Why EllieGrid?   Product Description

EllieGrid, a startup company specialising in healthcare technologies empowers busy people with a smart pill organiser. It simplifies medication management with organisation, reminders, and adherence tracking. Sleek and portable, it breaks free from traditional pill containers, making healthcare an on-the-go accessory.
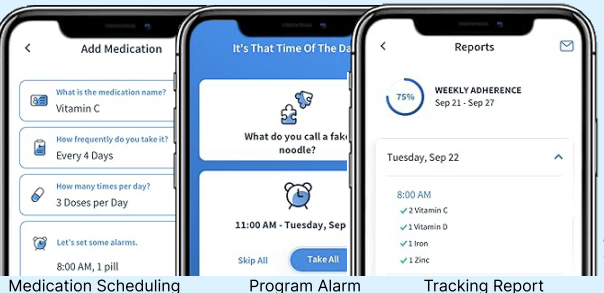
Features

- 7 pill compartments
- Phone notifications reminders
- Box light indicator instructions (which pill and # of pills)
- Linked app   • Slide-able lid

Paid Features

🔔 Synced notification to caretaker/family members

📄 Medication adherence tracker reports

$ **Normal Tier**
$149.00 + Free app Features

$$ **Plus Tier**
$149.00 + $0.99/week
Normal + 📄

$$$ **Premium Tier**
$149.00 + $1.99/week
Normal + 📄 + 🔔

Medication Scheduling | Program Alarm | Tracking Report

If EllieGrid user want relatives or a caretakers to receive notifications and reports on their pill consumption will have to pay $50-100 extra to access these features, this premium may not be financially accessible to users who require these features to adhere to their medication routine.

Market Research

Demographic:
- Generation X, Millennial, and Gen Z (*<75 years old*)
- People with good level of technology experience (*High digital fluency*)
- People on-the-go
- People who are forgetful about taking their medication

77%

EllieGrid has been shown to improve adherence in 77% of users (Ellie Health Team, 2023)
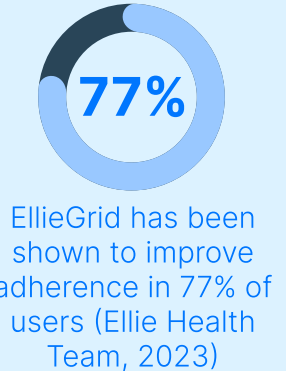
Product Reviews:

👤 ★☆☆☆☆
Paying $149 and all you get is a functionality heavily dependent on your mobile device.

👤 ★☆☆☆☆
The app reminds me to take my meds... but the pill box does nothing.

👤 ★☆☆☆☆
Pay for the app monthly!!!!??? Why?? Small pill get stuck in tracks.
See Appendix - A for full reviews.

👤 ★☆☆☆☆
...had to check on the app which medication was which since a lot of mine look the same.

👤 ★☆☆☆☆
Some older people may struggle with opening and closing the box ... hard to get him to understand that when it beeps, what it means...

Ellie Health Team. (2023). Partners. [online] Available at: https://elliegrid.com/pages/partners [Accessed 24 Nov. 2023].

User Research

Methodology   User Interviews

4 participants were interviewed to understand their attitude and behaviour towards pill organisers as older adults, their experiences using pill boxes and technology. This will help empathise with current pain points elders face when using pill organisers and the conditions causing these pain points. (Appendix - A)

Participants Criteria

- Elders: 60+ • Organises their medication*
- Any nationality (*provides wider range of insights, help create a universal design*)

*Either using pill organiser or relative/caretaker helping them

P1 (Chinese, 83, Female)
- Never used pill organiser
- Relative manages pills
- Retired
- Basic phone functions (calls & messages)

Conditions: heart conditions, motor and cognitive conditions.

P2 (Chinese, 71, Male)
- Uses pill organiser
- Relative manages pills
- Retired
- Declined usages of technology

Conditions: Heart disease, high blood pressure, cerebral infraction

P3 (Zambian, 62, Female)
- Used to use pill organiser
- Currently a nurse
- Confident with using technology

Conditions: Hypertension, asthma.

P4 (Lebanese, 87, Female)
- Uses pill organiser
- Retired
- Comfortable with using technology

Conditions: Arrhythmia, high blood pressure, poor vision.

Proto-persona
Created with an empathy map to gain a deeper understanding of a pill organiser user.

75yr old, independently living, uses pill organiser, and basic level of technology

Pain Points
- Hand Tremor
- Decline in cognitive ability
- Visual impairments

- Organise different medication with specific intakes.
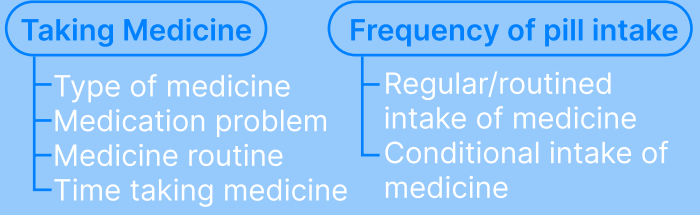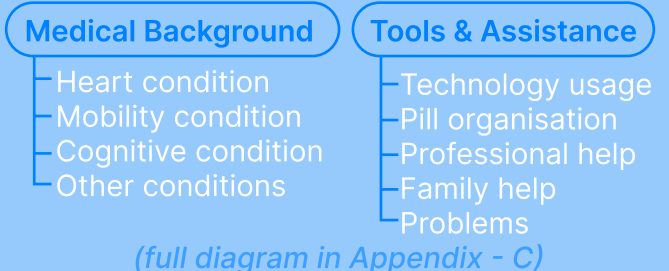- Take pills for extended periods of time

Motivations
- Reminder system for medication intake
- Easy organisation for medication

- Easy to pick pills
- Ability to involve relative in tracking
- Ability to complete tasks independently

See Appendix - B for full participant information, proto-persona & empathy map

Key Insights   user-centred methods

Affinity Diagram

This tool has been utilised to analyse and organise findings from the interviews to find overarching themes of issues, attitudes, behaviours toward using pill organisers.

Medical Background
- Heart condition
- Mobility condition
- Cognitive condition
- Other conditions

Tools & Assistance
- Technology usage
- Pill organisation
- Professional help
- Family help
- Problems

(full diagram in Appendix - C)

Taking Medicine
- Type of medicine
- Medication problem
- Medicine routine
- Time taking medicine

Frequency of pill intake
- Regular/routined intake of medicine
- Conditional intake of medicine

Key Insights

Based on the findings from affinity diagram, insights have been prioritised to find user needs, opportunities to overcome the pain points elders face when using pill organisers. These insights have been prioritised based on improving convenience and medication management for elder, promoting independent lifestyle and usage of pill organised.

(Matrix and insights in Appendix - C)
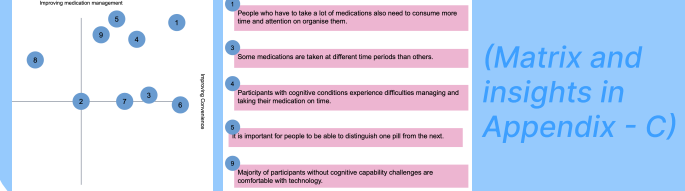
Product Analysis

SWOT Analysis on Pill Box

Utilised to map the strengths, weaknesses, possible opportunities and threats to elders when using the EllieGrid; provides insight into how the EllieGrid that affect elder's experience.

