

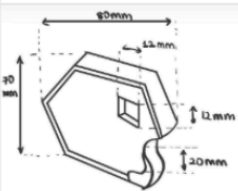
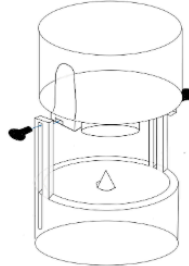
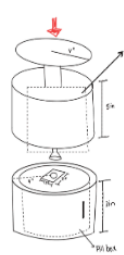
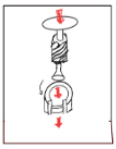
| A    | B                       | C                     | D                                                                                 | E        | F                                                                                  | G      | H                                                                                   | I                                                                                   |
|------|-------------------------|-----------------------|-----------------------------------------------------------------------------------|----------|------------------------------------------------------------------------------------|--------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|      |                         |                       |  |          |  |        |  |  |
|      |                         |                       | Switchblade                                                                       |          | Push, Cut, Pop                                                                     |        | Salad Spinner                                                                       |                                                                                     |
| Rank | Criteria                | Total Possible Points | Score/10                                                                          | Weighted | Score/10                                                                           | Weight | Score/10                                                                            | Weight                                                                              |
| 1    | Minimal Actuation Force | 25                    | 6                                                                                 | 15       | 8                                                                                  | 20     | 7                                                                                   | 17.5                                                                                |
| 2    | Simplicity/Ergonomics   | 20                    | 8                                                                                 | 16       | 9                                                                                  | 18     | 8                                                                                   | 16                                                                                  |
| 3    | Patient Safety          | 20                    | 6                                                                                 | 12       | 8                                                                                  | 16     | 8                                                                                   | 16                                                                                  |
| 4    | Ease of Fabrication     | 15                    | 4                                                                                 | 6        | 7                                                                                  | 7      | 4                                                                                   | 6                                                                                   |
| 5    | Reliability             | 10                    | 6                                                                                 | 6        | 9                                                                                  | 9      | 7                                                                                   | 7                                                                                   |
| 6    | Portability             | 10                    | 9                                                                                 | 9        | 7                                                                                  | 7      | 7                                                                                   | 7                                                                                   |
|      | <b>Total</b>            | 100                   |                                                                                   | 64       |                                                                                    | 77     |                                                                                     | 69.5                                                                                |

Table 1. Design Matrix

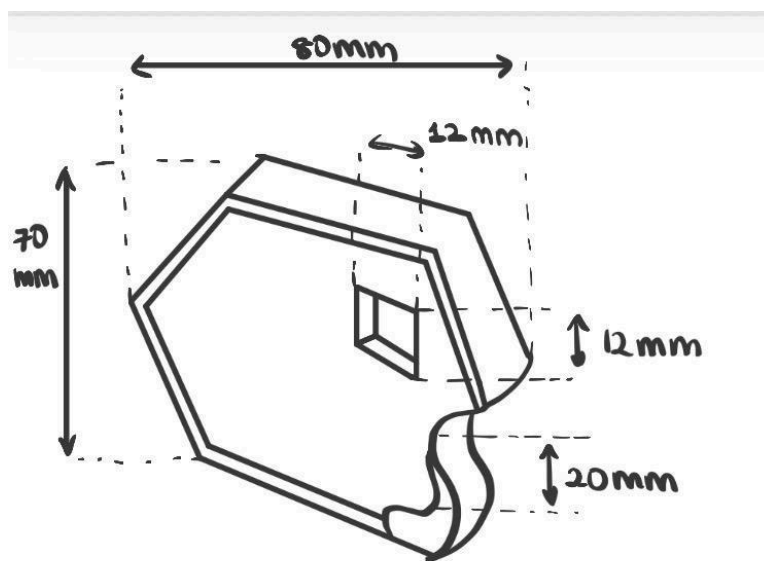
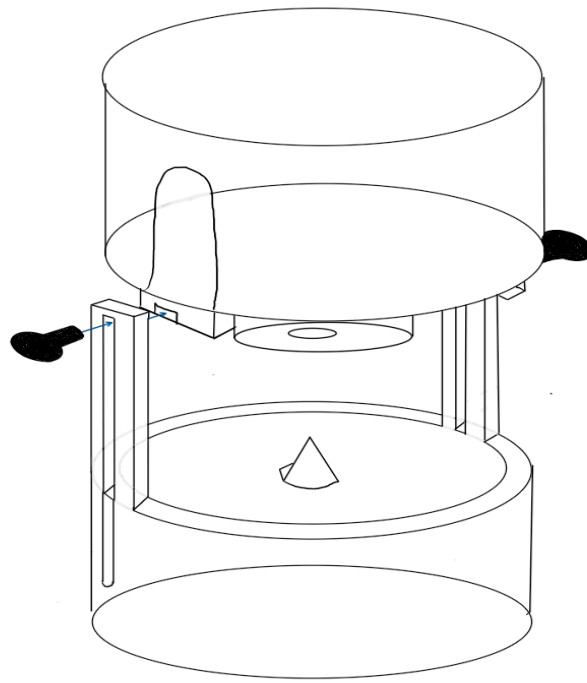


