avoid.

Needs

It's difficult to know all the drugs her patient are taking, explain every detail, and follow up when they have questions.

Healthcare Professional

Nancy

Older adult living by herself

About

Mary is an older adult living by herself and she is taking 5+ drugs to relieve her high blood pressure, back pain, and kidney disease.

Needs

She needs a way to learn and avoid major drug interactions quickly and be aware of drug-food interactions.

⭐Core User: Elder Adults

Bob

Master Student at UCSD

About

Bob take several supplements on a daily basis, and taking multiple drugs occasionally when he is sick.

Needs

Bob needs to know whether there's any interactions between the supplements, the food, and the drugs he is taking but learning all these are tedious.

General Public

EasyMed

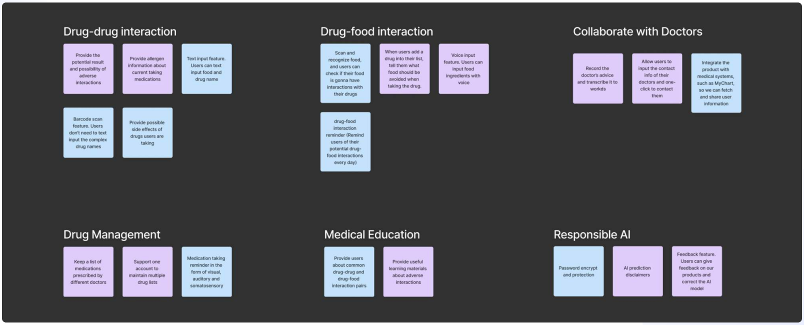
Ideate

Brainstorm possible solutions to address the issues

IDETAE

We brainstormed as many solutions as possible

Informed by research, we worked together to generate 20 features addressing key pain points and user needs.



Drug-drug interaction

Provide the potential result and possibility of adverse interactions

Provide allergen information about current taking medications

Text input feature. Users can text input food and drug name

Barcode scan feature. Users don't need to text input the complex drug names

Provide possible side effects of drugs users are taking

Drug-food interaction

Scan and recognize food, and users can check if their food is gonna have interactions with their drugs

When users add a drug into their list, tell them what food should be avoided when taking the drug.

Voice input feature. Users can input food ingredients with voice

drug-food interaction reminder (Remind users of their potential drug-food interactions every day)

Collaborate with Doctors

Record the doctor's advice and transcribe it to workds

Allow users to input the contact info of their doctors and one-click to contact them

Integrate the product with medical systems, such as MyChart, so we can fetch and share user information

Drug Management

Keep a list of medications prescribed by different doctors

Support one account to maintain multiple drug lists

Medication taking reminder in the form of visual, auditory and somatosensory

Medical Education

Provide users about common drug-drug and drug-food interaction pairs

Provide useful learning materials about adverse interactions

Responsible AI

Password encrypt and protection

AI prediction disclaimers

Feedback feature. Users can give feedback on our products and correct the AI model

IDETAE

With limited resources, how shall we prioritize our MVP features?

We employ an **impact vs. effort matrix** to prioritize features, meticulously aligning each solution with a distinct user problem. Our strategy focuses on addressing features with low effort and high impact, ensuring we prioritize users' most pressing needs first.

Key Features

🌟 Potential result and possibility of drug-drug and drug-food interactions

🌟 Potential side effects of drugs

Problem	Solution	Why P0?
No idea of interactions between current drugs	**Drug-drug interaction checker**	This is the core problem that our app is trying to solve

- 🌟 Drug barcode scan to add drugs
- 🌟 User drug list
- 🌟 Scan food ingredients/product barcode to check drug-food interaction
- 🌟 Information about common drug-drug and drug-food interaction pairs
- 🌟 Learning materials about adverse interactions
- 🌟 AI prediction disclaimers
- 🌟 Password encrypt and protection
- 🌟 Feedback feature to enable AI accountability

No idea on food interactions with current drugs	**Drug-food interaction checker**	Establish competitive advantage compare to other products
Hard to remember the name when taking multiple drugs	**Drug List**	Maintain coherency and save time for users and physicians
Vague understanding of DDI and DFI	**Education material on DDI & DFI**	Enhance understanding of DDI & DFI
Hard for users to input drug info	**Scan drugs by barcode**	Save time and effort for users
Hard for type all food ingredients	**Voice input**	Easier for users to input food ingredient