Strengths
- Amount of medicine to take displayed through the lid

Weakness
- Inflexible & unobvious notifications
- Poor capacity
- Pay extra for features

Opportunity
- Simple design
- Support system through app
- Reminder System

Threats
- No audio reminder
- Hard to pick up pills
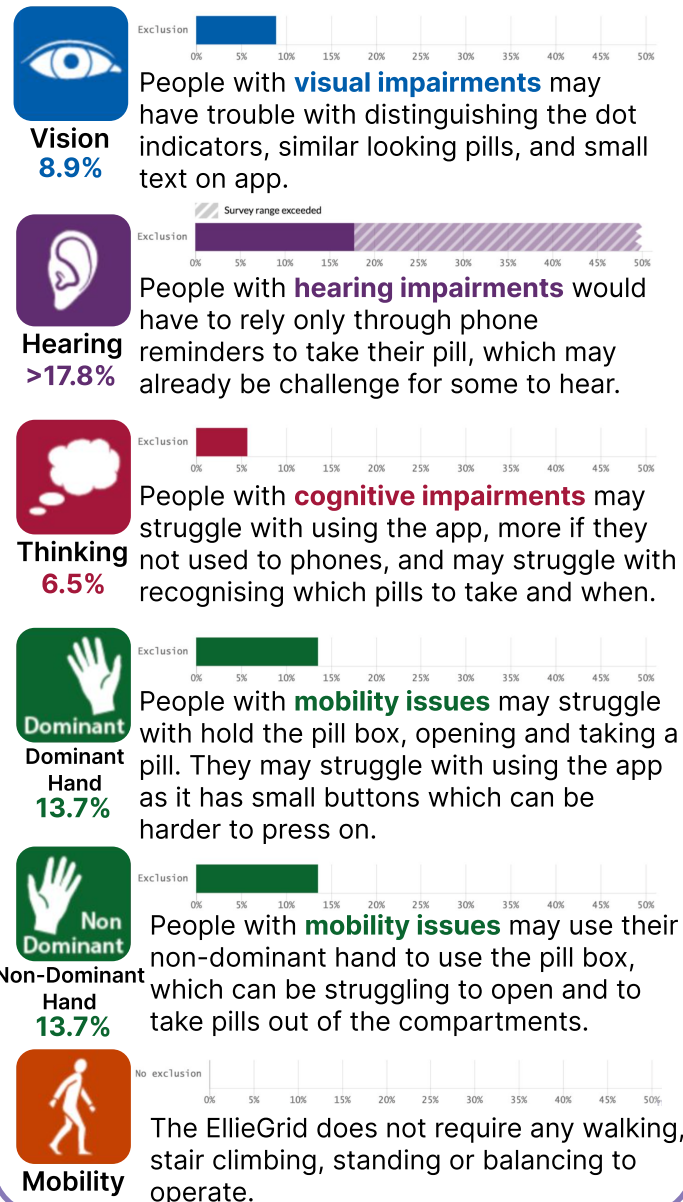- Lid slips off easily
- Unclear light indicators

Accessibility Evaluation on App

Analysis conducted against the *WCAG 2.2 Guidelines* to investigate the EllieGrid app.

% of issues/category:

👁 **Perceivable** 50% 6 issues

⚖ **Operable** 16.7% 2 issues

💡 **Understandable** 16.7% 2 issues

⚙ **Robust** 16.7% 2 issues

The main issues include:
- Non-compatible with assistive technologies (*screen reader*)
- Interface components may not be detected by assistive tech
- Clickable items are smaller than standard
- No audio description for videos

These issues affects the user's experience from the app as it *excludes users who require assistive technologies to navigate apps*.
(SWOT & Accessibility Evaluations in Appendix - D)

Exclusion Calculation

Based on the target population of age *60+*, *proto-persona*'s profile, and *EllieGrid*'s features.

30.4% of elders excluded from using EllieGrid + App

👁 **Vision 8.9%**
People with **visual impairments** may have trouble with distinguishing the dot indicators, similar looking pills, and small text on app.

👂 **Hearing >17.8%**
Survey range exceeded
People with **hearing impairments** would have to rely only through phone reminders to take their pill, which may already be challenge for some to hear.

💭 **Thinking 6.5%**
People with **cognitive impairments** may struggle with using the app, more if they not used to phones, and may struggle with recognising which pills to take and when.

✋ **Dominant Hand 13.7%**
People with **mobility issues** may struggle with hold the pill box, opening and taking a pill. They may struggle with using the app as it has small buttons which can be harder to press on.

✋ **Non-Dominant Hand 13.7%**
People with **mobility issues** may use their non-dominant hand to use the pill box, which can be struggling to open and to take pills out of the compartments.

🚶 **Mobility**
No exclusion
The EllieGrid does not require any walking, stair climbing, standing or balancing to operate.
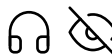
Inclusive Design

The world has been designed in a manner that there are people who being excluded from using services, products, and everyday essential functions due to a lack interactions and accessibility for those functions. Exclusion is the negative by-product of companies, organisations and governments not including everyone in the design process (Keates et al., 2003), resulting in issues faces by people are on the environment and the barriers it creates for people (Marks, 1997). Inclusive design attempts to breaks the barriers and issues people face in all contexts of life, to minimise their exclusion from society (Keates et al., 2003).

Inclusive design may not always be able to design one product to address the needs of the population, but guides an appropriate response through (The British Standards Institute, 2005):

📞 📱 **Create a Product Suite:** Expand a core product with variations to reach more people.

🎧 🚫👁 **Target with Focus:** Design for specific user needs.

🏠 🚚 **Effortless Access:** Design for broad usability and diverse contexts

Ageing Population

Population 60+:

1 billion (2020)

1.4 billion (2050)

By 2030, 1 in 6 people in the world will be 60 or older. By 2050, the global population of people aged 60+ will double (2.1 billion), and the number of people aged 80+ is anticipated to triple between 2020 and 2050, reaching 426 million (WHO, 2022).
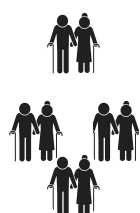
Common Health Conditions with Ageing

Hearing loss, cataracts, osteoarthritis, chronic obstructive pulmonary disease, diabetes, depression, and dementia are all common illnesses among the elderly. As people age, they are more likely to have visual, motor, and cognitive conditions at the same time (Efraim and Barron, 2017).

Challenges in Response to Population Ageing

While ageing brings biological changes, the diversity we see in older adults isn't random. It's heavily shaped by the physical and social environments they navigate, which in turn affect their opportunities and health choices. These environments are often skewed by factors like background, sex, ethnicity, leading to unfair health inequalities. Ageist stereotypes that paint older people as frail, dependent burdens, leading to discrimination, harmful policies, and ultimately hinder their path to healthy ageing. Public health professionals and society as a whole must do better to recognise and address these outdated and damaging attitudes (WHO, 2022).

