

Biomedical Innovation Project: The Smart EpiPen

Plymouth North High School

Describe the Problem:

Although EpiPens are already well established devices in society, the overall technology and different uses of an EpiPen is rather limited.

Right now in the market, there only exists prefilled Epinephrine auto injectors that consist of only one single dose of epinephrine per EpiPen (RxList). Because of this, according to NIAID food allergy guidelines, patients should carry two EpiPens as studies have found that “20% of patients may need a second dose due to ongoing symptoms” (EpiPen.com). This can be very inconvenient for people who are always on the go and who do not like to be carrying many things with them.

In addition, other problems with the EpiPen include remembering the expiration dates of it, as well as not having tech savvy components such as embedded location trackers for dispatching purposes, and for notifying hospitals/emergency vehicles. Currently with the EpiPen, it is just suggested that you contact your local doctor when it is put to use.

Our Team's Solution:

- Our new and improved “smart” EpiPen is a smaller, more compact device (7.5 inches x 1 inch) (56 grams in weight).
- It includes three separate doses for injection embedded in the device, compared to the generic EpiPen that only includes one dose. With this improvement, consumer's will no longer be required by doctors to carry around a second EpiPen in case of failure to inject. This is based off of a dose re-loading system.
- Location Tracker System: Will include a GPS component where local dispatchers are notified once an injection is seen and are additionally sent the location of the EpiPen. This is so that emergency vehicles are able to go to the site immediately if needed.
- USB Port to have the ability to charge the device.
- Will include detachable one-use parts for disposal.

Resources to Develop Prototype:

Materials:

- EpiPen for disassembly
- Programmable computer chip
- USB Charging Cable to charge device
- 3D Printer to print capsules and casing for computer chip & battery
- Chargeable battery

Budget:

- About \$20 to design prototype

How to test Prototype & Evaluate Solution:

Who to test on?

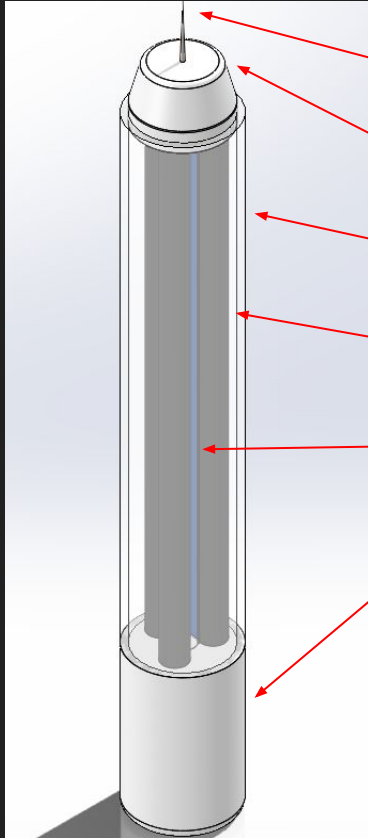
When testing the prototype, we will need to provide a method to test the Smart EpiPen safely. To test this Smart EpiPen, we will incorporate ideas from the “Ballistic Dummy Lab,” which is a company that produces accurate human replicas. These products are made out of ballistic gelatin, which is a solution of gelatin powder in water that stimulates the density and viscosity of human and animal tissue. Using these dummies, we will be able to get an accurate understanding on how the specific dosages of the EpiPen may react on actual humans without actually testing them (ballsticdummylab.com).

How to evaluate?

We will evaluate based on how well the dose re-loading system works, how accurate the location tracking system is, and specifically how experimental groups respond to each dosage for injection.

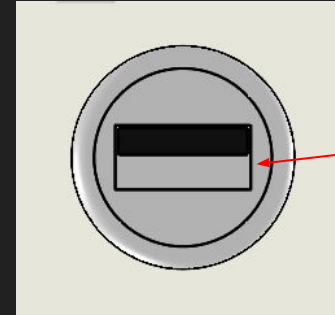
Once the product has reached final stages in testing and is safe to test on humans, we will consider reaching out to patients ranging from children to adults, who typically require the use of EpiPens for allergy purposes. This data and feedback gathered from the target audience will be helpful to compare against the common EpiPen on the market today.