EasyMed

Use of AI

How do we plan to use AI Strategically

AI

AI technology we applied

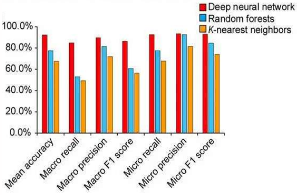
Core AI Technology - Deep DDI

We developed DeepDDI, a computational framework using drug-drug and drug-food pairs' **compound structural** information as inputs to generate 86 important drug-drug interaction (DDI) types as human-readable sentences. DeepDDI achieved a mean accuracy of **92.4%** in predicting DDIs using DrugBank data. It suggested causal mechanisms for adverse drug events in **9,284 pairs** and identified alternative drug candidates for **62,707 pairs** with negative health effects. Additionally, DeepDDI predicted drug-food interactions for **3,288,157 pairs.**

Multiple Other AI Services

In order to address user pain points more comprehensively, we innovatively integrate multiple AI services to create seamless experiences, which also shows our accessible and inclusive considerations in UX for a positive and trust impact.

Google barcode scanning API → ✓ We intend to utilize the Google Barcode Scan API to assist users in entering medication information. Users will be able to view drug details without manually entering lengthy and complex drug names.



Accurate performance for 7 metrics
(DeepDDI gets best performance among 3 ML algorithms)

Microsoft cognitive services API ✓

To assist elderly individuals with visual impairment, we plan to leverage the text-to-speech capabilities within the Microsoft Cognitive API. This will enable the system to read lengthy texts aloud for elderly users, thereby enhancing the inclusivity of the design.

Foodviser food recognition API ✓

To save users time when inputting food they are about to consume, we plan to integrate the Foodviser food recognition API. This will allow users to open the camera and easily scan the food they want to consume, enabling them to view potential drug-food adverse interactions.

EasyMed

Prototype

Design considerations we had while crafting age-friendly designs

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DESIGN PROCESS

Design Principles

Keeping our core users in mind, we utilized the Usability Heuristics and the Microsoft Responsible AI principle as the guideline for our design.

Accessible Design

Proper font size, use of icons and visual imagery

Privacy & Security

Password protection & Username resetting

Help & Support

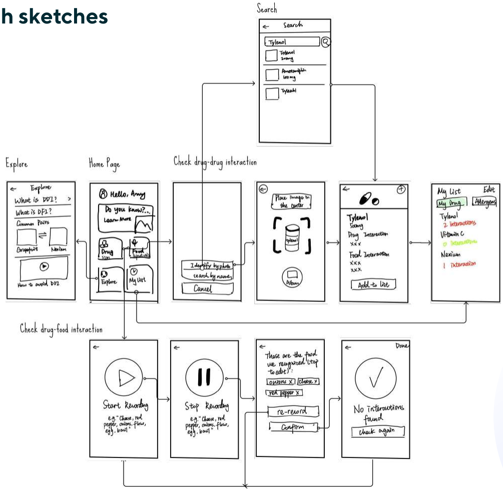
Onboarding guide and confirmation windows

Transparency

Include disclaimers and warnings

SKETCH

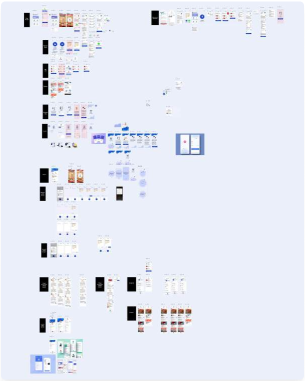
Iterating quickly with sketches


Search
Search
Tylenol
Tylenol 200mg
Amoxicillin 100mg
Tylenol
Explore
Home Page
Check drug-drug interaction
Explore
What is DDI? >
What is DFI?
Common Pairs
Grapefruit
Nexium
How to avoid DDI
Hello, Amy
Do you know?...
Learn More
Drug Scan
Food
Explore
My List
Identify by photo
search by name
Cancel
Place image in the center
tylenol
Album
Tylenol
500mg
Drug Interaction
xxx
Food Interaction
xxx
xxx
Add to list
My List
Edit
My Drug
Allergens
Tylenol
2 interactions
Vitamin C
0 interactions
Nexium
1 interaction
Check drug-food interaction
Start Recording
e.g. "Cheese, red pepper, onions, flour, egg, basil"
Stop Recording
e.g. "Cheese, red pepper, onions, flour, egg, basil"
Those are the food we recognized (tap to edit):
onions x
cheese x
red pepper x
re-record
Confirm
Done
No interactions found
check again

PROTOTYPE

More and more iterations

We had multiple design explorations based on the sketch, continually refining the UX and UI based on feedback.