Problems in Focus from User Research

From the user research, the insights uncovered that issues for the participants come from visual and cognitive capabilities to using their pill organisers and managing their medication. Additionally, secondary research looking at people using EllieGrid highlights the lack of consideration of elder people using the pill box, excluding them to using smart home technology.

→ People who have **visual impairments** excluded by not have adequate audio feedback, and may not be able to distinguish between pills.

→ People with **cognitive issues** may not have the capability to understand the app's functionality and the light indicators for which pill to take, creating confusion. Furthermore, people may have complex medication routines which requires, time, attention and space to organise their pill accordingly.

→ EllieGrid does not match the **mental model** of using traditional pill organiser, they have to slide 1 large lid which exposes all the pills (dangerous as they may not be fully aware of which pill to take, or take different pills at once) rather than opening separate pill compartment lids.

Medication Adherence

Adherence to recommended drug regimens has been linked to better health outcomes and lower healthcare expenditures. Non-adherence in the elderly population can be attributed to a variety of factors, including increased vulnerability to drug-related problems due to pharmacodynamic and pharmacokinetic changes, high prevalence of comorbidity leading to polypharmacy and functional impairment and increased risk of drug interactions (Smaje et al., 2018).

Specific factors that lead to negative adherence:
- Neurotic personality trait (anxious, sensitive)
- High level of comorbidity
- Cognitive impairments

(Smaje et al., 2018)

Understanding why elders show negative adherence to medication will help design a pill organiser inclusive to people with high number of different pills to take and with cognitive impairments. Intuitive and simple design must be used to help guide people into organising their pills and taking their pills correctly.

Elders Needs from Smart Devices

There is a need to address the design and potential utility of smart devices for older persons in ways that allow for both practical and enjoyable outcomes. It is especially important for elders to build digital life skills in collaboration with others, through curious, fun, and exploratory contacts. This gives a chance for elders to develop digital literacy and another step towards living independently (Strengers et al., 2022).

Visual Impairments

As people become older, the natural function of their eyes deteriorates, and ocular disease becomes more common. Age is the most accurate predictor of blindness and visual impairment. Untreated vision impairment causes physical disability, increased risk of falling, depression, social isolation, and dependency on other people and their other senses (Loh K, Ogle J, 2023). EllieGrid does not provide alternatives for visually impaired users, although the app sends notifications to the user's phone, the pill box itself does not provide any audio feedback. Inclusion of visually impaired people is needed so that they are able to take their medication correctly.

Cognitive Impairments

The most significant changes in cognition associated with ageing include reductions in performance on cognitive tasks that involve speedy processing or transformation of information to make a choice, such as measures of processing speed, working memory, and executive cognitive function (Murman, 2015). Although EllieGrid does provide reminders through phone notifications, it does not consider the need for back reminders from next-of-kin to be altered whether someone has forgotten to take their medication. Not having this feature freely available can cause negative impact on an elder that is not able to be fully independent.

Use of Technology by Elders

The percentage of older persons who own a smartphone has increased considerably, from 18% in 2013 to 83% (ages 50-64) and 61% (ages 65+) in 2021. An even greater proportion of older persons (90%) possess computers and utilise the internet. However, harmful generalisations that elders are unwilling or incapable of using technology has created Institutional barriers such as the design of patient portals or digital health app (Mace et al., 2022). This discourages older people from seeking health information. As a result, older people are at danger of becoming underrepresented in digital health at all levels of care.

Design Solution

In order to overcome the barriers caused to visually and cognitively impaired older adults when using smart pill organisers such as EllieGrid, the device has to able to represent and output information through different methods (e.g. audio and visual outputs) in an intuitive way which neglecting one type of user's impairment. Additionally, the device has to be able to not only remind users of when to take their pill, but make them aware that they have medication to take. These impairments are more inclined to lead to negative medication adherence which is why they have been prioritised for an inclusive design solution. Although mobility impairments has not been focused in this study, the solution will attempt to design for broader usability and diverse contexts as elder people are more likely to display mutliple impairment and comorbidity.

Technological Consideration

The solution aims to be made from readily available market parts to reduce the need of specially made parts; in an effort to be at an accessible price tag.

To promote elders' independent living, seamless communication and interaction with AI-powered systems can assist with the medication management, pill organising, reminders and alerts, and adherence tracking (Srikanta Padhan et al., 2023). AI-powered assistance would provide immediate guidance and help to any queries with pill organising to not make the user feel any burden towards receiving assistance, resulting in feeling independent by co-effectively organising the user's medication and reminding of pill intake.

Keates, S., Clarkson, J. (2003). *Countering Design Exclusion : An Introduction to Inclusive Design.* Springer London, Limited, London.

Deborah Marks (1997) Models of disability, Disability and Rehabilitation, 19:3, 85-91, DOI: 10.3109/09638289709166831

The British Standards Institute (2005) standard BS 7000-6:2005: *'Design management systems - Managing inclusive design'*

WHO (2022). Ageing and health. [online] Who.int. Available at: https://www.who.int/news-room/fact-sheets/detail/ageing-and-health#:~:text=At%20this%20time%20the%20share,2050%20to%20reach%20426%20million. [Accessed 15 Jan. 2024].

Efraim Jaul and Barron J. (2017). Age-Related Diseases and Clinical and Public Health Implications for the 85 Years Old and Over Population. Frontiers in Public Health, [online] 5. doi:https://doi.org/10.3389/fpubh.2017.00335.

Smaje, A., Maryse Weston-Clark, Raj, R., Mine Orlu, Davis, D. and Mark James Rawle (2018). Factors associated with medication adherence in older patients: A systematic review. Aging medicine, [online] 1(3), pp.254–266. doi:https://doi.org/10.1002/agm2.12045.

Strengers, Y., Duque, M., Mortimer, M., Pink, S., Martin, R., Nicholls, L., Horan, B., Eugene, A. and Thomson, S. (2022). 'Isn't this Marvelous'. Designing Interactive Systems Conference. doi:https://doi.org/10.1145/3532106.3533502.

Loh K, Ogle J (2023). Age related visual impairment in the elderly. The Medical journal of Malaysia, [online] 59(4). Available at: https://pubmed.ncbi.nlm.nih.gov/15779599/#:~:text=Visual%20impairment%20among%20the%20elderly,of%20blindness%20and%20visual%20impairment. [Accessed 15 Jan. 2024].

Murman, D.L. (2015). The Impact of Age on Cognition. Seminars in Hearing, [online] 36(03), pp.111–121. doi:https://doi.org/10.1055/s-0035-1555115.

Mace, R.A., Mattos, M. and Ana-Maria Vranceanu (2022). Older adults can use technology: why healthcare professionals must overcome ageism in digital health. Translational Behavioral Medicine, [online] 12(12), pp.1102–1105. doi:https://doi.org/10.1093/tbm/ibac070.

