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REX

1.1 Contact Information

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1.2 Submitting Category

Submitting Category: Student
Autodesk Fusion 360: Yes
Aluminum: No

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2.1 Description

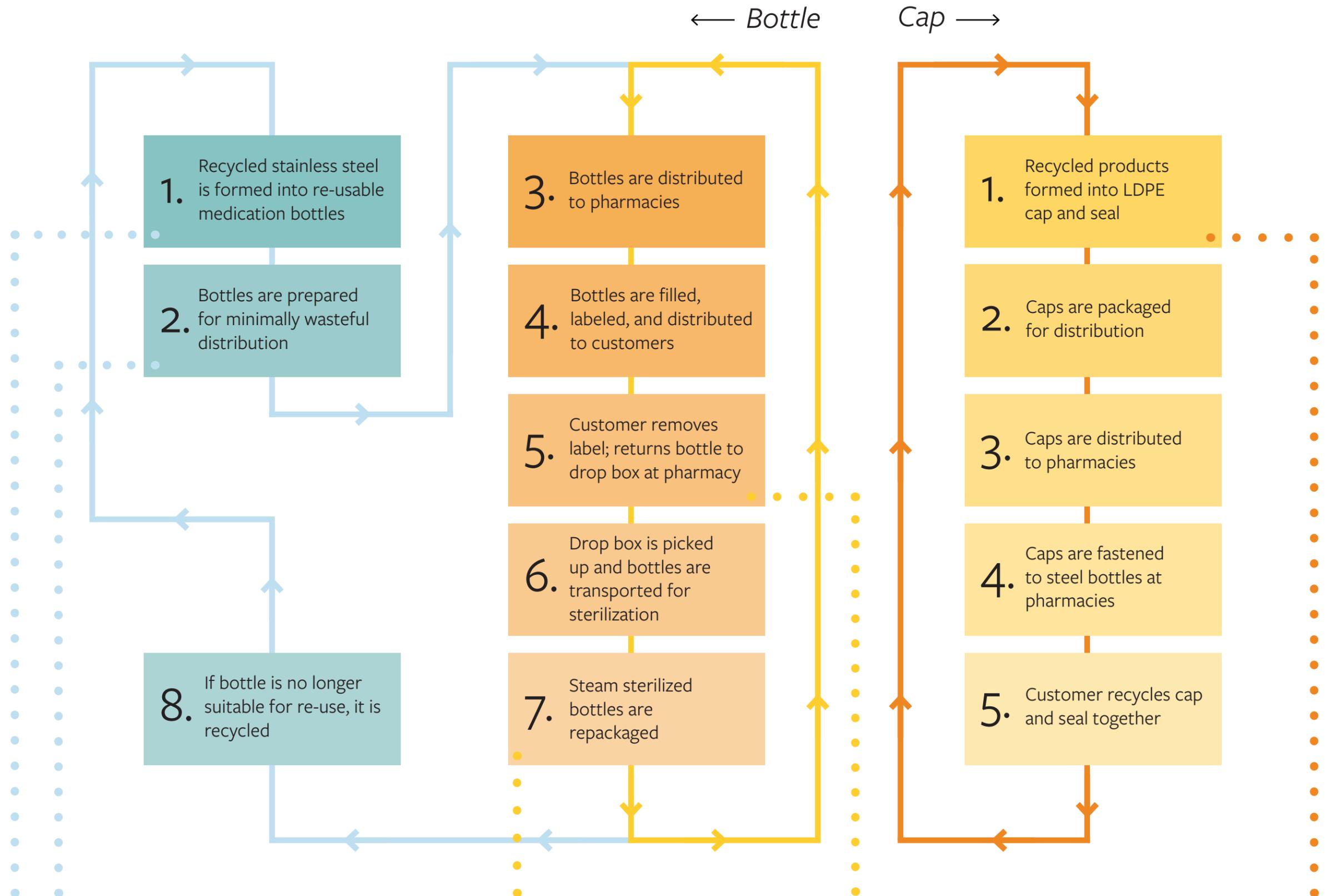
A re-usable stainless steel prescription medication bottle that eliminates the need for the constant reproduction of currently used plastic bottles, and no longer requires adhesives for labeling.



2.2 Image

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2.3 Product System



Recycled stainless steel is sourced from feed stocks, and is formed using stamping and drawing methods.
<http://www.bir.org/index.php/industry/stainless-steel/>

Stainless steel is durable and can withstand transportation with minimal packaging and protection. The only required protection will be for sterilization purposes, and this can be a recyclable LDPE bag. The bottles are sterilized with steam sterilization.

Paper labels made without additives or adhesives will biodegrade.

Recycled low-density polyethylene will be sourced from recycled LDPE products such as food containers and plastic bags.

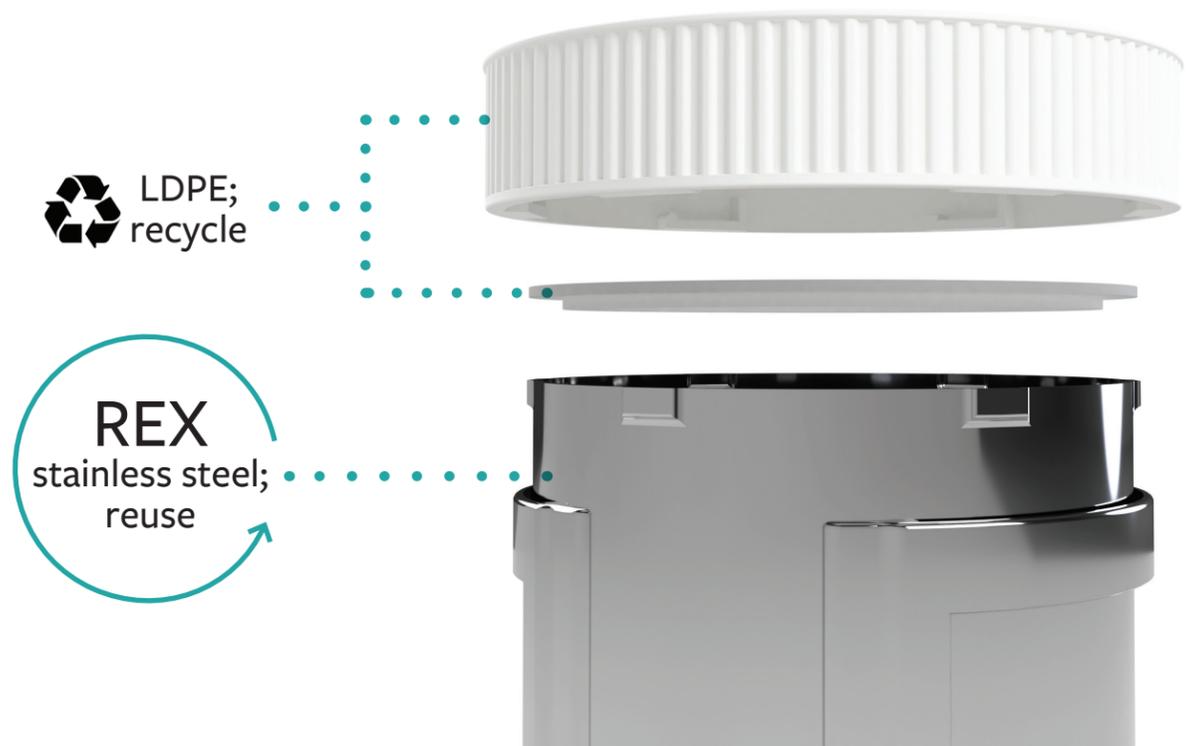
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3.0 Reutilization Cycle

REX is intended to be reused, and therefore will not need to be recycled or completely thrown away as frequently as current plastic medication bottles. The rate of production of new bottles will decrease. The child lock cap and seal will remain plastic for sealing and child lock purposes; they will both be made of the same grade of low-density polyethylene to support their recycle-ability, where as current child lock caps and their seals tend to be two different kinds of plastics that are not easily separated, which inhibits their ability to be easily recycled.

The stainless steel used to produce the bottles and label holding attachments will be sourced from recycled feed stocks. The low-density polyethylene will be made from recycled LDPE products, like food storage containers and plastic bags, or a combination of virgin and recycled LDPE. If the stainless steel bottles are recycled and reformed into the same application, there will be no question of the alloy properties and they will be very easy to recycle into the same purpose.

“Recycling one tonne of steel saves 1,100 kilograms of iron ore, 630 kilograms of coal, and 55 kilograms of limestone.”
<http://www.bir.org/index.php/industry/stainless-steel/>



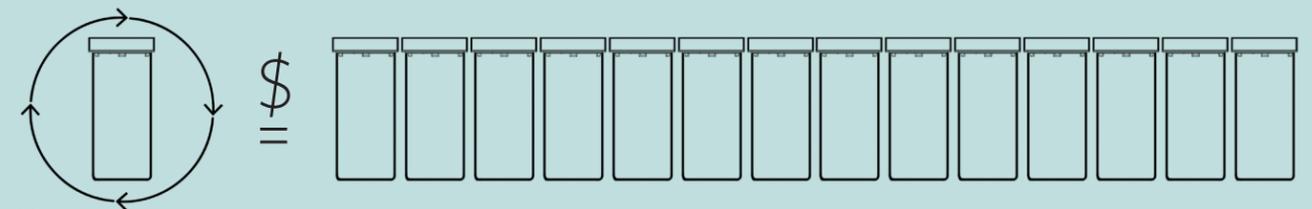
3.0 Business Model

REX is distributed by pharmacies to customers, used by customers, and then returned to the pharmacies by the customer who used the bottle. The pharmacies will have a “drop box” for the bottles. The design of the label holders allow for companies to employ single faced or pamphlet style labels, while protecting the label edges. They also allow customers to easily remove their own labels via sliding for privacy before returning the bottle, and they eliminate the need for adhesives. Pharmacies can implement an incentive program for returning the bottles, potentially in the form of discounts or credits. The bottles will be collected and transported to a steam sterilization facility, sterilized, and repacked for redistribution.

REX bottles can be reused numerous times and will only be subject to recycling when they are too damaged to be re-distributed for another refill. The condition of the bottles and their ability to be redistributed will be determined by the companies distributing them or by the companies overseeing the individual pharmacies. Stainless steel is a durable material and is not likely to be subject to frequent or fast damages. The increased cost of production of the steel bottles over the plastic bottles is offset by the reduction in the number of bottles required to be produced. The cost of transporting the bottles to the sterilization facilities is offset by the cost of taking the plastic bottles to the landfills and the cost of new materials.

A 30 dram (110 mL) plastic prescription medication bottle costs around 30 cents each at retail price. The proposed stainless steel equivalent would likely cost around 4 dollars each at retail price. If this stainless steel prescription pill bottle was reused at least 14 times, the cost of producing of the steel bottle instead of the plastic bottle would be justified. If it is reused more than 14 times, the overall cost of producing the steel bottles will be more cost effective than the production of the plastic bottles.

<http://www.calpaclab.com/amber-pharmacy-vials-child-resistant-caps-30-dram-110cc-case-240/psa-avcr30>



Production of one stainless steel prescription bottle costs approximately the same as the production of 14 plastic bottles.

One stainless steel bottle can be used, returned, sterilized, and redistributed more than 14 times. This will offset costs and save materials.

A plastic bottle is used once before being thrown away or recycled; with a label and adhesives still attached.

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Materials

4.1 Overview

Recycled Stainless Steel

Stainless steel is used for the bottle and the stamped label holder attachments. It presents itself as an item worth reusing. The material supports the life-cycle of the container and will allow it to endure many rounds of sterilization and reuse. Stainless steel requires no additional coatings to be considered 'food safe.' Common food safe grades of stainless steel are the 316 grades (1.4401/1.4404). The bottle protects the pills from UV rays. The label holder attachment is stamped separately to minimize complex procedures during manufacturing. The bottle and child lock features are stamped and drawn. The label holders are spot welded into place. These eliminate the need for adhesives in attaching drug labels to the bottles.

<http://www.bssa.org.uk/topics.php?article=45>

Recycled (or combined) Low-Density Polyethylene

Recycled or combined virgin and recycled low-density polyethylene is used for the cap, its seal, and the plastic bag used in packaging for sterilization purposes. The cap and seal must remain plastic to maintain the air tight quality required in bottling prescription medications. If the two pieces are made of the same plastic they can be recycled without being separated, unlike current designs.

Paper

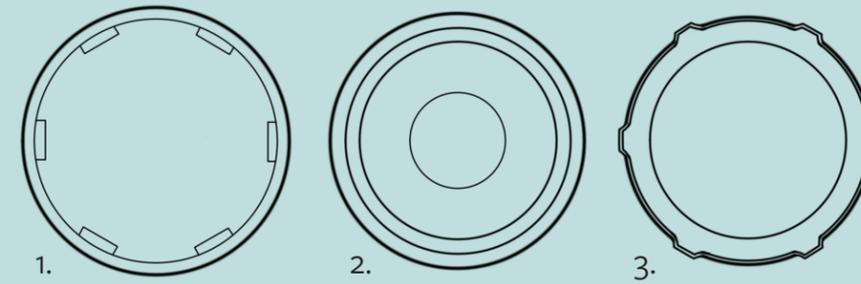
Pharmacies will still print their prescription labels as they always have, on paper with no additives or adhesives, perhaps on products from Steinbeis Papier GMBH.

http://www.c2ccertified.org/products/scorecard/steinbeis_copy_paper

Ink

Pharmacies will utilize a less toxic ink, sourced from Emerald Offset Inks.

<http://www.c2ccertified.org/products/scorecard/emerald-offset-inks-green4print-bv>



1. Low-density polyethylene cap
2. Low-density polyethylene air-tight seal
3. Stainless steel bottle with stamped child lock features

4.2 Material Reutilization

$$\frac{[(100) \text{ recycled or rapidly renewable} \times 1] + [(100) \text{ recyclable or compost-able/biodegradable} \times 2]}{3} = 100$$

This calculation is based on a material distribution estimate where 100% of the stainless steel used to produce the bottle is sourced from recycled material, 100% of the low-density polyethylene is recyclable, 100% of the paper is biodegradable, and 100% of the ink is biodegradable.

4.3 Material Health

Stainless Steel: NFPA health score 0

<http://www1.msdirect.com/MSDS/MSDS00030/00052050-20160831.PDF>

Low Density Polyurethane: NFPA health score 0

<http://aqcind.com/downloads/MSDS/MSDS%20HDPE-LLDPE.pdf>

Paper: Biodegradable

<http://www.greenhome.com/blog/eco-terms-biodegradable-and-compostable>

http://www.c2ccertified.org/products/scorecard/steinbeis_copy_paper

Ink: Primarily consists of bio-solvents and vegetable oils

<http://www.c2ccertified.org/products/scorecard/emerald-offset-inks-green4print-bv>



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Designing with Autodesk's Fusion 360

Autodesk's Fusion 360 was a crucial tool in the development of Rex, a reusable prescription medication bottle. Fusion 360 allowed for precise comparisons when making decisions regarding sizes and dimensions. It also allowed for quick fixes and adjustments to keep the evolution of the design moving forward.

Fusion 360 allows for the implementation of multiple materials into one design quickly and easily and supports rapid local and cloud based rendering for quick evaluations of choices and easy alterations. These tools are especially helpful when trying to make smart material choices without jeopardizing form or function.

The Rex model was created entirely in the parametric modeling setting in order to achieve precise measurements and details that would be plausible to manufacture.

Fusion 360 is a cloud based modeling system which makes it an exceptional tool for collaborative projects. This feature would prove especially helpful in a group setting where multiple people can work on the same design in a collaborative setting. If each member is able to fully grasp each aspect of a design and collaborate on decisions regarding form, function, and material choice, this can aid in the ability to consider features beyond those initial characteristics. It creates an environment that supports a more complete design, with consideration of the products earliest beginnings to its very end.