Vision of final product



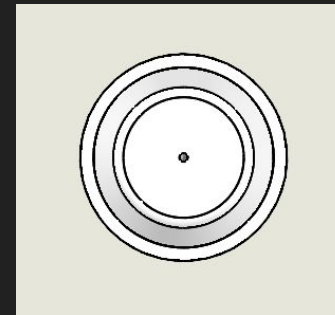
- 1. Needle
- 2. Cover
- 3. Main Body
- 4. 3 Dose Capsules for 3 separate injections
- 5. Dose Grabber
- 6. Computer Housing

Bottom View



USB port
For charging

Top View



How to Promote our Idea: How will we get the word out?

- Present to FDA for authorization
- Sending promos to large hospitals and medical corporations; reaching out to to these hospitals/corporations and presenting the product to them.
- Promote to urgent care pharmacies
- Bring product to healthcare events and conferences such as *The Innovation World Cup Series*, *Biotech Week* or *World Healthcare Congress*.



Citations:

Ballistic dummy lab. Ballistic Dummy Lab. (n.d.). Retrieved September 28, 2021, from <https://ballisticdummylab.com/>.

EpiPen Dosage Guide. Drugs.com. (n.d.). Retrieved September 28, 2021, from <https://www.drugs.com/dosage/epipen.html>.

EpiPen® Auto-Injector Epinephrine, USP Auto-injector 0.3 mg. Epinephrine Auto-Injector. (n.d.). Retrieved September 28, 2021, from <https://www.epipen.com/hcp/about-epipen-and-generic/dosage-and-administration>.

Innovation world cup series. Innovation World Cup Series. (2021, September 23). Retrieved September 28, 2021, from <https://www.innovationworldcup.com/>.

RxList. (2021, February 4). *Epipen (Epinephrine Auto Injector): Uses, dosage, side effects, interactions, warning*. RxList. Retrieved September 28, 2021, from <https://www.rxlist.com/epipen-drug.htm>.

Design Brief Worksheet: Student

Title: The Smart EpiPen -- Design Brief

Client Company	NC Designs & Co.
Target Consumer	For my smart EpiPen, the target consumers would include anyone who is moderately to severely allergic to certain foods and who has specifically been prescribed an epinephrine auto-injector by their doctor. This includes people of all ages who may be allergic to certain foods, from young children to elderlies. In addition, local drug stores like CVS Pharmacy, Walgreens, Walmart, Target, etc may choose to carry the tech savvy/smart EpiPen product in their stores for consumers to buy.
Designer	Nathalie Carlon
Problem	Although EpiPens are already well established devices for use on the go with people who have allergies, the overall technology and different uses of an EpiPen is rather limited. For example, it is often recommended by doctors that people who are at risk for severe anaphylaxis injection carry two of them in case one of them fails to inject. This can be very inconvenient for people who are always on the go and who do not like to be carrying a lot of things with them. In addition, other problems with the EpiPen include remembering the expiration dates of the it as well as not having tech savvy components such as embedded location trackers.
Design Statement	My new and improved smart EpiPen is a smaller, compact device that includes up to two separate doses for injection. People with this EpiPen no longer will need to carry two different EpiPens in case the first one doesn't work, but rather includes two different doses of injection in one. In addition to this, as consumers may be prone to easily forgetting when the expiration date of the EpiPen is, the product will set off an alarm reminder 5 days before the expiration date so that consumers can better prepare and avoid using an expired, faulty one. Lastly, this EpiPen will include a bluetooth, up-to-date location tracker where once it is put to use, local hospitals are notified and automatically send an ambulance to that exact location.
Constraints	Must be a smaller, more compact product than other EpiPens (specifically 3 inches in length). Must include up to two doses of injection. Must include bluetooth components to constantly keep an updated location of the consumer when use is needed. Must have a 911 number built into the system. Must include space for a light to flash when expiration date nears. Must be able to fit in your pocket (portable).