Pillpal home is a voice activated smart home pill organiser, with AI integration to assist independent elders with their pill management and medication adherence. A suite of reminder systems have been incorporated to assist visual, audio, and cognitive impairments, providing alternative ways of being informed when it is time to take a pill. Amazon Echo's technology has been used to interlink with existing smart home devices, and promote independence in elders; decorating the **pillpal home** as a smart home device rather than another medical piece of equipment reduces the mundane stigma toward medication intake and promotes an inviting, fun, experimental experience to digitally illiterate elders.

Camera/Microphone
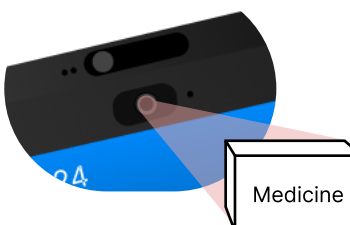
To help with the setup of a persons pill intake schedule and organisation, AI powered camera assists users with identifying the type of medicine the user has to take. With the help of the microphone, users are able to communicate what the medicine is (to confirm with the AI) and also inform what the intake schedule is for that medicine.

The AI will take all the information provided by the user to best place each medicine in its respective compartment, and create all the required reminder and alert systems for when the user needs to take a pill. All the user has to do is add the pills to the correct compartment and wait until the upcoming reminder from **pillpal**'s reminder system.

Power Button

Braille 'P' for Power, common practice seen with TV remotes.
*High contrast colours for buttons to be more visible.

Volume Buttons

Braille 'V' for Volume. This is common practice seen with TV remotes.

Camera On/Off Switch

Braille 'C' for Camera. Switch can open and close with low force, making it easy to turn on and off the camera.

Open Button

Braille 'O' for Open, Opens all the pill compartment lids.

Voice Activated

Users can use their voice to complete tasks and to ask questions to the AI. Alongside the **pillpal**'s audio feedback, this allows for seamless communication and understanding for the user in situations where they are not able to touch the screen or view the screen.

Touch Screen

7-inch touch screen provides clear information and instructions, utilising the large screen to display text/buttons/info in a large size and with high contrast. Touch screen gives easy navigation and inputs for users.
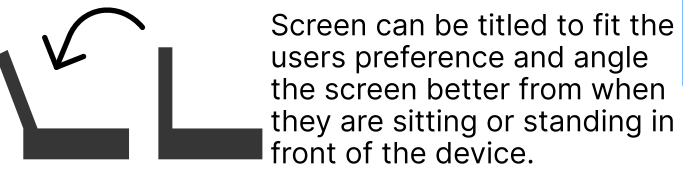
Screen can be titled to fit the users preference and angle the screen better from when they are sitting or standing in front of the device.

As the **pill pal home** is integrated with Amazon Echo, the screen doubles as a home speaker device, able to make calls, play music and videos on demand. Providing a source of entertainment gives the pill box more meaning to elders than just another medical device, as they are able to make calls to relative or stay in track with the latest news.

Speakers

Provides audio feedback to pill instructions, pill management setup and reminders. Users have the option to set the reminder sound to their preferred alarm sound, or have music be played as an alarm.

Phone Linking

To make it as easy to connect the user's phone; and the phone's of relatives and caretakers, NFC technology allows for autonomously connect users to the reminder system through SMS notifications. It also allows relatives and caretakers to be in the loop of when its time for their loved one to take a pill, and receive another notification once they have taken the pill. Using NFC technology remove the need for users to setup their profile and the profile of others individually, as the necessary contact information will be shared directly to the **pillpal home** system.

Mobile/Tablet pillpal App

Paired with the **pillpal home**, users have the option to download a free app to view their historical medical adherence reports, pills taken and pills missed. Relatives and caretakers also have access to the app and are able to view adherence reports freely and customise their own notification reminder system. The app would follow the WCAG guidelines to adhere to accessibility requirements for users, allowing assistive technologies users to utilse the app.

Smart Device Link

Pillpal can seamlessly link to any existing smart home devices in the person's home to use those devices as a backup reminder system.

Limitations

As the **pillpal home** has been designed as a home device, it lacks portability which may not entice people who are usually on the move. Although there has been some consideration for mobility impaired people (push-to-open lids, voice activation, and concave compartments), further secondary research and testing would be required to determined whether these feature would be useful to helping pill opening the lid and taking a pill. Moreover, the research only provided insight from a small set of nationalities and older adults who majority are used to using technology. Further user research would be needed to gain more insight in other older people who use technology less and other nationalities to provide better insight into their digital literacy. This would allow an optimal solution that both makes use of new technologies while bridging the person's mental model of pill organisers.

Push-To-Open Pill Compartments

Each compartment uses transparent push-to-open lid systems to make it feel effortless to open the pill compartments. Paired with the reminder system, the compartment from which a pill needs to be taken is illuminated, making the pills more visible, in addition to the audio and visual instructions provided on the touchscreen. The transparent lids allow users to be able to see whether they need to top off the pill compartment. Only the illuminated compartments can be opened, the other compartments will be locked to prevent the wrong medication from being taken.

Concave Compartments

The compartment spaces have been designed to be concave; with curved corners inside, to help users taking pills out from the bottom of the pile. This concave bowl-like shape prevents pills from getting stuck in corners and edges, making it easier to take out a pill by using the curve edges to slide the pill against the wall of the compartment.

Compartment Numbering

Each compartment has its number printed largely alongside its corresponding braille number to help people recognise the different pill compartment spaces.

Screen display: Tuesday, 16 Jan 2024 — 16:30 — Hi Ellie 👋, how has your day been? ☐ Box #5: Take 2 Tablets ☐ Box #7: Take 1 Tablet

10mm / 105mm / 200mm / 105mm / 30mm

Tuesday, 16 Jan 2024 — 16:30 — Hi Ellie 👋, how has your day been? — Upcoming Pill Reminder: 17:00

Front sectional view of concave pill compartments

Sketches and concept design available in Appendix- E

Feedback from P4

"I think this was a nice way of making a new, futuristic pill organiser. I like the tablet screen because it means I can call my grandchildren when at my dining table rather than having to bring my iPad with me. What I also like is that it looks more like a cool new tech that my daughter-in-law uses to cook, rather than more medicine, so maybe it will help me learn to cook new recipes. The pill pocket spaces are good enough for me, but I worry how would people taking more than 8 medicines at a time would use this pill organiser."

EllieGrid Product Reviews:

Chris

★☆☆☆☆ **May not work for older seniors**
Reviewed in the United States on November 8, 2020
Verified Purchase

Some older people may struggle with this product... I setup the app and pill box for my Dad and he struggle with the simple task of opening and closing the box. There is nothing on the pill box that shows you need to slide it to open. So every time he tries to open it, he try's to flip the lid up and almost brakes it. In addition, it is hard to get him to understand that when it beeps, what to do. His usual response is "what is that beeping. So the older the user, the hard it appears it is for them to use this product.