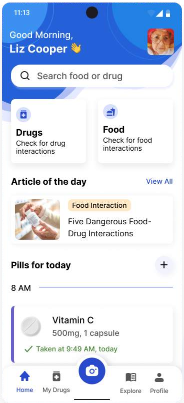


HIGH-FIDELITY PROTOTYPING

Considerations when crafting age friendly designs #1

Legible font

- Use text size that are legible ranging from 14-22px
- Use Inter, a Sans Serif type to increase readability
- Icon with text for less confusion
- Ensure the touch zone is big enough


11:13
Good Morning,
Liz Cooper 👋
Search food or drug
Drugs
Check for drug interactions
Food
Check for food interactions
Article of the day
View All
Food Interaction
Five Dangerous Food-Drug Interactions
Pills for today
+
8 AM
Vitamin C
500mg, 1 capsule
Taken at 9:49 AM, today
Home
My Drugs
Explore
Profile

H1 Title Large
Inter Bold 22px

H2 Title Bold
Inter Bold 18px

H3 Title Medium
Inter Bold 18px

Label Large
Inter Medium 20px

Body Text Large
Inter Regular 18px

Body Text Regular
Inter Regular 16px

Sub-label
Inter Regular 14px

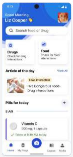
HIGH-FIDELITY PROTOTYPING

Considerations when crafting age friendly designs #2

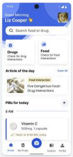
Ensure color contrast & Color Blind Freindly

- Follow Material Design to generate accessible color palette.
- Ensure proper color contrast by passing at least the WCAG AA standards and mostly passing AAA standards
- Checked the design would be friendly for color blind people.

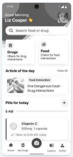
Normal



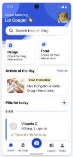
Protanopia



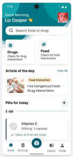
Achromatopsia



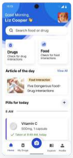
Deuteranopia



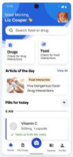
Tritanopia



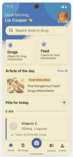
Blurred



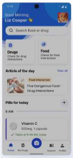
Ghosting



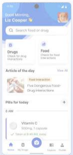
Yellowing



Loss of Contrast



Bright Light

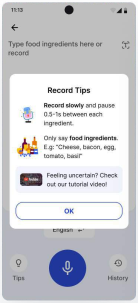


HIGH-FIDELITY PROTOTYPING

Considerations when crafting age friendly designs #3

Simple Interactions & Detailed Guidance

- No difficult or hidden interactions since older adults are typically less familar with technology
- Comprehensive Guidance, Step-by-Step Support, and Error-Recovery Tooltips to Aid Users
- Clear and big CTA buttons


11:13
Tips
History
English

Type food ingredients here or record

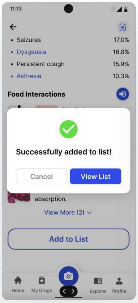
Record Tips

Record slowly and pause 0.5-1s between each ingredient.

Only say **food ingredients**. E.g: "Cheese, bacon, egg, tomato, basil"

Feeling uncertain? Check out our tutorial video!

OK


11:13
Home
My Drugs
Explore
Profile

Seizures	17.0%
Dysgeusia	16.8%
Persistent cough	15.9%
Asthesia	10.3%

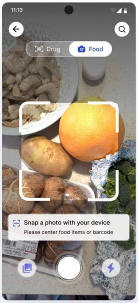
Food Interactions

Successfully added to list!

Cancel
View List

absorption.