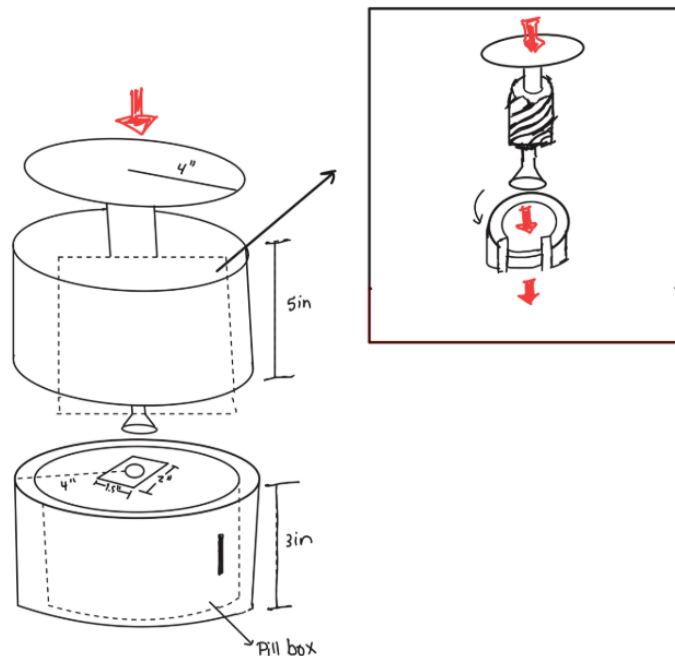
Figure 1. Switchblade

Figure 1 shows a hexagon shaped medication package opener. The user holds the device and places the curved opening against the medication package. The square cut-out is intended to act as a button that opens or activates the blade, which helps the patient cut into the package more easily. The blade would remain covered when not in use to improve safety and the overall design is meant to be reusable and easy to carry.



*Figure 2. Push, Cut, Pop*

Figure 3 depicts a proposed prototype assembly with 2 components of varying functions connected via a sliding mechanism. The base of the design acts as a tray to catch the pill and contains a strategically placed point that will pierce the foil side of the blister pack. The top component utilizes a block in its center that will apply force to the plastic side of a blister pack when a pushing force is applied to the very top of the design.



*Figure 3. Salad Spinner*

Figure 3 illustrates a small prototype operated by down on the top of the plate with the patient's palm. This downward force is what activates a spinning mechanism that drives the spiral drive through the blister pack's plastic cover, dispensing the pill through the foil backing and into the pill box below. The spiral drive will include a flat circle shaped bottom to ensure minimal pill breakage.

### **Minimal Actuation Force**

The "Push, Cut, Pop" prototype scores highest in minimal actuation force at 8/10 because the downward pushing motion allows the user to apply force using the palm rather than relying on finger strength. This is especially beneficial for users with reduced grip strength. The "salad spinner" design scores a 7/10 because the user can also activate the mechanism by applying downward pressure to the top of the device, although additional force may be required to operate the internal spiral mechanism and pierce the medication packaging. The "switchblade" design scores lowest at 6/10 because activating the blade and manipulating the device may require more localized hand or finger force. Although the device is intended to be easy to hold, the user would still need enough force to activate the blade and guide it through the packaging.

### **Simplicity/Ergonomics**

The "Push, Cut, Pop" prototype scores highest in simplicity/ergonomics at 9/10 because of its effortless downward push design. It allows patients to actuate the device without the use of extreme complexity or body weight. In comparison to the "switchblade", this device does not require finger dexterity. The switchblade is an easy to hold concept which is why it scores high

at 8/10, but it requires precision and multiple steps. The “salad spinner “ similarly scoring 8/10 is great in this category due to its great stability via the suction cup base and activation by pressing a plate. Although it loses points because of the required force needed to work the mechanism.

### **Patient Safety**

Patient Safety is ranked third and weighted 20%. This is because the safety of our patients while using our device is crucial, as our device will have many moving components and possibly exposed blades. Additionally, our client also emphasised client safety, as our patients are mostly geriatric patients who are already more prone to injury/harm. Our first design, the Switchblade, was ranked lowest at 6/10 as it is the one with the most exposed blade. Although the blade is not always exposed, it will directly pop out with the push of a button, so an accidental push of the button could potentially be dangerous. Our other two designs, the Push, Cut, Pop, and the Salad Spinner, are ranked safer at an 8/10 and neither of them have an exposed blade. They both function on enclosed mechanisms where the pill pack is being opened in between two surfaces where it is harder for a hand or finger to go in and possibly get cut. For these reasons, design two and three are preferred in terms of patient safety.

### **Ease of Fabrication**

Ease of Fabrication is ranked fourth and weighted 15/100 because while it is an important factor to consider, it is not a priority over ensuring the design can effectively open medication packaging. The “push, cut, pop” design and “salad spinner” design both scored an 8/10 because they will have similar fabrication procedures. Both designs are heavily dependent on being able to create an assembly of the components in solidworks that can then be 3D printed in the design labs. There may be a learning curve with actually creating the solidworks files but the 3D print and assembly will be a relatively easy fabrication process. The “switchblade” design scored a 4/10 because fabricating a small enough blade would be a complex process. A small, appropriately-sized piece of metal would need to be shaped and sharpened which would be hard to do with only resources from the design lab. Alternatively, a razor blade could be cut down to size, but this would be hard to do without laser equipment.

### **Reliability**

Reliability is ranked fifth and weighted 10/100. The "push, cut, pop" design scored the highest at 9/10 because its sliding mechanism guides the top component straight down onto the fixed piercing point, so the blister pack is pierced and pushed the same way with every use. With few moving parts and no blade or spring to wear out, little could fail or fall out of alignment over time. The "salad spinner" scored a 7/10. Its flat-bottomed spiral drive should dispense pills consistently without breaking them, but turning a downward palm press into a spinning motion adds internal parts that could jam or wear down, and the suction base could lose its hold on the surface. The "switchblade" scored the lowest at 6/10, since its button-activated blade depends on a small internal mechanism that could stick or fail to retract, and the blade would dull after repeated cuts. Because the user has to position the curved opening against the package by hand, its results would also vary more from use to use than the other two designs, which hold

the blister pack in a fixed position. For these reasons, the “push, cut, pop” design is preferred in terms of reliability.

### **Portability**

The portability is ranked co-last and weighted 10/100. While portability is important enough to be a metric, the portability of the product is not the most important aspect as the product would likely stay in the patient’s residence, and would only need transport throughout the residence. The “switchblade” prototype scored a 9/10. The switchblade scored the highest among the options. It is a tool that would be easily transportable. It would fit in a purse or even a smaller handbag. It would be extremely light, not a burden to move throughout the residence. The “push, cut, pop” design scored a 7/10. The “salad spinner” model also scored a 7/10. Both of these prototypes are of similar shape and size. Transport around the patients residence would be no problem even with reduced grip strength. The reduced score comes from the increased size and two-piece nature of the two prototypes in comparison with the switchblade. Despite this reduction, both models are still extremely portable and thus still scored well for this metric.