32 people found this helpful

| Helpful | Report |

Bianca

★☆☆☆☆ **Great idea, poorly executed**
Reviewed in the United States on January 21, 2021
Verified Purchase

I've had this device for three days. I was so excited when it arrived and couldn't believe it was going to be the solution I've been waiting for. I had no trouble paying for something that was going to help me take medication, especially since it was portable! And compared to a lot of other products, cheap.
I travel a lot for work and had a lot of trouble remembering to take my medication. I take a lot of medication in the morning and evening and thought this would be the perfect device to help me remember.
The first day it worked perfectly! It reminded me and sent me cute notifications as well as lighting up and ringing every time. I opened the box and the lights lit up accordingly. I thought this would be just the thing I needed!
The second day I brought it with me to work on location. A consistent red light lit up and I couldn't find any resources to help. I contacted customer service who reassured me it wasn't the device but how I was using it. I was very off put by the demeaning accusations of someone who couldn't understand why the device wasn't working. They also mentioned that this seemed to be a consistent problem with their product! I was told and did everything that was recommended to no avail. Finally when I got home it started to work again after attempting to reset it all day. It began to light up, remind me and send notifications again. I thought it must have been a fluke and I'd give it another chance.
The third day, it didn't remind me at all. Nor when I remembered to finally take my medication no lights lit up as they had before. I had to check on the app which medication was which since a lot of mine look the same. I checked the battery life and it was at full power. Again, I contacted customer service in which they offered to send a replacement. At this point I had had enough. I didn't want to fight with a device that was supposed to be helpful. I really wanted this to work but it's not worth fighting for and the massive headache it gave me.

55 people found this helpful

Kalidas Radhakrishnan

★☆☆☆☆ **Pretty box, but useless beyond that**
Reviewed in the United States on August 1, 2023
Verified Purchase

The box is pretty. Functionality wise, It is useless considering the amount you spend to buy it. It needs the phone nearby to work. No built in time/clock functionality. I wonder if most of the reviews here are real. If we are using a pill box, then we have some complex health issues and the box is supposed to help us. This one is pretty useless beyond its looks. If you are paying $149 and all you get is a functionality heavily dependent on your mobile device, please look for better options. I am medication heavy and this box makes it more difficult to manage your medication. On account of its prettiness, I give it 1 star. I do feel bad for the founder, but come on, it has a very weak alarm. Completely defeats the purpose for people like me who don't like to lug a phone around all the time. My mistake as I should have done my homework.

| Helpful | Report |

C. Alford

★☆☆☆☆ **It's a $150 pill container**
Reviewed in the United States on November 3, 2021
Verified Purchase

It constantly disconnects from my (new) i-phone 13 pro. Even with all permissions enabled and Bluetooth on and auto connect turned on...I was having to reset it every day and have finally given up. The app still reminds me to take my meds...but the pill box does absolutely nothing. It's just a plastic pill holder. No alarm, no lights...I wish I had saved my money.

2 people found this helpful

| Helpful | Report |

Price

★☆☆☆☆ **Pay for the app monthly !!!!???? Why?**
Reviewed in the United States on April 19, 2022
Verified Purchase

I was very unhappy with this. Traveling was a pain cause the lid would slid open some an pill will fall out, the app you have to pay for to have a text sent to your care taker an that doesn't even work after texting it 4 times. One other thing is... small pills will get stuck in the tracks if you have it on its side.
They need to think on their way of remaking this an the price isn't with on paying for when the text alarm doesn't the work.

3 people found this helpful

Interview Questions:

A. Personal Information

- Can you share a bit about your overall health and any medical conditions you have?

B. Medication Background / Tech Background

- How many different types of medication do you take?
  - How often?
- What medications are you currently taking?
- What is your daily routine for taking medications?
- How long have you been taking them?
- What kind are they? (e.g. capsule, pill, liquid)

C. Awareness and Understanding of Timely Medication

- How do you organize and manage your medications at home?
- Have you used any auxiliary tools such as pill organizers, reminders, or other technologies to help manage your medication better?
- where did you learn about these tools?
- Are you still using them?
- How do you use these tools?
- How helpful are these tools to you?

D. Challenges Faced

- How do you find using your pill organiser?
- How long does it take for you to complete your pill organisation?
- what would you/do you do if you can't fit any pills into your pill organiser?
- how do you keep track of what pills to take and when to take them?
- What sort of challenges do you face when it comes to managing your medication/pills at home?
- Do you ever have difficulty identifying your pills? / Do you experience challenges when trying to identify or distinguish one pill from the next?
- Do you usually read the instructions/prescription before you take the medicine?
- Did you find some difficulties while reading them?

E. Assistance and Support

- Is there anyone providing support during your medication process, be it family members, friends, or community members?
  - How do they help you?
- Do you comfortable & confident with using tech? give examples of what you can do?

F. Solutions, Improvements and Recommendations

- What do you think would make your experience of managing your own medication at home better? Why/How do you think this would improve your day-to-day?
- What are the areas for improvement

Participant Information:

	P1	P2	P3	P4
Nationality	Chinese	Chinese	Zambian	Lebanese
Age	83	71	62	87
Gender	Female	Male	Female	Female
Live in	Guangxi Province, China	China	Harrogate, UK	Houston, USA
Occupation	Retired	Retired	Nurse	Retired
Health Conditions	Heart disease, High blood pressure, Sciatica, Rheumatism, Geriatric depression / anxiety, Early Alzheimer's disease, kidney stone	Heart disease, high blood pressure, cerebral infarction	Hypertension, Asthma	Arrhythmia, high blood pressure, poor vision
Usage/ type of pillbox	Never	Pill sorting box	None currently - used a traditional pill organiser in the past	Weekly Pill Organiser box

Proto-persona:

Mrs. Beatrice Heart

Background:
- 75 years old
- Female
- Lives independently (widow)
- Children live nearby and often visit to help out
- Already uses a traditional pill organiser
- Basic level and usage of technology

Conditions
- Hand tremor in dominant hand
- Pre-dementia
- Poor eyesight (short sightedness)
- high blood pressure

Pain Points:
- Tremor in dominant hand makes it hard for her to keep things steady.
- Recent decline in cognitive ability due pre-dementia diagnosis.
- Children have to remind her of the medications she needs to take.
- Trouble reading small prints and small letters without her glasses.
- Has to take medication for extended amount of time due to high blood pressure
- Has to organise many different medications for the week, each specific intake times.

Motivations:
- Reminder system for taking medication
- Easier organisation for medication
- Easy to take out right amount of pills
- Ability to involve children in the tracking of medication intake.
- Ability to complete her tasks independently

Empathy Map:

Says

"I have been taking the blood pressure medication for decades. It need to be taken for live"

"They (her children) helped me a lot when I was suffering the illness"

'very satisfied with my current pill organiser, I don't ask for more'

"I have been able to organise my pills on my own from when I started using the pill organiser'

"They (her children) do the diligence of getting my medication and delivering them to me"

"I keep my pill organiser on my dining table so that I am always reminded to remember about the pills I need to take"

Thinks

thinks she could still handle all the medication stuff by herself

become easier to forget taking medicines recently

Wonders if there is an easier way to organise her pills

Does not like to bother her children

Asking for help is a nuisance

Thinks that there is not a better solution than the traditional pill organiser

BEATRICE

75 year old widow with multiple health conditions including poor eye-sight, high blood pressure, hand tremor and pre-dementia.