View More (2)
Add to List


11:13
Drug
Food

Snap a photo with your device

Please center food items or barcode

EasyMed

User Testing

How we validated and refined our design

USER TESTING

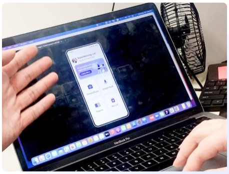
Validating designs with users

Participants

To validate our research and identify relevant problems, we invited 5 participants to test our prototype including 2 older adults, 2 healthcare professionals, and 1 ordinary adult.

Mythology & Analysis

We began with semi-structured interviews to gather background information and assessed task completion of participants. To synthesize insights, we used an affinity map and priority matrix, considering limited resources. We then used an affinity map to group the feedback and determined what we can improve given the limited time and resource.



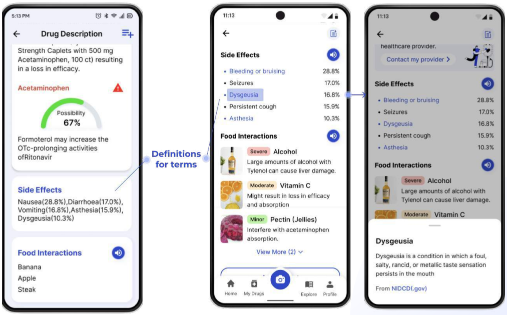
USER TESTING

Refinements 1: Bottom sheet for definition

Before
Side effects are presented without explanations

Research Insights
Participants reflect that it's hard to understand the complicated medical terms.

After
Offer explanations for medical terms from notable sources through a bottom sheet to avoid minimum disruption to the reading experience


Definitions for terms

5:13 PM

Drug Description

Strength Caplets with 500 mg Acetaminophen, 100 ct) resulting in a loss in efficacy.

Acetaminophen

Possibility
67%

Formoterol may increase the OTc-prolonging activities ofRitonavir

Side Effects

Nausea(28.8%),Diarrhoea(17.0%), Vomiting(16.8%),Asthesia(15.9%), Dysgeusia(10.3%)

Food Interactions

Banana
Apple
Steak

11:13

Side Effects

• Bleeding or bruising	28.8%
• Seizures	17.0%
• Dysgeusia	16.8%
• Persistent cough	15.9%
• Asthesia	10.3%

Food Interactions

Severe Alcohol
Large amounts of alcohol with Tylenol can cause liver damage.

Moderate Vitamin C
Might result in loss in efficacy and absorption

Minor Pectin (Jellies)
Interfere with acetaminophen absorption.

View More (2)

Home My Drugs Explore Profile

11:13

healthcare provider.

Contact my provider

Side Effects

• Bleeding or bruising	28.8%
• Seizures	17.0%
• Dysgeusia	16.8%
• Persistent cough	15.9%
• Asthesia	10.3%

Food Interactions

Severe Alcohol
Large amounts of alcohol with Tylenol can cause liver damage.

Moderate Vitamin C

Dysgeusia

Dysgeusia is a condition in which a foul, salty, rancid, or metallic taste sensation persists in the mouth

From NIDCD(.gov)

Before After

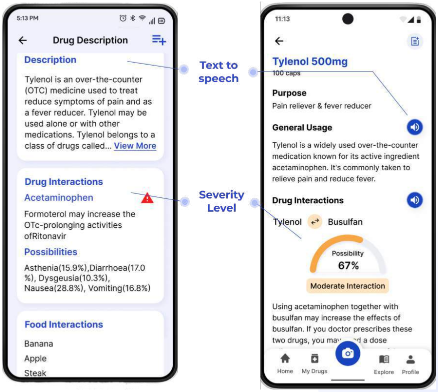
USER TESTING

Refinements 2: Text to speech for paragraphs

Before
Long paragraphs of text for users to read and comprehend

Research Insights
Older individuals had a hard time reading the long text and understanding the severity

After
Users can listen to the text and visualize severity levels using graphs and tags.


Text to speech
Severity Level

5:13 PM

Drug Description

Description

Tylenol is an over-the-counter (OTC) medicine used to treat reduce symptoms of pain and as a fever reducer. Tylenol may be used alone or with other medications. Tylenol belongs to a class of drugs called... View More

Drug Interactions

Acetaminophen

Formoterol may increase the OTc-prolonging activities ofRitonavir

Possibilities

Asthenia(15.9%),Diarrhoea(17.0 %), Dysgeusia(10.3%), Nausea(28.8%), Vomiting(16.8%)

Food Interactions

Banana
Apple
Steak

11:13

Tylenol 500mg
100 caps

Purpose
Pain reliever & fever reducer

General Usage
Tylenol is a widely used over-the-counter medication known for its active ingredient acetaminophen. It's commonly taken to relieve pain and reduce fever.

Drug Interactions
Tylenol Busulfan

Possibility
67%

Moderate Interaction

Using acetaminophen together with busulfan may increase the effects of busulfan. If you doctor prescribes these two drugs, you may ad a dose

Home My Drugs Explore Profile

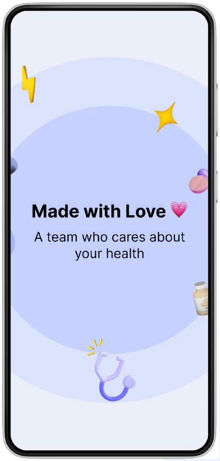
USER TESTING

Refinements 3: Guided onboarding

Before
First time users go to the sign up page directly.

Research Insights
Users feel confused about the app's functionality upon their initial entry.

After
We will start with an onboarding tour to guide users on how to make the most of the app.



Made with Love 💗

A team who cares about your health

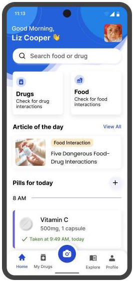
EasyMed

Final Product

An user-friendly drug and food interaction checker

FEATURES

Home


11:13
Good Morning,
Liz Cooper 👋
Search food or drug
Drugs
Check for drug interactions
Food
Check for food interactions
View All
Food Interaction
Home
My Drugs
Explore
Profile

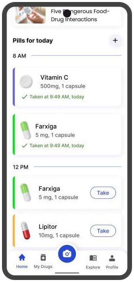
Article of the day

Five Dangerous Food-Drug Interactions

Pills for today

8 AM

Vitamin C
500mg, 1 capsule
✓ Taken at 9:49 AM, today


Take
Take
Home
My Drugs
Explore
Profile

Five Dangerous Food-Drug Interactions

Pills for today

8 AM

Vitamin C
500mg, 1 capsule
✓ Taken at 9:49 AM, today

Farxiga
5 mg, 1 capsule
✓ Taken at 9:49 AM, today

12 PM

Farxiga
5 mg, 1 capsule

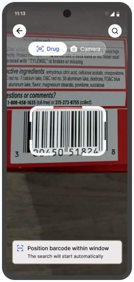
Lipitor
10mg, 1 capsule

All-in-one Homepage

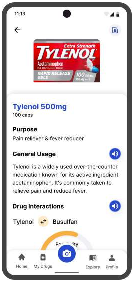
Through EasyMed's homepage, users can effortlessly check for drug-drug and drug-food interactions, access curated daily articles on polypharmacy, and access personalized pill reminders.

FEATURES

Drug Interaction


11:13
Drug
Camera

Position barcode within window
The search will start automatically

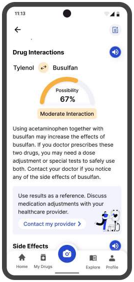

11:13
Home
My Drugs
Explore
Profile

Tylenol 500mg
100 caps

Purpose
Pain reliever & fever reducer

General Usage
Tylenol is a widely used over-the-counter medication known for its active ingredient acetaminophen. It's commonly taken to relieve pain and reduce fever.

Drug Interactions
Tylenol ⇄ Busulfan


11:13
Contact my provider >
Home
My Drugs
Explore
Profile

Drug Interactions

Tylenol ⇄ Busulfan

Possibility
67%

Moderate Interaction

Using acetaminophen together with busulfan may increase the effects of busulfan. If you doctor prescribes these two drugs, you may need a dose adjustment or special tests to safely use both. Contact your doctor if you notice any of the side effects of busulfan.

Use results as a reference. Discuss medication adjustments with your healthcare provider.

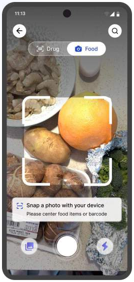
Side Effects

Check Drug-to-drug Interaction

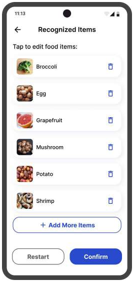
Effortlessly search or scan a drug by barcode to check interaction details with meds in your list, stay updated on side effects and food interactions, and add to list for future reference.

FEATURES

Food Interaction


11:13
Drug
Food

Snap a photo with your device
Please center food items or barcode

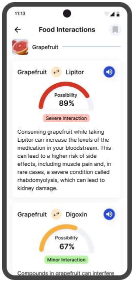

11:13

Recognized Items

Tap to edit food items:

- Broccoli
- Egg
- Grapefruit
- Mushroom
- Potato
- Shrimp

+ Add More Items
Restart
Confirm



Food Interactions

Grapefruit

Grapefruit ⇄ Lipitor

Possibility 89%

Severe Interaction

Consuming grapefruit while taking Lipitor can increase the levels of the medication in your bloodstream. This can lead to a higher risk of side effects, including muscle pain and, in rare cases, a severe condition called rhabdomyolysis, which can lead to kidney damage.

Grapefruit ⇄ Digoxin

Possibility 67%

Minor Interaction

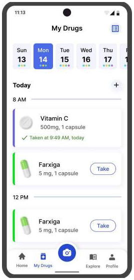
Compounds in grapefruit can interfere

Check Drug-to-food Interaction

Just snap a photo of your food items or product barcode, and the app performs a thorough analysis, alerting you of any potential adverse interactions with your list of medications.

FEATURES

Drug List


11:13

My Drugs

Sun	Mon	Tue	Wed	Thu
13	14	15	16	17

Today

8 AM

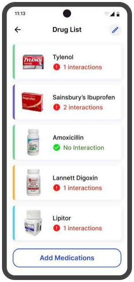
Vitamin C
500mg, 1 capsule
✓ Taken at 9:49 AM, today

Farxiga
5 mg, 1 capsule

12 PM

Farxiga
5 mg, 1 capsule

Take
Take
Home
My Drugs
Explore
Profile


11:13

Drug List

Tylenol	1 interactions
Sainsbury's Ibuprofen	2 interactions
Amoxicillin	No Interaction
Lannett Digoxin	1 interactions
Lipitor	1 interactions

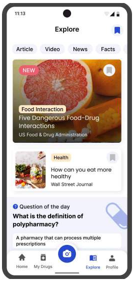
Add Medications

My Drug List & Drug Reminders

Keep a detailed drug list for future reference during doctor visits, and receive customized medication reminders to ensure timely and accurate dosing.

FEATURES

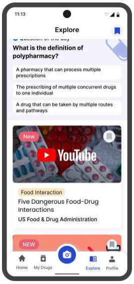
Explore


11:13
Explore
Article
Video
News
Facts
NEW
Home
My Drugs
Explore
Profile

Food Interaction
Five Dangerous Food-Drug Interactions
US Food & Drug Administration

Health
How can you eat more healthy
Wall Street Journal

Question of the day
What is the definition of polypharmacy?
A pharmacy that can process multiple prescriptions


11:13
Explore
New
YouTube
NEW
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What is the definition of polypharmacy?
A pharmacy that can process multiple prescriptions
The prescribing of multiple concurrent drugs to one individual
A drug that can be taken by multiple routes and pathways

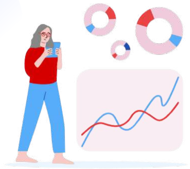
Food Interaction
Five Dangerous Food-Drug Interactions
US Food & Drug Administration

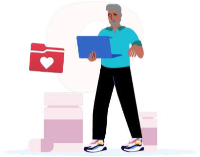
Explore

Access personalized articles to enhance your understanding of polypharmacy, with the option to filter articles by category and enjoy interactive quizzes for added engagement and learning.

CONCLUSION

Future plans





Refine AI Model

We would like to refine our machine learning model to support analysis of allergen and dosage information in relation to interactions.

Personalized Support

Add more features such as medication reminders, search by text, and food image recognition

MyChart Integration

Integrate with digital health record system like MyChart for more transparency in data sharing between patients and physicians

NEXT STEPS

Thanks!

Thank you!

Thanks for reading through the end, hope you enjoyed it!