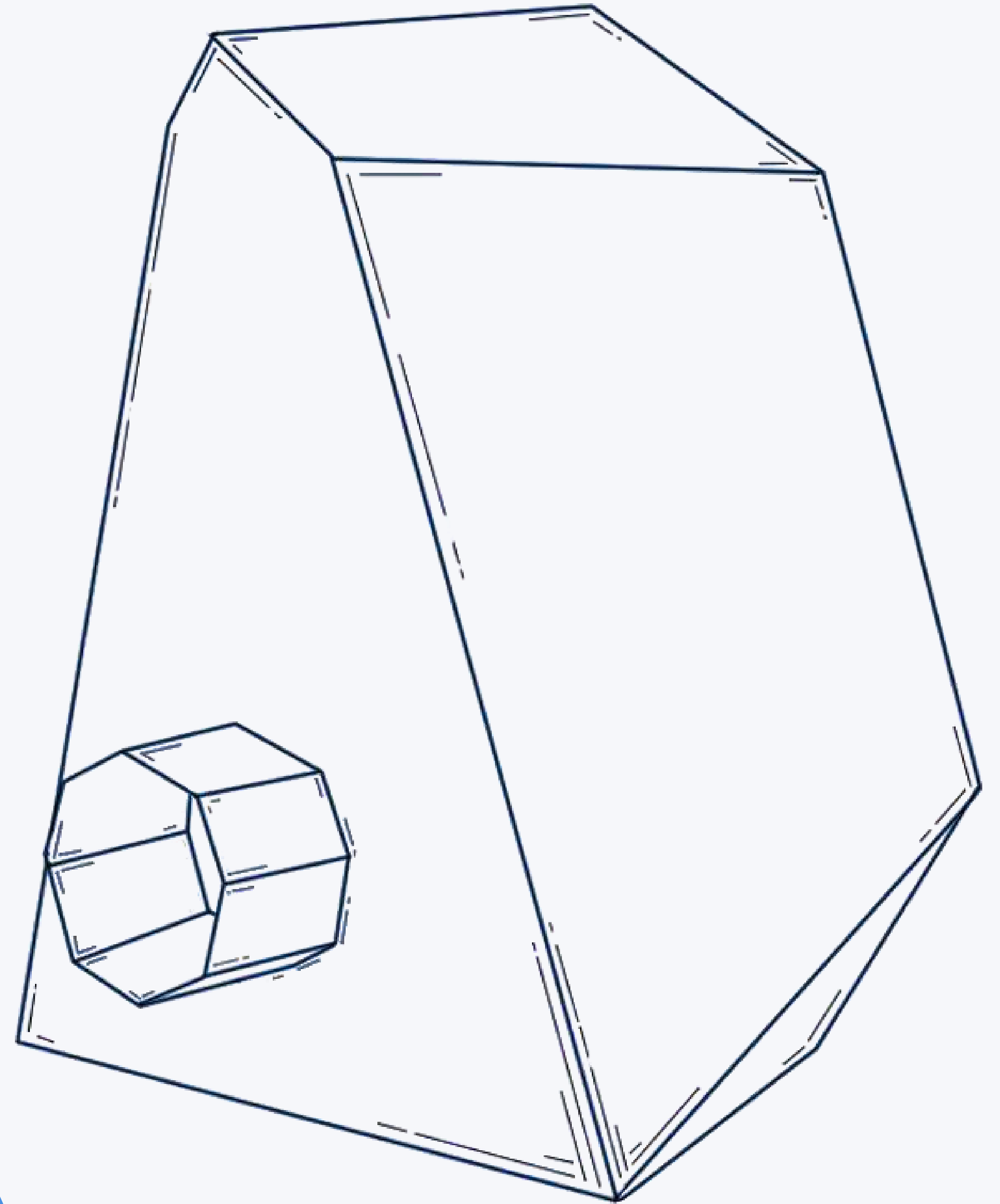


# PolyMask

Zappos – Updated May 26, 2020



# Executive Summary

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## Problem

COVID-19 has undoubtedly caused a huge strain on our modern healthcare system by creating a huge shortage of ventilators. Luckily, the FDA has approved the use of modified non-invasive ventilation (NIV) for treating patients with mild COVID-19. Unfortunately, our current NIV technologies pose a huge risk towards front-line healthcare workers since they are prone to aerosolization of the virus.

## Solution

We have developed PolyMask, a 2-part NIV mask consisting of an airtight ICU ventilation mask and a detectable filtration valve. Using PolyMask, we can filter out 99.97% of inhale and exhale particles from COVID-19 patients, allowing us to prevent aerosolization of the virus. Compared to other ventilator manufactures, PolyMask was designed for COVID-19 and provides a UV light disinfecting method of cleaning.

## Outcome

PolyMask has the potential to help thousands of COVID-19 patients by providing curial NIV treatment. PolyMask's ability to filter out 99.97% of particles, allows us to provide a treatment with a near-zero chance of aerosolization. The design of PolyMask uses a very simple manufacturing process, allowing us to cost-effectively and cheaply provide PolyMask to hospitals and healthcare facilities.

PolyMask currently plans to operate as a B2B company and will primary sell PolyMask to healthcare facilities to help front-line workers and those who are infected. After the COVID-19 pandemic, PolyMask will continue to work with health facilities, but will start diversifying by working with First-Aid Kit manufactures and First Aid Certification providers.



## PolyMask Problem

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### Ventilator Shortage

*It's estimated that more than 880,000 ventilators will be needed to meet the demand*



### Alternative Ventilation

*Modified NIVs can be used to treat COVID-19 patients, but can potentially aerosolize the virus*

COVID-19 has created a massive shortage of ventilators: the equipment required for Invasive Ventilation (IV). Even with increased production by ventilator manufacturers, we still won't have enough ventilators to treat COVID-19. To produce enough ventilators for COVID-19, **we need a 1,000% growth in production.**

Luckily, research shows that Non-Invasive Ventilation (NIV) can be used to treat mild COVID-19 patients. With 1M+ machines at disposal, the FDA has approved the use of current sleep apnea, CPAP, and BiPAP technologies to provide COVID-19 treatment. Unfortunately, using these technologies requires heavy modification since **current ventilation masks can further spread the virus** through aerosolization. Although modified, NIVs can still aerosolize the virus due to the mask's fundamental design.

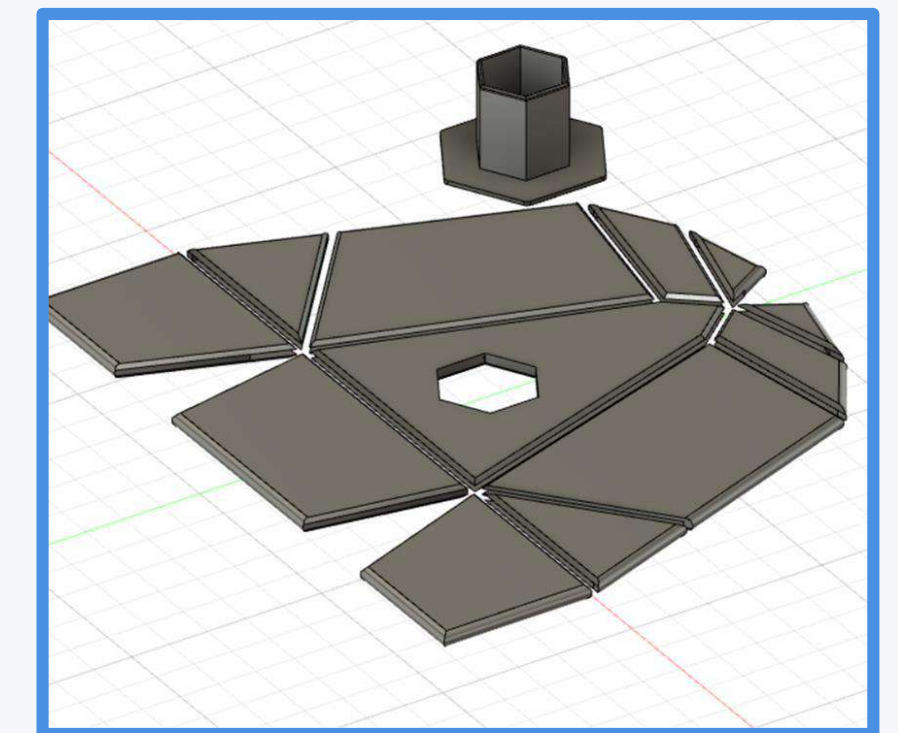
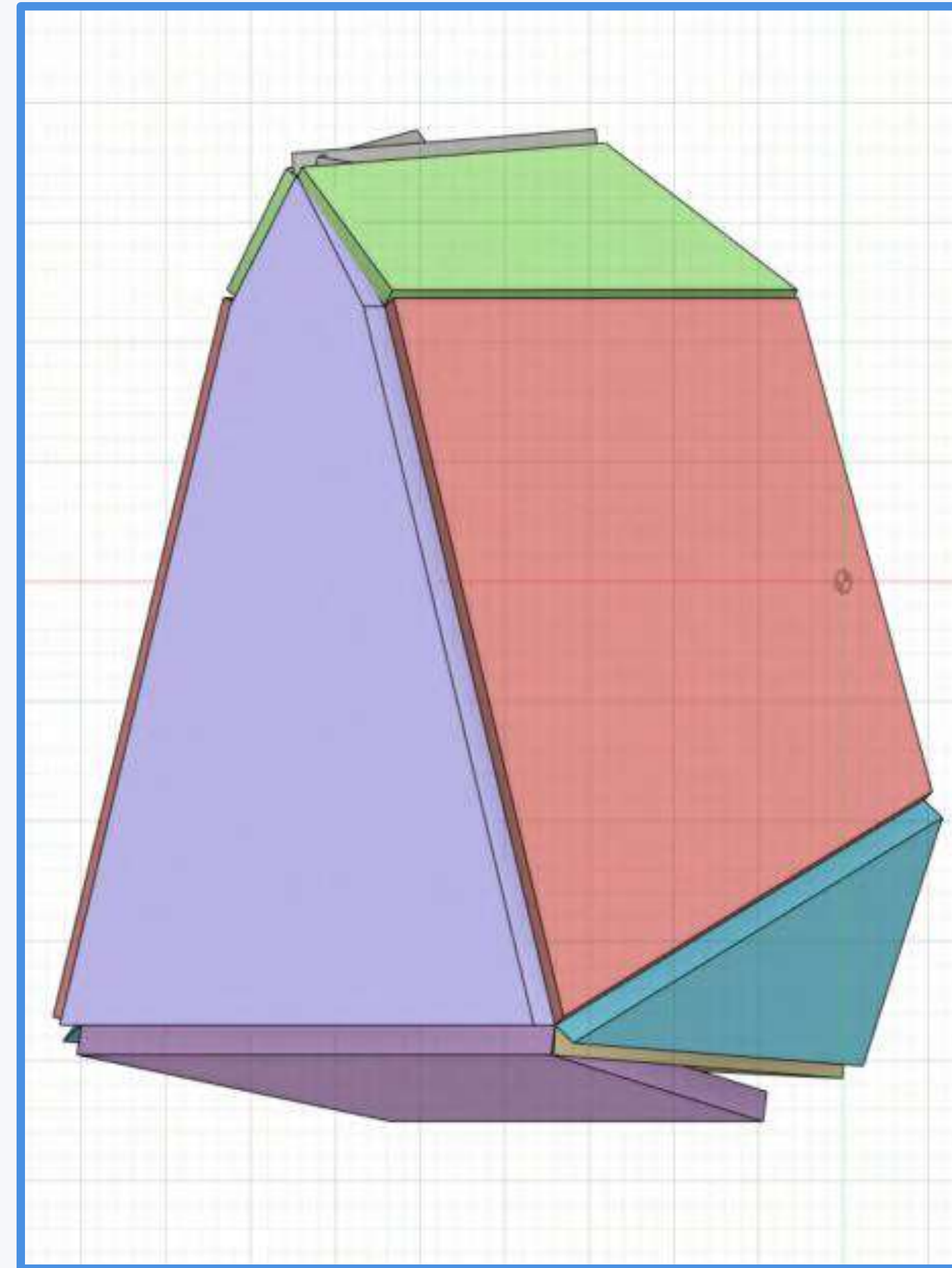


## Solution & Outcome

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PolyMask is a **foldable aerosolization-proof ventilation mask designed to provide NIV treatment** to COVID-19 patients. PolyMask consists of detectable 2 parts: a foldable mask and a filtration valve. The foldable mask can serve as a normal standalone NIV mask in the ICU and the filtration valve will only be used in environments where aerosolization is possible. It will easily connect to the base mask and filter 99.97% of inhale and exhale particles using melt-blown nonwoven fabric.

PolyMask can be used to effectively provide treatment while ensuring a **near-zero chance of aerosolization** of the virus. In addition, the detectable design of PolyMask allows for a comforting and long usage of the mask. PolyMask can also **quickly and cost-effectively ease the ventilator shortage** since it uses a simple manufacturing process.



# Competitive Advantages



## Filtration System

Our removable filtration system allows for quickly assembly in many situations. It is also made using melt-blown nonwoven fabric, allowing for a filtration rate of 99.97%.



## UV Light Disinfection

PolyMask will be manufactured with clear vinyl and UV resistant polycarbonate to allow for quick and safe disinfection using only UV light.



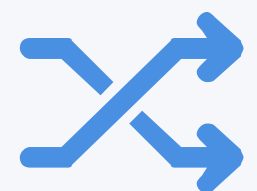
## Cost Effective

We use a simple manufacturing process and common materials. This allows us to manufacture in bulk at an estimated price of \$20 USD per mask. Shipping and other fees are estimated to be \$5 USD per mask.



## Multipurpose Usage

PolyMask was designed to be a multipurpose mask. It can be used by EMS, in the ICU, and for CPR. It's folding mechanism also allows it to be stored anywhere.





## Target Market



Medical devices and equipment account for majority of the spending in hospitals. It's estimated that hospitals spend approximately \$93B USD per year in medical equipment.

Aerosolization-proof ventilation masks have ran out in many hospitals around the world. Many hospitals are currently making makeshift masks using full-face scuba diving masks.

Estimates show that 10% of all COVID-19 patients require ventilation and only 20% of those "will ever come off" the ventilator. This is not sustainable since ventilators can't be used by other patients.

Not many patients have access to ventilation during the transit to the ICU. Ventilators are too large to fit in the ambulance, and the only viable option (during transit) is to use NIV treatments.

Ventilators are given first priority to younger individuals who deem to have a "better quality of life" as opposed to the elderly. This system puts our most vulnerable population at the highest risk.

During the COVID-19 pandemic, we will be selling PolyMask to only hospitals and healthcare facilities. In many hospitals, the current demand surpasses the supply by many orders of magnitude. Many ventilators aren't being reused and hospitals are turning to community-made NIV masks. Without the proper standards and regulations, these masks can cause aerosolization of the virus.



# Research & Validation

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## Our Research\*

*Our research shows that NIVs can be used to treat mild COVID-19 patients. While they are not as effective as IVs, they are sufficient to provide emergency care.*



## Potential Users

*We have tested our initial concept and mockup with adults who have sleep apnea. It was proven that PolyMask was a viable and comfortable mask in providing NIV.*

## Business Plan

*Our business plan has been reviewed by the prior global managing director at Cisco and by a business professor from UC Berkley. It has been also reviewed by startup accelerators.*

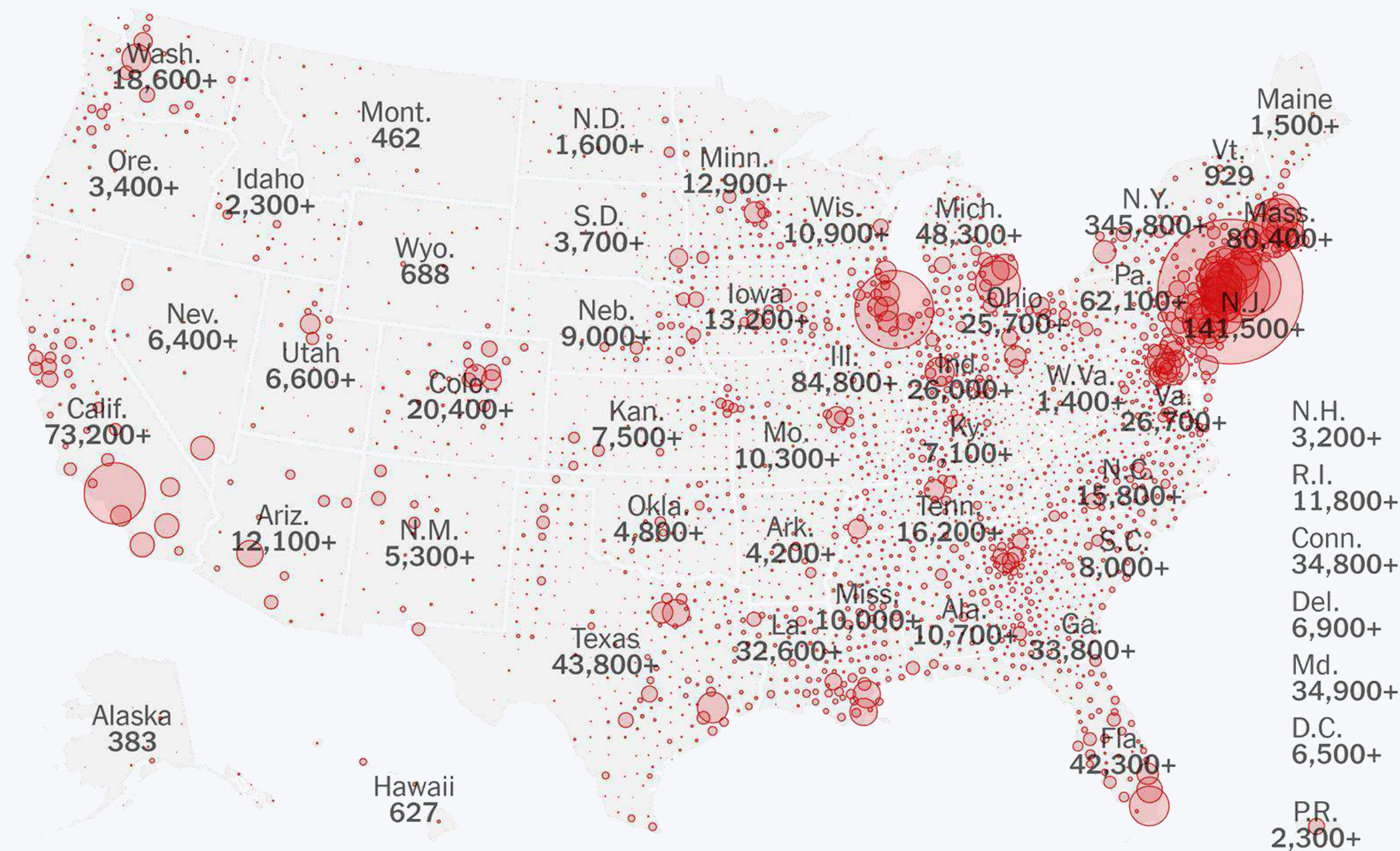


## Medical

*The concept of PolyMask has been reviewed by various engineers via engineering forums. We have also talked to front-line healthcare workers and professors from Stanford.*

*\* Access to full research workspace available upon request*

# Market Size (Pre COVID-19)



As of May 14, The US has 1.45M+ COVID-19 cases with New York, New Jersey and Illinois representing nearly 40% of all cases.

Source: Google, New York Times



## Global

The current global market size for mechanical ventilators is \$4.5B USD with a CAGR of 6.8%.



## Domestic

The USA accounts for almost 40% of the global market with a market size of \$1.43B USD.



## Post COVID-19

Due to conditions such as respiratory failure, the ventilator market is predicted to continue to thrive after COVID-19.



## Future Market Size

The ventilator market is expected to grow at a 15.8% CAGR after COVID-19.



PolyMask

## Business Model

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### Contracts with Healthcare Facilities

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*During the COVID-19 pandemic, PolyMask will only be selling to hospitals. We aim to have contracts with hospitals to provide PolyMask now and in the future.*



### Partnerships with First-Aid Kit Manufacturers

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*After COVID-19, we plan to partner with first-aid kit manufacturers. Since PolyMask is multipurpose and can be used during CPR, we hope to have them in first-aid kits.*



### Partnerships with First-Aid Certification Providers

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*Once PolyMask is in first-aid kits, we need to train first-aid providers to use PolyMask. During this phase, we plan to partner with first-aid certification providers such as St. John Ambulance.*



## Closest PolyMask Alternatives

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Unlike many of its alternatives, PolyMask was designed and engineered specifically for the COVID-19 pandemic. We focused on providing maximum effectiveness for NIV treatments, whereas our competitors focused on the comfort of the user. This allowed us to create a ventilation mask that is airtight. While PolyMask is less visually appealing and has less consumer features, it is the only mask that can fundamentally prevent aerosolization.



While ResMed and Philips are giants in the ventilation industry, their products are not suitable for the COVID-19 pandemic. The closest PolyMask alternatives, the AirFit F20 Full Face CPAP Mask (by ResMed) and the Respironics ComfortGel Blue Full Face CPAP Mask (by Philips) have a high rate of air leakage, allowing for the aerosolization of the virus. Since both masks were designed for consumer and sleep apnea use, they are designed to be more comfortable and have higher pressure settings than the PolyMask.

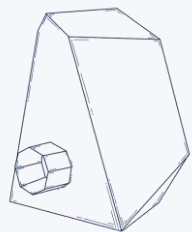
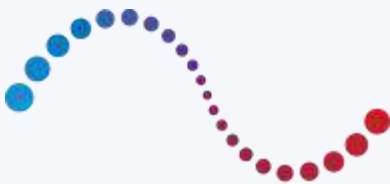




PolyMask

# Competitive Analysis

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	 <b>PolyMask</b>	 <b>ResMed</b>	<b>PHILIPS</b>	<b>Fisher &amp; Paykel</b> HEALTHCARE
Business Model	<b>B2B Focused</b>	B2B, B2C Focused	B2B, B2C Focused	B2B, B2C Focused
COVID-19 Effectiveness	<b>High</b>	Normal	Normal	Normal
Multipurpose Usage	✓	✗	✗	✗
UV Light Disinfecting	✓	✗	✗	✗
Price Range	<b>Less than \$30</b>	\$100–\$200	\$100–\$175	\$100–\$175

Unlike major healthcare and ventilator manufacturers who focus on the B2C market, PolyMask prides itself as an **emergency care and B2B focused company**. Rather than long-term consumer usage, PolyMask prefers to focus its resources and products directly towards emergency care patients. **Our devices are specifically engineered and designed for NIV usage in ICU settings**. While our competitors have B2B operations, they primarily focus on B2C operations such as sleep apnea and non-emergency care.



PolyMask

Minimum Viable Product (MVP)

We expect our MVP to cost approximately \$1,400 to build. The major costs are from the legal operations and the polycarbonate manufacturing. Since polycarbonate 3D printing is rare and our mask requires specific measurements, the cost of the MVP is higher than usual. In addition, our mask has multiple polycarbonate sections, leading to higher costs.

We believe that it'll take approximately 3-5 weeks for our MVP to be ready. Our biggest challenges are finding a manufacturer that is willing to help us build an MVP, the time spent on shipping, and the legal aspects. Once the MVP is a success, we will need to purchase custom CNC-made injection molds and work with health professionals to get them into hospitals.



Using 3D printing, we expect our MVP to arrive within 7-14 days (including COVID-19 delays).



We are currently working with legal professions and are in the process of getting a patent.

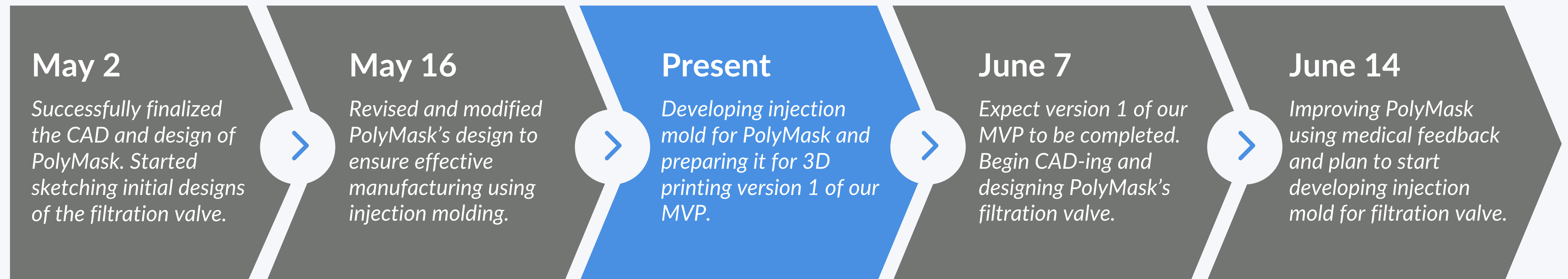
Item	Cost
Polycarbonate 3D Printing	\$500
60 Gauge Clear Vinyl	\$30
1/8 ID Vinyl Tubing	\$20
Packaging	\$100
Shipping Costs	\$50
FDA Regulations	\$400
Provisional Patent	\$300
Total	\$1,400



## Current Progress

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We have been working on PolyMask since mid-March for a total of 2 months. As of date, **we have researched NIV ventilation treatments, built our website, designed and built a mock-up of PolyMask, prototype PolyMask using a 3D-printer, built partnerships with 3 non-profit organizations, and got recognized on local media platforms.** We have consulted with university professors to ensure that PolyMask abides with medical standards and regulations. We have reached out to local manufacturers and are currently working on minor details to ensure that the manufacturing of PolyMask is seamless. We are currently internally testing PolyMask with individuals diagnosed with sleep apnea. Once the internal tests are a success, we plan to file and apply for medical regulations.





# PolyMask Manufacturing

## Mass Production

After the MVP has been built and tested, we will be moving onto mass production. We plan to manufacture only the polycarbonate sides of PolyMask to reduce costs.



**\$300**

Base Manufacturing  
Fee



**~\$3**

Per Part  
Manufactured



**2M+**

Injection Mold  
Shots



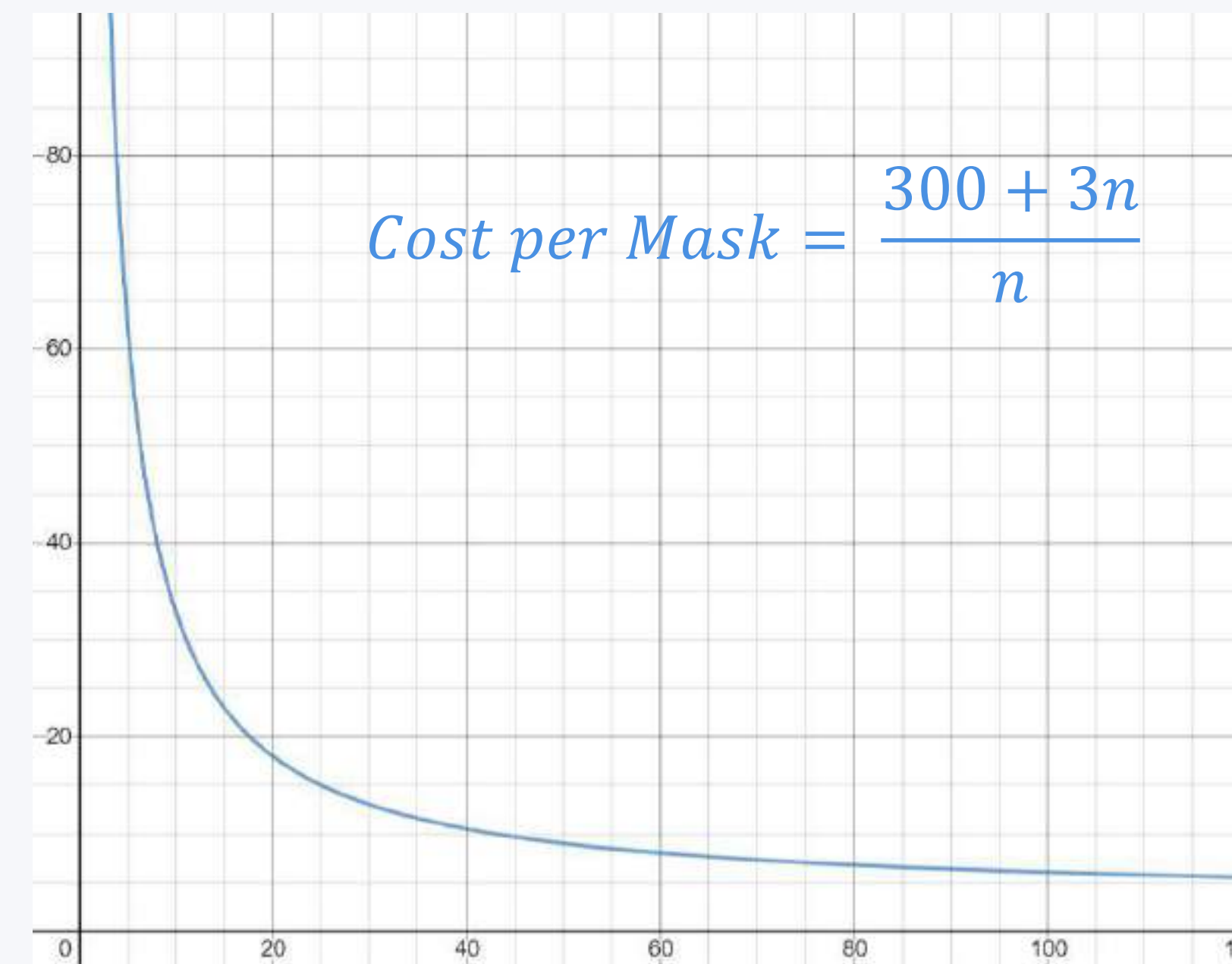
**\$400**

Custom CNC  
Mold

## Injection Molding

Polycarbonate is a hard material to work with. Due to its high melting point and stiffness, the only viable cheap method of using it in manufacturing is via injection molding. This form of manufacturing will help us reach economies of scale.

We expect the bulk manufacturing cost of PolyMask to be approximately \$20 USD per mask. The raw material is expected to cost a total of \$10-15 USD and the manufacturing process will cost \$300 USD + \$3 per piece. Shipping and logistical fees are estimated to cost \$5 USD, causing the landed price of PolyMask to be \$30 USD. The larger the order size, the lower the cost per mask will be.





# PolyMask Supply Chain

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While the polycarbonate sections of PolyMask will be manufactured via injection molding, we plan to assemble and pack the masks in-house to reduce labor costs.



## 1 Mask Assembly

*Once we receive the polycarbonate sections from the manufacture, will we attach the vinyl hinges and edges in-house. This will help simple the supply chain.*



## 2 Labeling & Packaging

*All packaging and FDA labeling will be done in-house. This will allow us to reduce costs and ensure product quality. We will also be able to optimize the packaging.*



## 3 Shipping

*For local hospitals, we plan to deliver them ourselves. For other hospitals, we will using a shipping service. The costs may be high due to express shipping.*



PolyMask

## Zappos' Involvement

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By working with us, Zappos will be able to help provide NIV treatment to many COVID-19 patients. This will help decrease the spread of COVID-19 and help re-open the economy faster. As the holder of PolyMask's IP and patents, Zappos could continue PolyMask and work with B2B companies to get it in first aid kits. Zappos can also use PolyMask to help its parent company, Amazon, get into the healthcare industry. If Zappos is aiming for an early exit with PolyMask, Zappos can sell the IP and patents to other medical device companies.



1

*With Zappos' experience in shipping logistics, we can get PolyMask into more hospitals.*

2

*Zappos' experience in with supply chains can help PolyMask reduce unnecessary costs.*

3

*We believe the mentorship and talent at Zappos can help PolyMask strive during these difficult times.*



# PolyMask

## Risks & Obstacles

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### Medical

To get PolyMask into hospitals, we must ensure that all Health Canada medical standards and regulations are met.

Although medical regulations and processes can be sped up due to COVID-19, it is very capital intensive.



### Legal

In addition to its medical regulations, PolyMask must file its legal paperwork with legal representatives.

Legal paperwork may include patents, contracts, insurance, trademarks, IP, etc.



### Manufacturing

As a medical device, PolyMask must abide to regulations and be manufactured in an FDA-approved facility.

The sourcing of raw materials and manufacturing is also an obstacle since supply chains and borders are delayed (due to COVID-19).



### Distribution

Getting PolyMask to hospitals may require crossing between states and countries, causing inconvenience and/or delays.

We'll also need to have deals and purchase contracts with healthcare facilities.



# Future Roadmap

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## Partnerships (6-9 Months)

We currently plan to form partnerships with hospitals and first-aid kit manufactures to get PolyMask to market. While we will mainly focus on getting PolyMask into hospitals, we will start working with first-aid kit manufacturers to get PolyMask into their products.



## Internet of Things (9+ Months)

Within 9 months, we expect the number of COVID-19 to have decreased and that the curve to have “flattened out”. At this stage, we plan to implement Internet of Things (IoT) into our masks. Using IoT micro-sensors, we can monitor oxygen levels, carbon dioxide density, air flow and send real-time data for analyses.



## Artificial Intelligence (1-1.5 Years)

Using IoT to transit real-time data, we can leverage Artificial Intelligence (AI) to perform through analyses using patient data. This will help doctors better diagnose and understand the problem. Using AI, we can also tune ventilation settings automatically on the doctor’s behalf.



PolyMask

## The Team

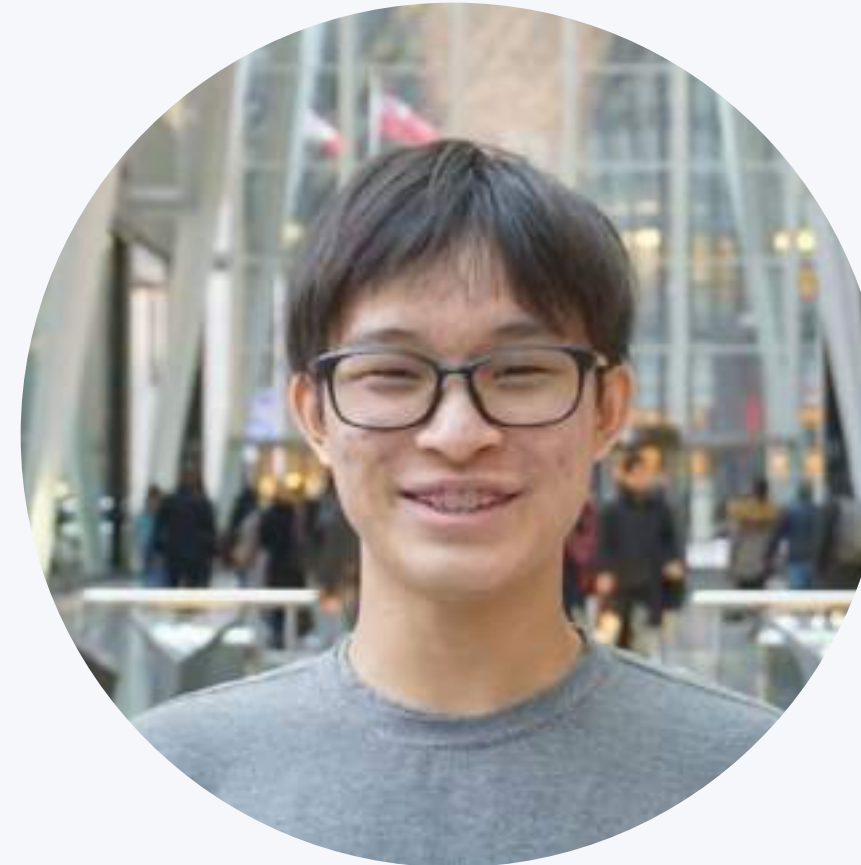
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**Ryan Lam**

Co-founder & Lead

*Physics & Computer Science student,  
Founded multiple businesses/side  
hustles, Experienced with business  
logistics & marketing*



**Marcus Chan**

Co-founder & Logistics

*Business student, Founded various  
organizations, Investor with 20%  
returns YOY, Experienced with market  
research & CAD*



**Vedaant Varshney**

Engineering & Design

*Engineering student, Chairman and  
designer for FRC national semi-finalists,  
Executive at various non-profits,  
Experienced with AI, CAD & CNC*



# PolyMask

**Questions? Contact us at:**  
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*polymask.ca*