Does

She always forgets that she have already taken her medicine, and will take them again, which cause an overdose

Having difficulties on reading the medication introduction

Her son collects and delivers medication reserved for her from the pharmacy

Receives help from children to organise medicine every week

She places her pill organiser in one stop in her home that she remembers

some tablets need to be cut in half to take

Relies on family members for the procurement and sorting of medications

Sometimes Requires Reminders to Take Medications Promptly

Experiences some difficulty when distinguishing between similar-looking pills

Feels

Struggles to ask other people for help

She is very comfortable with using the pill organiser

Grateful for the assistance that she receives from her children

May feel annoyed when she her hands shake when she has to grab and take medication

Can feel frustrated when not being able to distinguish different pills

feels uncomfortable after double taking medicines

Affinity Diagram:

Medical Background

Cardiovascular Conditions
- Heart disease P1
- arrhythmia (Diagnosed 3 years ago)
- Sciatica P1
- Rheumatism P1
- High blood pressure P1
- High blood pressure P4
- Water to move around. Can wait for time enough before needed to stop or sit down P4
- Hypertension P3

Mobility Conditions

Cognitive Conditions
- Depression /anxiety in old age P1
- Early Alzheimer's disease
- Cognitive decline due to cerebral infarction. P2

Other Conditions
- Suffers with asthma P3
- Kidney stone P1
- nourishment P1
- Toothache P1
- Glasses for poor vision, but no visual impairment

Pills/Medicine taken
- LOSARTAN 50 mg (treat high blood pressure) P4
- SIMVASTATIN 20 mg (decrease elevated lipid levels for weight loss)
- Other Adjunct Medications P2
- Fostair inhalers P3
- Salbutamol P3
- Metoprolol: Reduces cardiac burden, controls hypertension.
- Indapamide P3
- Cetirizine P3
- Ginkgo Biloba Extract: Aids in vascular dilation. P2
- Vitamin D P3
- trihexyphenidyl hydrochloride
- Shensong Yangxin Capsule P1
- Nifedipine Extended Release Tablets. Controls hypertension. P1
- Heart saving pill P1
- Antihypertensive Medications
- Calcium Supplements and Vitamin D: Maintains bone health.
- painkiller P1
- Nitroglycerin P1
- Vitamin A/E/D P1
- Stroke Treatment Medication P2
- Cardiovascular Medications P2

Taking Medicine

How long they have been taking the medication
- Has been taking this medicine for 10 months P2
- Has been taking this medicine for 20 years P3
- Taking these medications since being diagnosed with arrhythmia
- Some medicines have been taken for decades and need lifelong medication P1
- Has been taking this medicine for 5 years P3
- Takes other medicines for long time due to age P4

Type of medicine
- Inhaler P3
- Tablet P3
- Capsule P3
- big pills P1
- Pills and tablets P4
- capsules P1
- big / small tablets P1

Medication problem
- some tablets need to be cut in half to take
- Some pills are as big as a meatball P1

Medicine Routine
- At the end of each week, the participant will refill her pill organiser
- Known to 11am by memory and by checking the time
- Takes medication at breakfast and bedtime P3

Frequency of medication intake

Regular/routined intake of medicine
- Calcium Supplements and Vitamin D: Maintains bone health. (Once daily) P2
- trihexyphenidyl hydrochloride: one pills twice a day P1
- LOSARTAN, DILTIAZEM & AMIODARONE in the morning after breakfast P4
- Nifedipine delayed release tablet: one tablet twice a day, morning and evening P1
- Metoprolol: Reduces cardiac burden, controls hypertension. (Twice daily)
- Fostair inhalers x2 puffs twice a day P3
- Indapamide 5mg once a day
- Vitamin D once a day P3

Conditional intake of medicine
- Vitamins: one pill per day P1
- Rheumatism: before the breakfast and after the dinner, twice a day, two pills.
- ASPIRIN at 11am SIMVASTATIN after dinner P4
- Ginkgo Biloba Extract: Aids in vascular dilation. (Three times daily)
- Salbutamol x2 puffs when required P3
- Cetirizine once a day P3
- Having Shensong Yangxin Capsule every now and then P1
- painkiller (only take when feel pain) P1
- Heart saving pill / Nitroglycerin Only take them when having a heart attack P1

Tools and assistance

Technology Usage
- Comfortable with technology P4
- Comfortable with using a tablet, phone, and recently a smart watch
- Can only use basic function of smart phone (e.g. sending voice message using Wechat) P1
- "I keep all my tablets in a drawer"
- The medicine in each period is wrapped in a tissue and numbered P4

Medication Organisation
- Uses the traditional plastic weekly pill organiser
- Confident using technology - mobile phone, tablet, emails, social media P3
- Confident using technology - mobile phone, tablet, emails, social media
- medicines are put on the table, in a conspicuous place

Professional Assistance
- Takes her / thinks to fill up her pill organiser. Much faster than before as she is used to it
- No always close to her whenever she needs to take medication
- "I try to keep my Salbutamol inhalers in my handbag"

Assistance/support from family members
- Her cardiologist explains her the medications and routine for taking the pills
- Learned to use from her parents, from them, she has only used the traditional pill organiser
- Her son will go to the pharmacy to get the medication reserved for her and deliver it to her
- The caregiver (her older daughter) help she to organise the medicine every two days.

problems met with organisation
- Relan on the little to assist with Daily Medication Planning
- A large number of medicines need to be organised P2
- Relying on family members for the procurement and sorting of medicines P1
- some medicines need to be preserved in dark place P1
- Some medicines are already lost P1

Comments

Distinction of Medicine

Comments on Pill Organiser
- She finds its perfect for her needs P4
- very satisfied with my current pill organiser, I don't need to replace it P4
- The pill organiser was very helpful
- Learned about the pill organiser from the internet
- never use an organiser

Improvements
- In the future, maybe design this pill organiser in a different colour so that different sizes medicines will be easily differentiate.
- The caregiver mentioned that it's better to have the function of preventing repeated taking
- She doesn't face any challenges managing her medication schedule. She doesn't think her current process needs any improvement

Reading Medication
- She always reads the instructions and prescriptions given by her doctor P4
- Cognitive decline stability to read instructions
- Some medications only have original package. Others with have to actual ways to read taking informations

Insights:

1 People who have to take a lot of medications also need to consume more time and attention on organise them.
What does it mean? Participants did not have enough drugs to classify, and classification was an unnecessary step for them. However, it can take time and effort for the patient or caregiver to organise their pills.
Why does it matter? Participants needed the right amount of pill compartments to fit their daily needs, as well as to avoid the hassle of sorting pills. It can also be tedious process that makes them feel tired which can lead to mistake being made while organising their pills.

2 The using of organiser may be influenced by nationality
What does it mean? Participants from China tend not to use traditional organiser
Why does it matter? People have different preferences or traditions on ways to organise their medications

3 Some medications are taken in a different time periods then others
What does it mean? most medications are taken around three meals, but some specific medications need to be taken in specific time (e.g. before sleep, while suffering the disease)
Why does it matter? Not all the medications could be managed in a same rule

4 Participants with cognitive conditions experience difficulties managing and taking their medication on time.
What does it mean? They are unable to effectively take their medication without assistance from caregivers or family members.
Why does it matter? While some participants have to rely on other people, they might want to exercise independence. Additionally, others might not have access to caregivers.

5 It is important for people to be able to distinguish one pill from the next.
What does it mean? There needs to be another way for them to be able to identify that a specific pill from their organiser must be taken at a specific time without increasing the participant's cognitive load.
Why does it matter? It is important for people to be able to take the correct medication at the correct time because mistakes can be fatal.

6 Participants prefer to have their medication in known/memorable space they can access anytime.
What does it mean? Participants do not have to worry about looking for their medication when they need to take them.
Why does it matter? Participants need to take their medication at certain points throughout the day, either routinely or at specific times of the day. Therefore, knowing where the medication is and having convenient access to it is. is vital.

7 Some medications requires only a half pill while taking
What does it mean? People have to break the pills into half before taking
Why does it matter? some elderly may don't have the ability to break the pills, or they need some tools to help

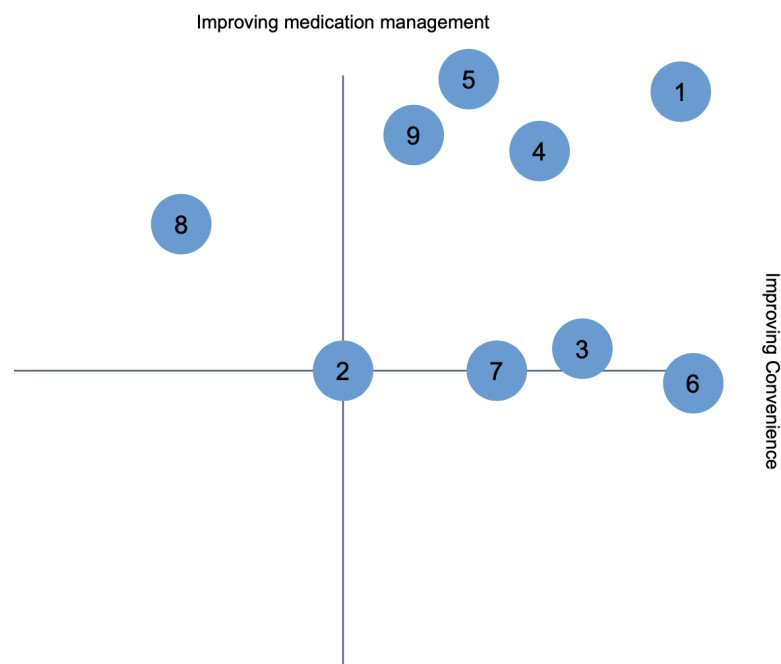**8** Baby-boomer/post war generation participants were satisfied with using a traditional pill organiser.
What does it mean? Their strong-willingness to be independent might overshadow their need to change or improve something.
Why does it matter? Participants may be able to have a better experience if they are willing to try something new or try mention what could be better.

9 Majority of participants without cognitive capabilities are comfortable with technology.
What does it mean? These participants are able to understand and utilise different forms of information from different mediums of sources.
Why does it matter? It can give the participants a sense of independence by completing tasks using technology on their own without the need of help. Participants are able to adapt to learn new technologies but would require clear instructions and guidance.

Insight Matrix & Key Insights:

Axes: Improving medication management (vertical), Improving Convenience (horizontal)

Plotted points: 5, 9, 1, 4, 8, 2, 7, 3, 6

1 People who have to take a lot of medications also need to consume more time and attention on organise them.

3 Some medications are taken at different time periods than others.

4 Participants with cognitive conditions experience difficulties managing and taking their medication on time.

5 It is important for people to be able to distinguish one pill from the next.

**9** Majority of participants without cognitive capability challenges are comfortable with technology.

SWOT Analysis:

using a traditional shape

small and exquisite

save time on organize the pills

be supported with app

The amount of medicine is displayed through the lid

different size compartments

easy to understand how to use after setting up

Automatic counting of the pills

S Strength

poor airtightness

hard to pick up the pills

hard to distinguish the pills

unhygienic

only suitalble for pills/tablets/capsules

Lid slips off easily

notifictions are not obvious

inflexible notifications

compartments are not big enough

W Weakness

O Opportunity

portable

simplicity in design

be supported with app

pure color

Innovative way

use dot light for notice

T Threats

unconvinent for elderly

may contaminate the surrounding medicine when taken

poor capacity

Single type of storage

not portable

no audio reminder

Not intuitive enough

high price

need to pay for the extra function

miro

Accessibility Evaluation:

ID	ACCESSIBILITY ISSUE	ACCESSIBILITY ISSUE CLASSIFICATION	PAGE & PART OF PAGE WHEN THE ISSUE OCCURRED
1	WCAG 1.2.5 - No Audio Description for the pre-recorded videos	Perceivable	Onboarding, pre-recorded tutorial
2	WCAG 1.4.4 - Text cannot be resized within the app settings	Perceivable	Pill Box Settings, card titles
3	WCAG 2.4.5 - Users can only find content by clicking through menu items. No search function has been provided to help users find content.	Operable	Throughout the app
4	WCAG 2.5.5 Target Size (Enhanced) (Level AAA): The size of clickable items need to be larger. The current height of buttons are 29-38dp and should be 48dp or larger	Operable	Throughout the app
5	WCAG 1.4.3 Contrast (Minimum) (Level AA) - Text contrast not enough, need to increase the contrast between the text foreground and background.	Perceivable	Throughout the app
6	WCAG 1.1.1 Non-text Content (Decoration, Formatting, Invisible) (Level A) unexposed text, can be misread by assistive technology and confuse visually impaired users.	Perceivable	Onboarding (sign-in page), account settings page
7	WCAG 1.3.1 Info and Relationships (Level A) - Multiple items have the same description, the alt text of different items are identical	Perceivable	Throughout the app
8	WCAG 1.1.1 Non-text Content (Controls, Inputs) (Level A) - Item labels may not/do not have a label readable by screen readers.	Perceivable	Text fields, pillbox interaction on home screen
9	WCAG 3.3.2 Labels or Instructions (Level A) - Input fields are not clearly shown as editable	Understandable	Caregiver page, editing caregiver's details
10	WCAG 4.1.2 Name, Role, Value (Level A) - user interface components may not be programmatically determnied by assitive technology	Robust	Throughout the app
11	WCAG 4.1.3 Status Messages (Level AA) - status messages can not be programmatically determined by assistive technology	Robust	Throughout the app
12	WCAG 3.2.6 Consistent Help (Level A) - There is no fully automated contact mechanism	Understandable	Help page or throughout the app

Initial Pill Organiser Sketch:
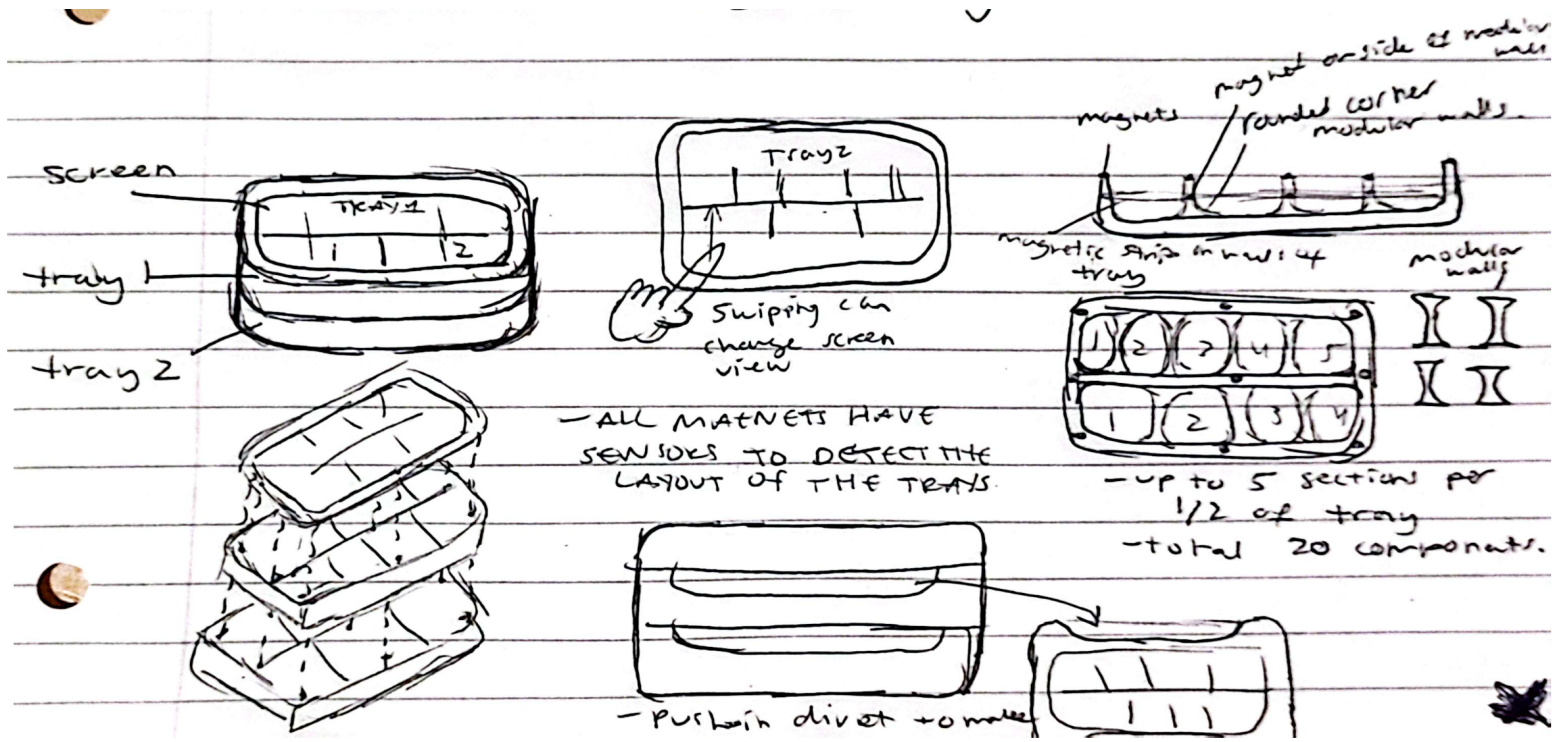
Revised Pill Organiser Sketch:
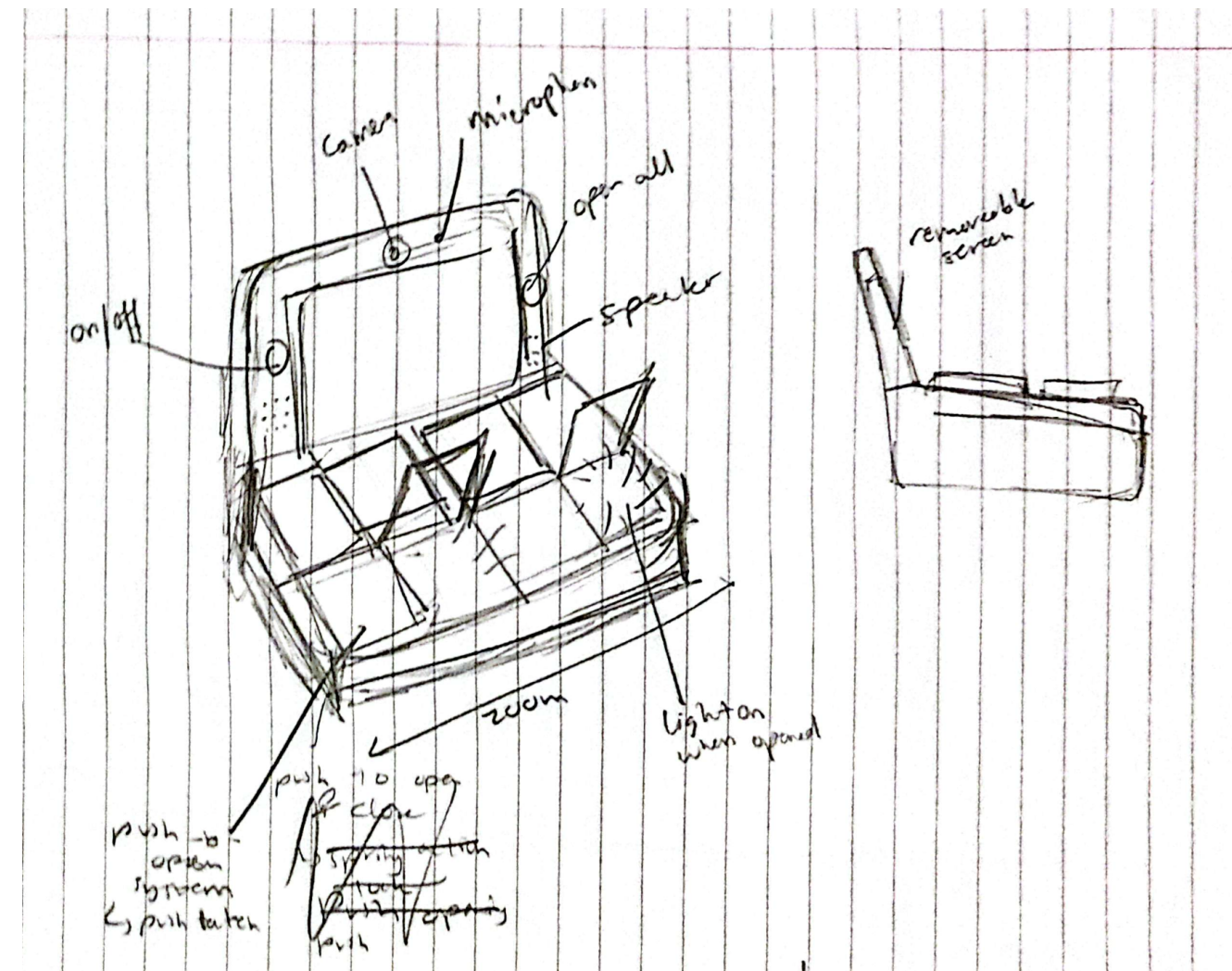
Revised Pill Organiser Scale Sketches: