

DIY MASK MANUAL

Due to the COVID-19 pandemic, our loved ones, public-facing workers and healthcare professionals are at risk of contracting coronavirus.

This manual outlines the need to wear masks to protect those around us, and offers an evidence-based mask-making tutorial. By taking responsibility for our own bodies and health, we can save lives.



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Updated web version, audio and multilingual translations will be posted here:

<https://covidstudentresponse.org/campaigns/ppe/mask-making/>

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This is an open-access resource, intended for free of charge distribution. Please send and print out this document for your local and global community.

Thank you for your service!

A Call to Action: Why we should all wear masks

As of 3/3/20, the United States [CDC officially recommends](#) national cloth mask use.

The mixed messaging around masks

COVID-19 has been marked by a storm of media coverage. With doctors, news anchors, policy-makers and politicians all giving different advice, it has been difficult to know what the public can do to help flatten the curve for this global pandemic other than stay home and practice good hygiene.

During the first phases of this pandemic, the messaging in the United States was clear: don't wear masks. The intention was to save surgical masks and N95s for healthcare providers and hospital staff in contact with COVID-19 patients. As the situation has escalated, mask supplies have dwindled in the U.S. and the CDC has begun recommending the use of [scarves, T-shirt masks and bandanas](#) to help prevent the spread of COVID-19 when medical-grade masks are unavailable. The conversation around the public wearing masks has been minimal, [until now](#).

Masks protect the people around you

The good news: by being responsible for our own bodies, we can protect those around us and alleviate the burden of disease carried by the elderly, the immune compromised, healthcare workers, and the essential workforce.

What can science tell us about making masks? This short answer is: it's complicated. Cloth masks vary in design, maker's skill, type of cloth / filters used, and the wearer's hygiene.

[This study](#) demonstrated that handmade masks could be 50-94% effective in protecting against microorganisms. Mixed cloth showed a high filtration of 70-75%. Although not included in the study, a common HEPA filter has the power of 99% filtration and anecdotally provides easier breathing. Surgical masks effectively [block respiratory droplets](#), and block aerosolized particles less than 1.25 microns up to 96%.

These are pretty impressive numbers, showing cotton cloth masks are useful in preventing spread of nearly ¾ of aerosolized microorganisms in the air, and are even better at blocking out larger respiratory droplets. However, as much as filtering material helps, it is not fully protective.

N95s are the only masks that fully protect from contracting COVID-19.

Hand-made and surgical masks are missing **essential protective components of N95 masks: an airtight seal and specialized, medical-grade filters**. Without an airtight seal, COVID-19 can still infect an individual wearing a surgical mask or hand-made mask by entering in places

where the mask bends away from the skin. N95 masks balance protection, filtration and breathability. They're uncomfortable, but they work.

N95s become FDA, [NIOSH-approved](#) by passing a respiratory seal test with material that filters 95% of airborne particulate matter [greater than .3 microns](#) (300 nm) in diameter. NIOSH N95s come in different sizes, and healthcare professionals in the U.S. report to yearly [fit-testing](#) to make sure their size assignment is correct. This process is so sensitive that many [facial hair](#) styles prevent full air-tight seal protection, and folks who want to grow beards need to defer to larger respiratory units which covers the wearer's entire head.

Cloth masks are not useless. They are essential.

COVID-19 has been shown to be [spread by asymptomatic carriers](#), people who do not feel they are sick but are infected. Young people and children are major carriers, which is why there was rapid, national school closures. Asymptomatic transmission makes going to the grocery store for elderly people and immune compromised individuals a life-threatening experience. Asymptomatic transmission also puts grocery store clerks, delivery drivers, healthcare workers, domestic workers and restaurant workers at risk of continued exposure over time. Increased exposure is thought to increase symptom and disease severity.

Countries such as [China](#), [South Korea](#) and [Japan](#) have done an effective job of controlling COVID-19 spread, and many Asian nations have consistently recommended that all citizens wear masks. The Director-General of the Chinese CDC [stated that](#) “**The big mistake in the U.S. and Europe, in my opinion, is that people aren't wearing masks.** This virus is transmitted by droplets and close contact. Droplets play a very important role—you've got to wear a mask, because when you speak, there are always droplets coming out of your mouth. Many people have asymptomatic or presymptomatic infections. If they are wearing face masks, it can prevent droplets that carry the virus from escaping and infecting others.”

The United States CDC Director, Dr. Redfield, [stated](#) March 31, 2020 that as many as 25% of people infected with COVID-19 remain asymptomatic. The former commissioner of the FDA has also [suggested](#) that the CDC should recommend cloth masks for the general public, to offer some protection to the wearer and decrease transmission. Director-General of the World Health Organization, Tedros Adhanom Ghebreyesus, [said](#) March 27, 2020 that the “chronic, global shortage of personal protective equipment is one of the most urgent threats to our collective ability to save lives.” **On 3/3/20, the [White House](#) announced that the [CDC recommends](#) public cloth mask use.**

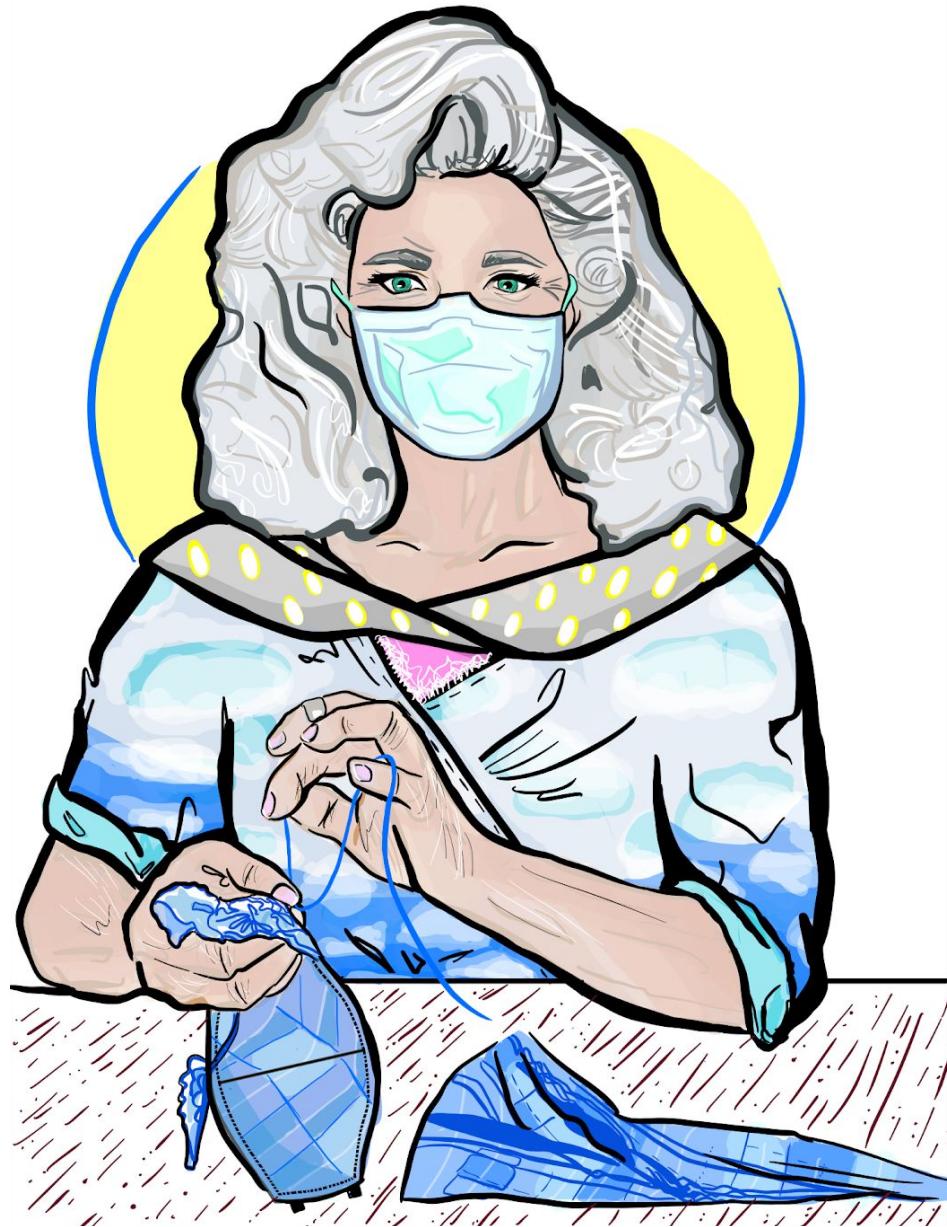
The United States does not have the same level quarantine measures as China. In our country, residents make trips for household necessities, go on walks with social distancing, order our favorite take-out, serve grocery-goers, take public transport to employment, and fly, drive or railway to various states to see our loved ones. With this freedom comes the collective duty to protect one another.

Looking into the future

The effects of a pandemic reach everyone. In the United States, UPS drivers are [denied paid time off](#) if they contract Coronavirus, grocery store workers are experiencing [unparalleled fear and anxiety](#), and our elderly population is [dying in large numbers](#). The medical system is feeling profound effects, with [doctors and nurses using garbage bags](#) as protection and healthcare workers becoming [infected](#). As of 4/2/20, 150+ [hospitals nationwide](#) are requesting “as many handmade masks as possible”, with numbers increasing rapidly.

Overall, it is [expected](#) that [100,000](#) - 200,000 Americans could die from Coronavirus.

If we do our part in making and wearing masks, we can lessen the disease burden of those around us and join a global movement of individual responsibility for the collective good. By staying home, washing our hands and wearing masks, we can flatten the curve, lower viral transmission and save lives.



Mask-Making Tutorial

These 3 mask schemas are utilized by [Stitch Room](#) in partnership with hospitals and healthcare workers on a national scale:

<https://stitchroom.s3.us-east-2.amazonaws.com/random/mask-instructions.pdf>

We are offering a variety of **classic mask styles utilized nationally**, which have varying difficulty of construction, with the simple coverage mask being the easiest. Later in this packet, we will offer **alternative materials that can be used for newer, innovative masks**. The idea behind offering various models and materials is to ensure **everyone has access to supplies that are proven** to decrease the chances of contracting and transmitting covid. We suggest considering multiple materials, to avoid creating an unnecessary shortage. Optimally, an individual should have multiple masks. **There are enough supplies in our country to make safe masks.**

Contents:

1. [The Full-Coverage Mask](#)
2. [The Filter Pocket Mask](#)
 - a. [Original](#)
 - b. [Edited version](#): less cloth, more wire, HEPA filter
3. [Simple Coverage Mask](#)

TOOLS AND MATERIALS

- *Cotton fabric
- Scissors
- Sewing machine or hands
- Pins
- Elastic or fabric for ties
- Printer for pattern or computer to watch tutorial
- Filter for filter pocket mask (optional)
- Wire for nose adherence (optional)

*Fabric must be cotton or cotton blend and washable. **TIGHTLY WOVEN COTTON is compliant with CDC recommendations**. If you're not sure what tightly woven means hold it up to the light, you should not be able to see through it.

Please contact your local hospital for their specific needs before donating!

SAFETY AND HYGIENE

All face masks should be **washed and sterilized before use and cleaned again after becoming damp or moist.** **Wash masks daily.**

Color-safe bleach like Clorox 2 or Purex 2 can be used to sanitize with hot water. Boiling for 20 minutes also works. This differs by material.

If you are using a HEPA filter, these are not washable and must be replaced.

Ensure you are not allergic to the various materials; safe alternatives are offered.

For optimal safety, once you don the mask, **do not continue to touch it or adjust the mask.** It takes some time to get used to, but re-adjusting will only increase chances of hand-mouth transmission and decreased mask hygiene.

Masks are inherently uncomfortable; they may make your face sweaty or red due to the seal. N95s that healthcare providers use are notoriously annoying. However, **you should be able to breath through your mask.**

Do not fall asleep in masks. Supervise children who wear / interact with masks.

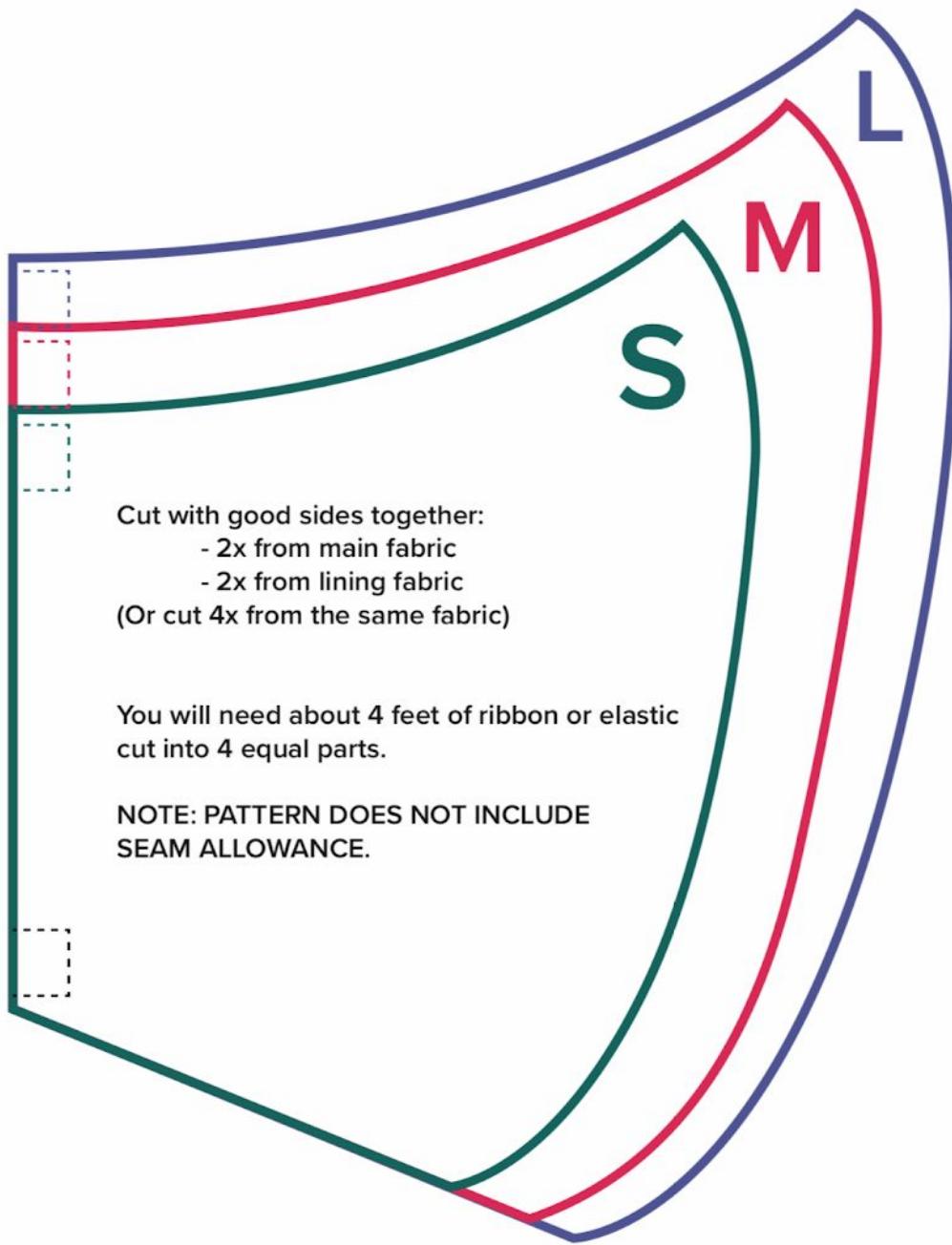
The Full-Coverage Mask

Retrieved from FreeSewing:

<https://freesewing.org/docs/patterns/fu/instructions/>

Watch the video tutorial:

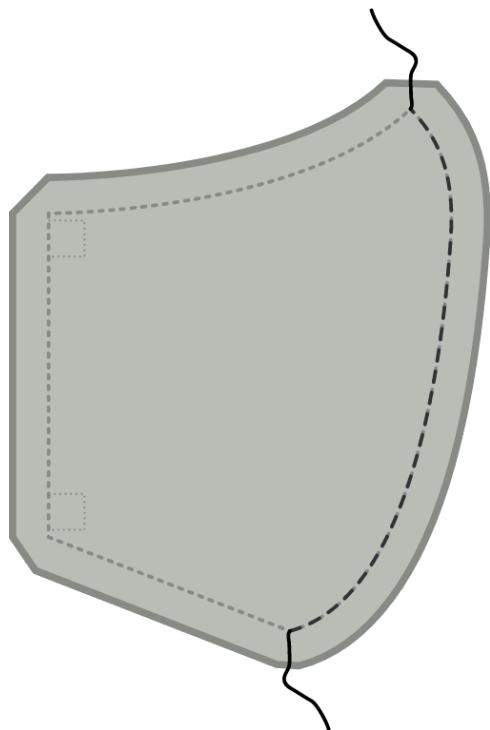
https://www.youtube.com/watch?v=VcQ69_ANsRA&feature=youtu.be



For scale, this box should be 4" when printed

Step 1: Join center seam

Join the curved seam that is center of our mask by placing the good sides together and sewing them in place.



Repeat this step for both the outer (main) fabric, and the inner (lining) fabric.

Step 2 (optional): Press the center seam

**This step has no functional value, it will only make your mask aesthetically pleasing.*

Press the seam allowance on the center seam open so the seam lies nice and flat.

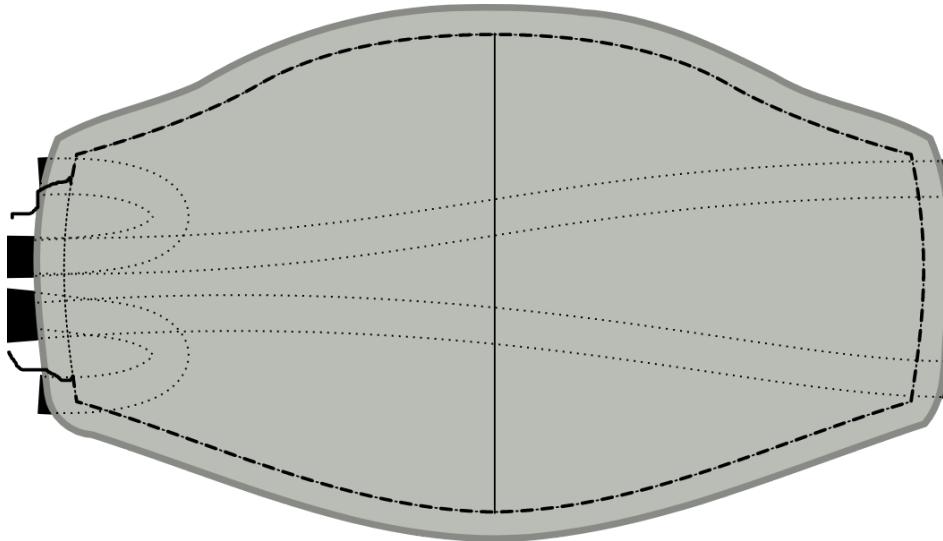
As this is a curved seam, it won't lay flat. But you can approach it with your iron from one side, then do the second half from the other side. Alternatively, you can use a tailor's hem or cushion to press.

Repeat this step for both the outer (main) fabric, and the inner (lining) fabric.

Step 3: Sew the outer to the inner fabric and attach ribbons

Now we will sew the inner (lining) fabric to the outer (main) fabric, and attach the ribbons all in one step.

- Place your lining fabric down with the good side up.
- Then, place two ribbons on the corners of one side (right in our example) so that they peak out just a bit from the mask, but the ribbon extends inwards.
- Now place the main fabric on top of this with the good side down. You should now have both layers of your mask on top of each other with good sides together and two ribbons sandwiched between them
- Pin through ribbons and layers to keep them in place
- Now do the same on the other side.



As you get some practice, you will find you don't need to pin this and can just insert the ribbons as you approach a corner.

Now sew around the mask, making sure to leave one side open so we can turn the mask inside-out later.

Be careful not to catch any of the ribbons in the seam apart from where you want them to. Either guide them through the opening you leave on one side, or bunch them up in between the masks of your layer to keep them out of the way.

Step 4: Turn the mask inside-out

Actually, your mask is inside-out now, so turning it inside out will mean we get it outside-out, or regular.

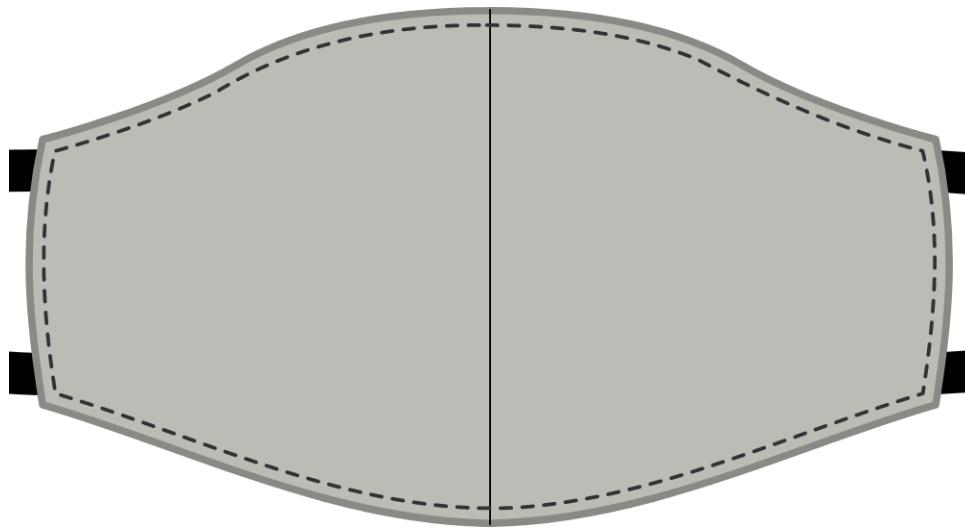
Just reach in through the side your left open and carefully pull the mask through to turn it.

Step 5 (optional): Press the mask

**This step has little functional value, it will only make your mask look better. So if you're not too bothered about that, feel free to skip it.*

Now that the mask is as it should be, it's time to press it. Before doing so, make sure to fold the seam allowance of the side we left open inwards, so that we press it flat as if it was sewn.

Step 6: Close open side of the mask and edge-stitch around the edge



Now it's time to close the side of our mask that we left open to turn it inside out.

We are not merely going to close the opening, but also edge-stitch around the entire mask to give our mask some extra stability, and keep the lining at the back.

Make sure the open side is folded neatly inside, then edge-stitch around the entire mask.

Step 7: Wear your mask or make a bunch

That's it, you're done! You can now wear your mask.

Even better, make a bunch so you can give others masks too.

The Filter Pocket Mask

Retrieved from:

<https://sweetredpoppy.com/how-to-sew-a-bias-tape-surgical-face-mask-with-flexible-nose/>

Watch the video tutorial: <https://www.youtube.com/watch?v=aHvghyn314U>

*see edited version below for removal of 1 layer of cloth and addition of a lower face wire.



SUPPLY LIST

- 100% Quilting Cotton Fat Quarters
- Sewing Machine
- Rotary Cutter
- Self- Healing Cutting Mat
- Acrylic Ruler
- Sewing Pins
- Floral Wire
- Wire Cutters

Cutting Chart

- Quilting (Tightly Woven) Cotton 3 Layers: Adult: 9" x 7" Child: 7" x 5"
- Cut 2 pieces of Double Fold 1/2" Bias Tape 40"
- Floral Wire 6"
- Learn how to make Bias Tape in the video: <https://youtu.be/-5EdcXG5oa8>

Step 1. Pin Fabric

Place two pieces of fabric right sides together. Save the third piece for the end of step 2.

Place a pin in each corner of the rectangle and horizontally mark the center of the rectangle.



Step 2. Sew Filter Pocket

Halfway down from the top of the fabric sew a straight horizontal line 2-3" long. Repeat this on the opposite side as well, leaving the middle unsewn. Refer to the photo below as a guide.



Pinch both corners of the top fabric and pull them downwards to meet the bottom. Do the same on the back fabric.



A filter can easily be slid into this pocket at the end of the tutorial.

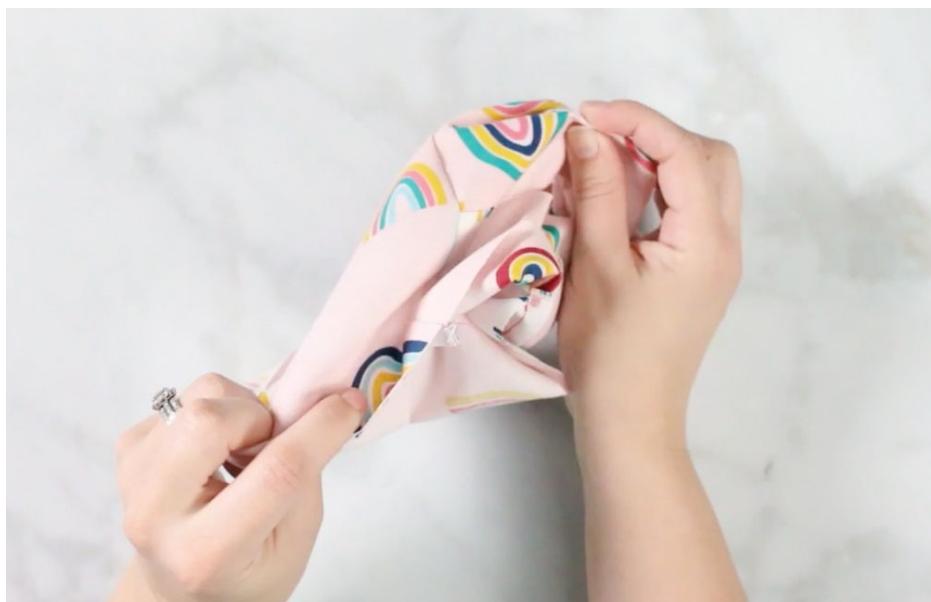
Place the last rectangle on top of the lining with right sides facing each other. Sew the short sides of the face mask making sure to backstitch at the beginning and end of each seam using a 3/8ths inch seam allowance.





Step 3. Turn Fabric

Turn the mask right side out and use an iron to press it flat. Take care to roll the seams outwards.



Step 4. Create Pin Tuck Markings

Create three pintuck markings by folding the mask in half and pressing it with an iron and then folding the outside edges to the center and pressing again.



Step 5. Sew Bias Tape.

Open the ends of the bias tape and fold them backwards so the right sides are touching each other. Sew a straight line along the short end of the bias tape making sure to backstitch. Turn the corner right side out to create a clean finish.

Find the center of the bias tape and position it at the center of the mask. Open the bias tape to align the raw edge of the bias tape with the raw edges of the mask. Pin in place along the length of the mask. Sew the bias tape in place along the crease closest to the raw edge, repeating this on the opposite side.

The filter slot should be facing away from you, this will be located on the backside of the mask.



*OPTIONAL: Cut a 5-6 inch piece of floral wire to create a flexible nose piece. Bend the ends of the wire inwards to prevent them from poking through the fabric. Slid the wire into the bias tape along the top middle of the mask. Pin on either side of the floral tape and push it upwards to avoid sewing over it.



Fold the bias tape upwards and encase the raw edge, pin in place and sew along the entire length of the bias tape 1/4th of an inch from the edge.



You can use your fingers on either side to guide the bias tape as you sew it.



Step 6. Create Pin Tucks

Create 1/2" folds facing downwards. Pin the folds in place making sure all tucks are facing the same direction.



Step 7. Topstitch

Sew over the pintucks along the right and left edge of the entire mask using a 3/8ths inch seam allowance.



HOW TO SEW A FACEMASK



1

CUT FABRIC

Cut 2 pieces of Quilting Cotton 9" x 7".
Cut 2 pieces of Bias Tape 54"



2

PIN FABRIC

Place 2nd piece of fabric on top with right sides together. Pin along right and left side leaving top and bottom unsewn.



3

SEW FACE MASK

Sew right and left side of mask using a 3/8ths inch seam allowance. Turn right side out and press flat.



4

CREATE PIN TUCKS

Fold mask in thirds and press. Create 1/2" pintucks facing upwards using pressed markings as a guide.



5

ATTACH BIAS TAPE

Open bias tape & align raw edges of fabric together with bias tape along mask. Sew along crease. Insert wire along top. Close bias tape, pin upwards & sew shut.



6

TOPSTITCH

Sew along either end of the wire to hold in place. Sew along over the pintucks along the right and left side of mask using a 3/8ths inch seam allowance.



Filter Pocket Mask EDITED

Edited: Improved breathability while maintaining filtration

1. Decreased layers of cloth from 3 → 2
2. Added a second wire along the lower edge of the mask

*as the [literature shows](#), layering fabric does not improve filtration ability. By decreasing the mask's layers and adding lower face reinforcement, the balance between breathability and safety is improved. This is a suggested design, but has not been rolled out on a national level and is not yet endorsed by Stitchroom.

By Eloise Sherrid, with advising from Beverley Sherrid

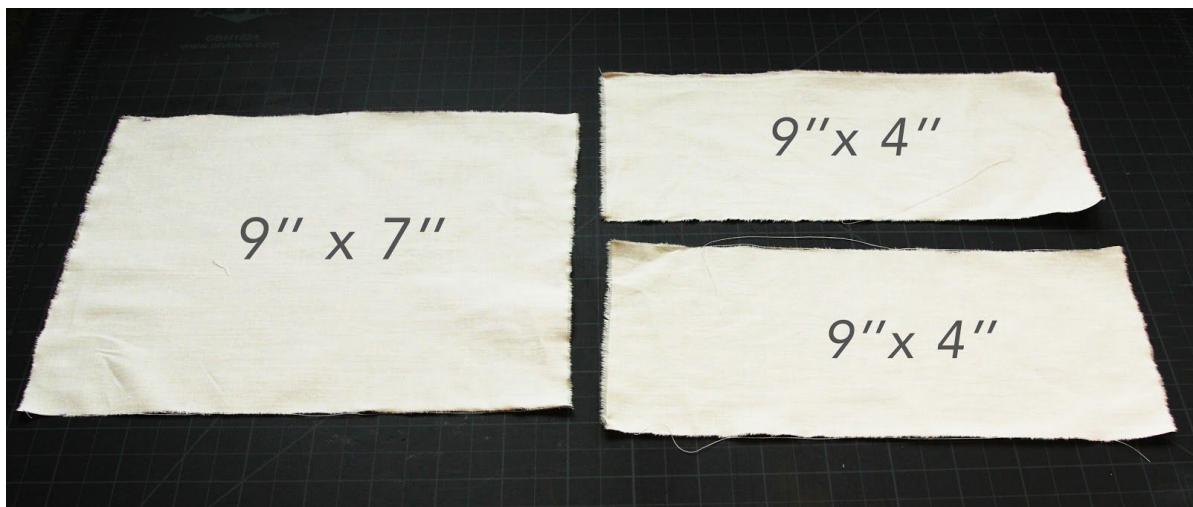
This is a design edit for the reusable filter pocket mask shown in the previous video above by YouTuber Sweet Red Poppy: <https://www.youtube.com/watch?v=aHvghyn314U>

New, edited video version: <https://www.youtube.com/watch?v=a4eB3vunbOE&feature=youtu.be>

For the filter insert, I used [these](#) HEPA filter bags. Remember - **the HEPA filters cannot be washed, and must be removed before you clean to mask to reuse it.**

This written guide references the Sweet Red Poppy tutorial video directly. I will supply the times for when you should divert from the video and return to it.

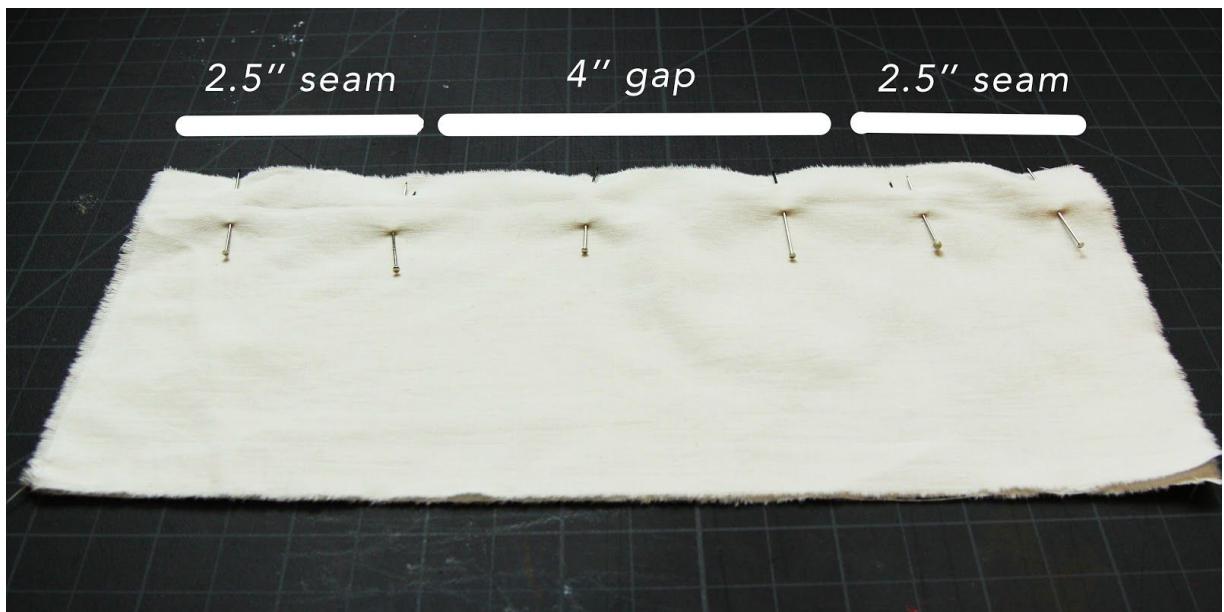
- 1) Start the video.
- 2) Around 1:50, the host tells you to use three sheets of fabric. **I also used three sheets, but I cut them at two different sizes: one 9" x 7", and two 9" x 4".**



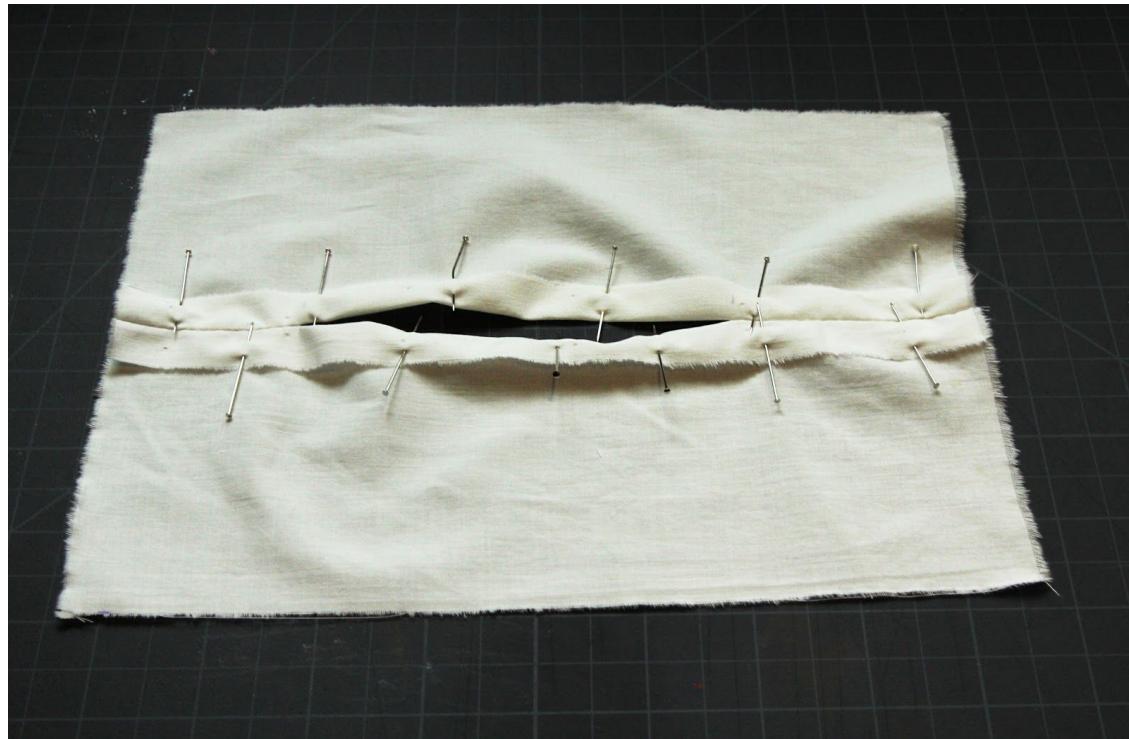
- 3) At 1:55, the host also suggests using bias tape for the straps. **If you don't have bias tape, you can also use a 2" x 33" strip of fabric.**



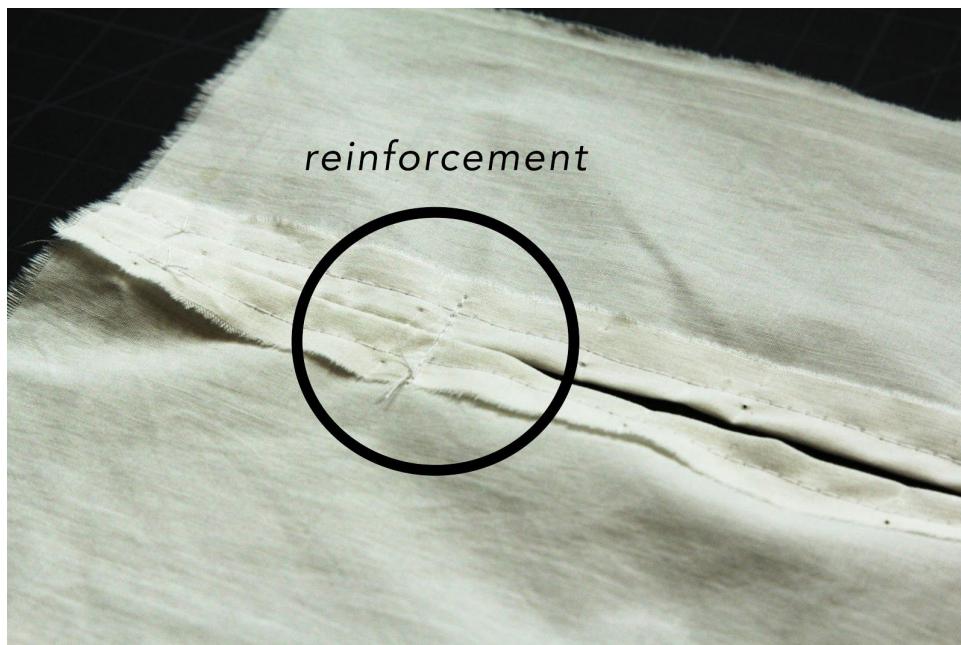
- 4) Lay your two 9"x 4" sheets of fabric face to face, and pin them together along the upper edge. Sew a 2.5" seam along this line from both ends with the seam gauge at 4/8. Double back so there are two lines of stitching along this seam- it will be under some pressure so it needs the additional strength. You are left with a gap of 4" in the middle.



- 5) Open the two pieces of fabric, and pin or iron the hems down. Sew these down.



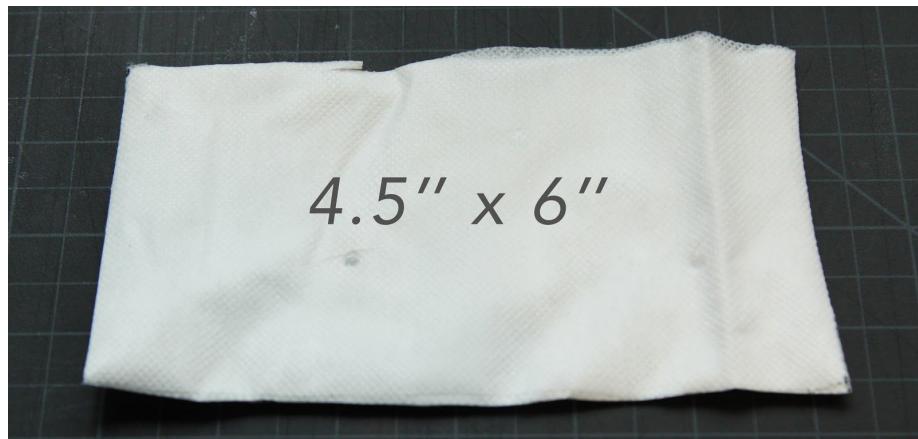
- 6) For additional support, add a few reinforcing stitches along the end of the seams, where they meet the gap.



- 7) Place this newly joined piece of fabric face to face with the 7"x 9" piece of fabric, and pin them together. You can now return to the video at 4:06 and continue to 6:50.
- 8) From 6:50 - 7:50, the host suggests an optional wire along the nose so the mask can be molded to the face. I would go even further and say that **not only does the wire need to be included along the nose, but you should also repeat these instructions along the lower edge of the mask as well, so that the bottom can also be molded and tighten around the face**. This will provide a better seal when the mask is worn, so that as small an amount of breath as possible will escape around the edges.
- 9) Continue watching the video from 7:50 to the end.
- 10) Your HEPA filter is going to come in bag form, with the edges attached to a cardboard ring. Cut the ring off and open the fabric so it lays flat.



- 11) Cut a stack of 4.5" x 6" filters from the bag and place them inside your mask one by one. Discard filter after use, and replace it after you clean the cloth mask.



The Simple Coverage Mask

*easiest mask

Retrieved from Deaconess Health System:

<https://deaconess.com/How-to-make-a-Face-Mask>

Watch the video tutorial:

<https://www.youtube.com/watch?v=aHvghyn314U>

Elastic PDF (child and adult):

<https://deaconess.com/How-to-make-a-Face-Mask/Documents-Mask/Mask-Information>

Ties PDF (adult):

<https://deaconess.com/How-to-make-a-Face-Mask/Documents-Mask/How-to-Make-an-Adult-Surgical-Mask-with-Ties-3-26>

With Elastic

What you will need

- Cotton fabric, a pretty print is best
- Rope Elastic, beading cord elastic will work (you may also use 1/8" flat elastic)
- Cut the elastic 7" long and tie a knot at each end (DO NOT knot the ends of the flat)

You can make two sizes: Adult or Child

1. Put right sides of cotton fabric together
 - Cut 9x6 (Adult) or 7.5 x 5 (Child)
2. Starting at the center of the bottom edge, sew to the first corner, stop. Sew the elastic with the edge out into the corner. A few stitches forward and back will hold this.
3. Sew to the next corner, stop, and bring the other end of the same elastic to the corner and sew a few stitches forward and back.
4. Now sew across that top of the mask to the next corner. Again put an elastic with the edge out
5. Sew to the next corner and sew in the other end of the same elastic.
6. Sew across the bottom leaving about 1.5" to 2" open. Stop, cut the thread. Turn inside out.
7. Pin 3 tucks on each side of the mask. Make sure the tucks are the same direction

8. Sew around the edge of the mask twice. It is so easy to make this. Be sure any fabric design is placed horizontally.

With Ties

What you will need

- One (1) 8x14 inch piece of cotton fabric
- Two (2) 1.5 x34 inch strips
- Thread & sewing machine / hands

Prepare the mask:

- On 8x14 inch piece, right sides together, sew $\frac{1}{4}$ inch seam, creating tube.
- Turn right sides out, press seam and fabric.
- Make 3 pleats, approx. 1 inch each in size, using steam or pins to hold.
- Mask will be approx. 3-3.5 inches in width.
- Sew $\frac{1}{4}$ inch seam on each side of mask, securing pleats. Trim seam allowance.

Prepare the ties:

- Fold in half and press (3/4 inch).
- Open tie back up.
- Fold each edge in to meet middle (3/8 inch/0.375 inch) and press.
- Fold in half again, securing raw edges inside and press.
- Each tie will be approx. 3/8inch in width

Assembly:

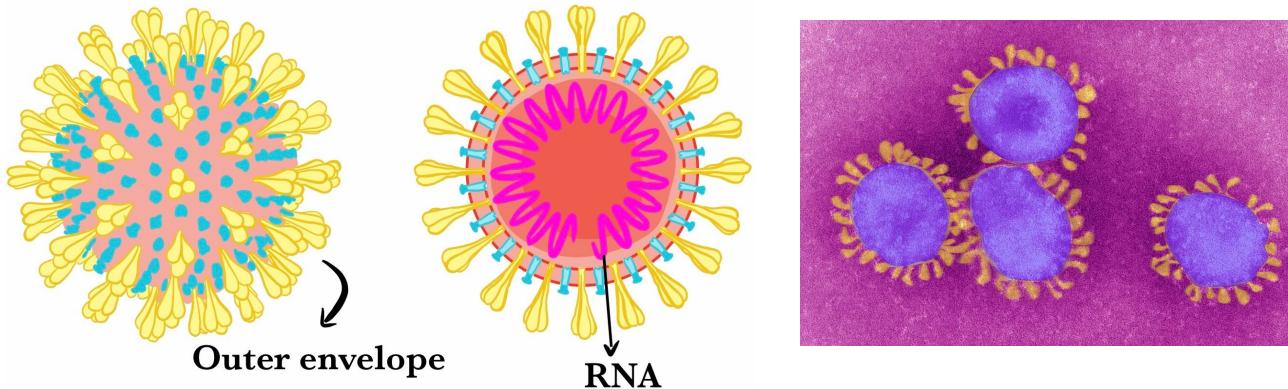
- Align center of tie with side of mask, open tie so edge of mask fits snugly inside. Pin.
- Sew tie to mask, seam will be very short, get as close as able while still catching all fabric. You are just attaching the mask to the tie at this point, not sewing the whole tie yet.
- Repeat for other tie and other side of mask.
- Sew down edges of tie, securing raw edges inside. Seam is very short. You will stitch over where mask is already attached. This is good because it helps reinforce.
- Repeat for other tie and other side of mask.
- Clip any stray fabric and enjoy

What we know about COVID-19

This brief tutorial was created using the CovidStudentResponse.org curriculum as a resource, citations are hyperlinked with recent news sources and research added. The Covid Student Response Curriculum was created by Harvard Medical students under the mentorship of Harvard physicians. See <https://curriculum.covidstudentresponse.org/> for a full in-depth review.

The Basics

The virus that causes COVID-19 / coronavirus disease is called **SARS-CoV-2**, a single-stranded enveloped RNA virus. It is part of a [family of viruses](#) called the coronaviruses, given their name because of the golden, crown-like projections surrounding the virus. “Corona” in Latin means crown.



Viral RNA (like human DNA) is how the virus makes more of itself. SARS-CoV-2 enters cells in the lung called [pneumocytes](#). When the virus enters the cell, it peels off its envelope and begins making more copies of itself using the machinery in lung cells and its RNA. When it has made a new version, the new SARS-CoV-2 virus escapes the cell and continues to replicate.

People infected with SARS-CoV-2 develop symptoms when the “viral load” overcomes the body’s ability to destroy the viruses with inflammatory cells and other immune molecules. This viral load of SARS-CoV-2, combined with our body’s immune response, creates the 3 major symptoms of COVID-19: fever, cough, and shortness of breath.

The most severe consequence of COVID-19 is Acute Respiratory Distress Syndrome (ARDS), which is thought to be caused when the immune system fights too hard to beat the virus. Immune cells called [neutrophils](#) and molecules called [cytokines](#) begin to damage the lungs. Some people need a ventilator to support their breathing when they

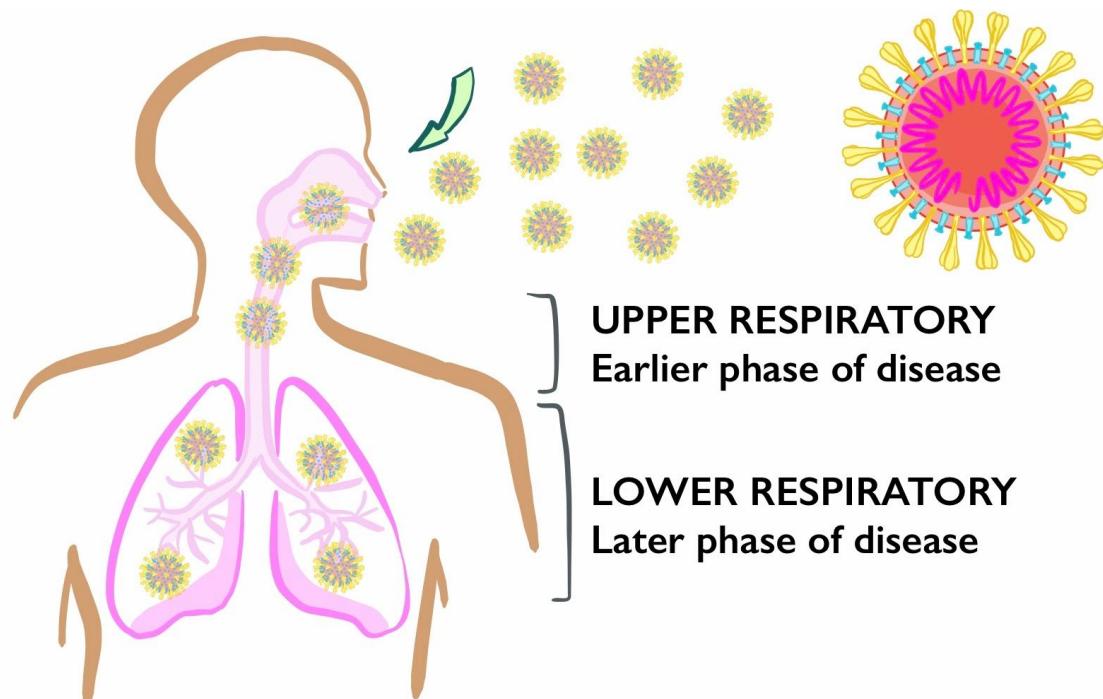
have ARDS, to make sure the body gets enough oxygen. The ventilators give the body time to recuperate.

Currently, scientists in several different countries are working to create a vaccine for coronavirus. A vaccine for coronavirus means that scientists are working on a way to inject a small, inactive version of the virus into people's bodies so they can make the immune cells and molecules the body needs to fight the real virus in the future. Then, if and when a person does contract Coronavirus from exposure to SARS-CoV-2, their body is better equipped to quickly fight and destroy the virus. Scientists and physicians have already begun testing trial vaccines on volunteers, but the possibility of a vaccine is still a long way into the future.

For elderly and immunocompromised people, COVID-19 can be particularly dangerous. This is because the ability of the body to fight off this disease is either delayed or muted in these populations. Because of this, it is essential to protect vulnerable patient populations by wearing a mask and practicing basic hygiene, as well as adhering to social distancing practices.

The spread

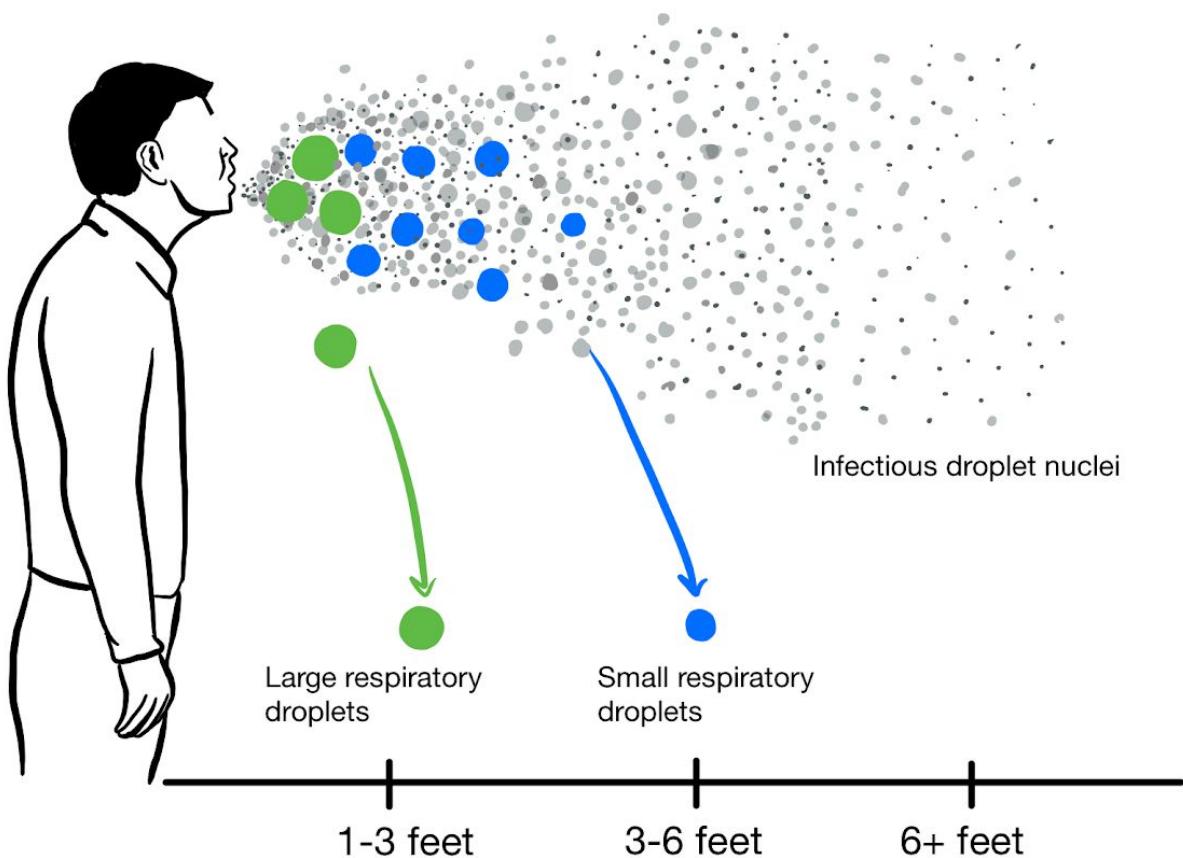
Transmission of SARS-CoV-2 is believed to occur primarily through [respiratory droplets](#) created by someone infected with the virus. Other routes of transmission include [touching objects](#) contaminated by the virus, and the virus lingering in the air within a confined space.



COVID-19 Respiratory Transmission

Asymptomatic individuals can spread coronavirus by producing respiratory droplets containing the virus. The Director of the U.S. CDC stated that 25% of people with coronavirus [never show symptoms](#). That means that even if you don't feel any symptoms, you could still infect other people if you are carrying the virus. The asymptomatic carrier may not feel symptoms because their bodies are handling the viral load effectively, or may not yet be experiencing symptoms because the virus is still replicating. A [German study](#) found that high levels of virus are emitted from the upper airways in the earliest days of COVID-19 disease, when individuals are experiencing mild or no symptoms. These symptoms peak before 5 days and then decrease steadily over time. This peak of viral load was found to be both earlier and 1000x higher than the peak viral load found in the 2002 SARS epidemic. This means the **coronavirus likely reaches its shedding peak before the appearance of very mild symptoms.**

Respiratory droplets are [generated](#) by sneezing, coughing and talking. Sneezing creates 40,000 droplets, coughing creates 3,000 droplets and talking creates 600 droplets a minute. Each respiratory droplet can contain hundreds of millions of viral particles.



Different size droplets travel different distances. It is believed that SARS-CoV-2 mostly spreads via larger droplets (>60 microns in size) which spread 3 feet (1 meter). These droplets require “droplet precautions” which include wearing a surgical mask so these large molecules do not enter the wearer’s mouth. This mode of transmission and protection is similar to the annual flu / influenza. However, unlike the flu, SARS-CoV-2 can also travel via smaller droplets and aerosols which travel as a cloud through the air. N95 masks can help to prevent these smaller cloud particles from infecting the wearer when worn appropriately. The risk of creating SARS-CoV-2 clouds increases with certain medical procedures such as [ventilation](#), which is why doctors and nurses are at increased risk of contracting COVID-19.

Healthcare workers experience severe disease and increased transmission risk due to a massive viral load from aerosol exposure and repeated contact with sick patients. The [study](#) “Viral dynamics in mild and severe cases of COVID-19” showed that patients with severe COVID-19 tended to have a high viral load and long virus-shedding period. According to these scientists, viral load of SARS-CoV-2 represents a “useful marker in assessing disease severity and prognosis.”

Individuals who have recovered from the symptoms of coronavirus are still at risk of transmitting it to others by “viral shedding”. A retrospective, [multicentre study](#) of 191 adult inpatients in Wuhan, China showed that survivors of COVID-19 can have a **duration of viral shedding for an average of 20 days, and up to 37 days**. Those who had critical cases shed for 4 more days on average than those who had more mild cases. A [German study](#) demonstrated **shedding in stool** for weeks after symptoms resolve. Although it is unknown how long these later-stage viral particles can cause disease in others, it is still best practice to [self-quarantine for 14 days](#) after a potential exposure.

Experts are still in [conversation](#) with one another regarding the impact of viral load on symptom severity and duration of transmissible virus. However, it seems a general consensus is that **more viruses means more problems**. This is why even young healthcare workers experience [dire consequences](#) of coronavirus, including [death](#). Without proper PPE, healthcare workers fall prey to a massive viral load.

Individuals who are in contact with many other people are more likely to contract and transmit coronavirus. Individuals who are at particular risk of continued exposure include grocery store workers, delivery personnel, home health aids, domestic workers and other essential personnel. **Essential workers should be given PPE to protect their lives and provide society with needed supplies.** In addition, essential workers must be given adequate [compensated time off, and accessible healthcare](#) to **ensure**

their safety, and the safety of 300 million United States residents who depend on essential workers for our daily needs. A country of overworked and sick essential workers puts us all at risk.

When greeting your delivery provider, it is best practice to use a mask and keep six feet of distance between you. If possible, use no-contact delivery options, disinfect and discard your packaging, and wash your hands with soap and warm water for 20 seconds after receiving a delivery. If you have a **sanitary, hand-made mask to donate, please give it to your essential workers in an unused plastic bag**. This will help protect them, your delivery packages, your neighbors and yourself.



Photo retrieved from:

<https://www.nytimes.com/2020/03/21/business/coronavirus-ups-fedex-xpo-workers.html>

Symptoms



Retrieved from U.S. [Centers for Disease Control](#)

The 3 cardinal symptoms are COVID-19 are **fever, cough and shortness of breath**. These symptoms typically develop between 2 and 14 days after being exposed to the virus, which means that someone with COVID-19 can spread the virus without knowing they have it.

Other symptoms include: tiredness, sore throat, and runny nose.

- It's important to note that these other symptoms occur less often, and may also be associated with the flu, common cold and seasonal allergies.

Serious symptoms include: pneumonia in both lungs, ARDS, multi-organ failure, and death.

When to Seek Medical Attention:

If you develop emergency warning signs for COVID-19 seek medical attention immediately. Emergency warning signs include*:

- Trouble breathing
- Persistent pain or pressure in the chest
- New confusion or inability to arouse
- Bluish lips or face



**This list is not all inclusive. Please consult your medical provider for any other symptoms that are severe or concerning.*

Prevention

Currently, most strategies to prevent COVID-19 have to do with personal hygiene.

- Wash your hands often with soap and water for at least 20 seconds, especially after blowing your nose, coughing, or sneezing; going to the bathroom; and before eating or preparing food.
- Avoid touching your eyes, nose, and mouth with unwashed hands.
- Stay home when you are sick.
- Cover your cough or sneeze with a tissue, then throw the tissue in the trash.



Masks will also play a major role in future COVID-19 spread.

Although the CDC as of 4/1/20 is [still deliberating](#) on national public use of masks and the role of handmade masks, at least 150+ United States hospitals are [requesting](#) “as many cloth masks as possible”. The former United States Food and Drug Administration (FDA) Commissioner Scott Gottlieb stood firm on the [need for national mask use](#) on May 18, 2020.

Many countries such as [China](#), [South Korea](#) and [Japan](#) have done an effective job of controlling COVID-19 spread, and have consistently recommended that all citizens wear masks. The Director-General of the Chinese CDC [stated that](#) “**The big mistake in the U.S. and Europe, in my opinion, is that people aren’t wearing masks.**” Director-General of the World Health Organization, Tedros Adhanom Ghebreyesus, [said](#) March 27, 2020 that the “**chronic, global shortage of personal protective equipment is one of the most urgent threats to our collective ability to save lives.**”

Treatment

There is currently no cure for COVID-19.

Household medications such as Tylenol (acetaminophen) can help with fevers, air diffusers can help with breathing difficulties, and adequate rest will give the body energy to fight the virus. Make sure to stay hydrated!

The bigger picture

If we all wear masks and maintain personal hygiene, we can decrease the overall presence of the SARS-CoV-2 virus and coronavirus / COVID-19 disease in our society. Nations world-wide are already implementing this strategy, and many top health experts and scientists believe a reason for the effective response to COVID-19 in countries such as [China](#), [South Korea](#) and [Japan](#) is in part due to national mask use. The use of masks as part of the United States' COVID-19 response strategy is currently [under consideration](#). If we act now, we can get ahead of the COVID-19 pandemic.

By making, distributing and wearing masks, we can save lives.

What the research tells us about home-made masks

This section will describe the findings of various research studies which have tested whether homemade masks can help to prevent viral illness.

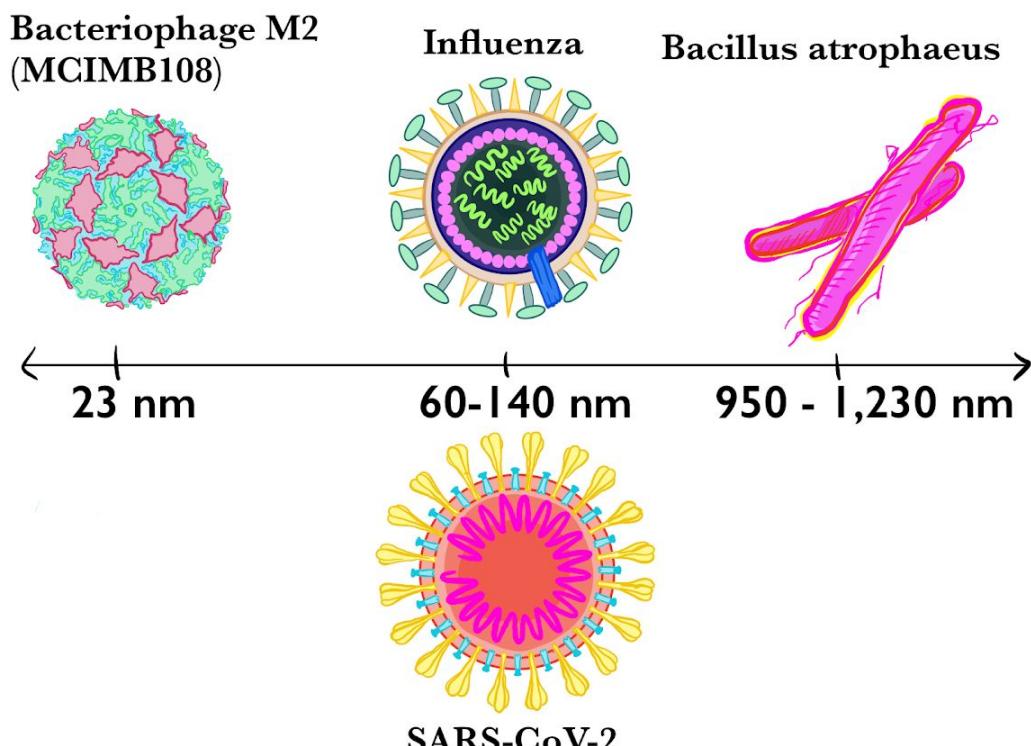
The most [pertinent study](#) was conducted in the UK in 2013, entitled “Testing the Efficacy of Homemade Masks: Would They Protect in an Influenza Pandemic?”.

Disaster Medicine and Public Health Preparedness

Volume 7, Issue 4 August 2013 , pp. 413-418

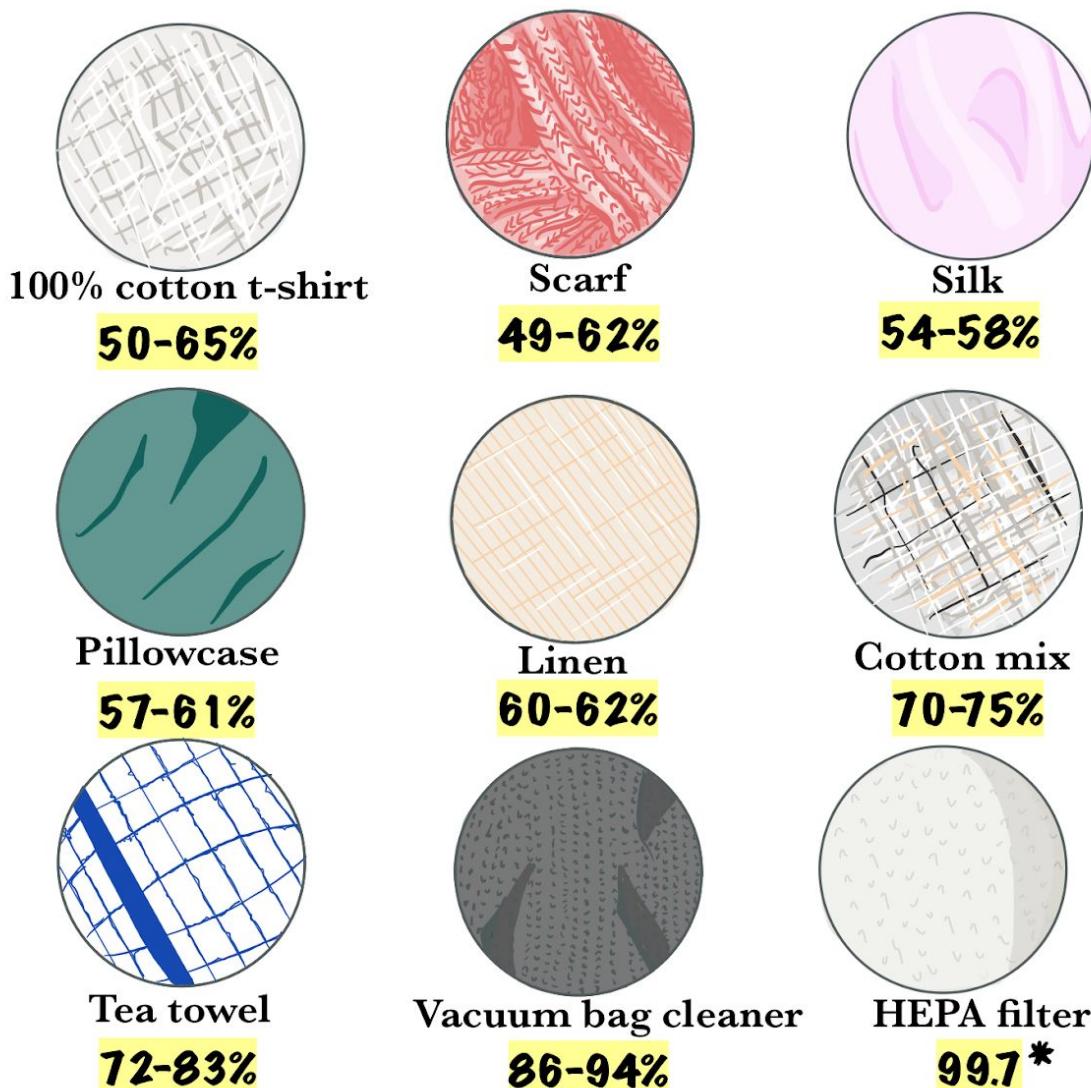
This study tested the abilities of common household materials to filter out high concentrations of bacterial and viral aerosols. Aerosols are airborne “clouds” of pathogens. The individual aerosols are larger than respiratory droplets. Pathogens such as bacterial cells and viruses can travel in the air in a cloud once “aerosolized”.

To test filtration for the influenza virus (60-100 nm), researchers measured pathogens bigger and smaller than the influenza virus to see what the range protection may be. The smaller pathogen is a virus called Bacteriophage MS, 23 nanometers in diameter. The larger pathogen is called Bacillus atrophaeus, 950-1230 nm. By using the study’s data, we can approximate how effective different household materials would filter coronavirus, which is around the same [size](#) of the influenza virus at **60-140 nm**.

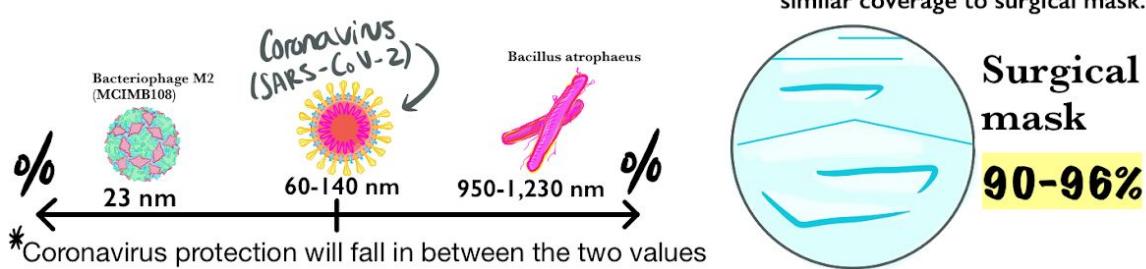


The study showed that **all materials tested showed some ability to block the microbial aerosol challenges**. In other words, all materials tested were more effective in blocking aerosols than not using any protection at all. In general, filtration efficiency for the smaller pathogens was 10% less than the larger pathogens. Additionally, both the surgical and homemade mask decreased the total amount of microorganisms expelled while coughing.

The science of materials % filtration



*For particles more than 3000 nm;
Not measured in study. Most likely similar coverage to surgical mask.



The researchers determined that the pillowcase and the 100% cotton t-shirt would be the most suitable household materials for a homemade face mask. The stretchy quality of the cotton was also noted to provide a better fit. The vacuum cleaner bag and tea towel had better filtration, but were more difficult to breathe through.

Doubling the layers of fabric was not shown to increase filtration efficiency, and was shown to increase the **pressure gradient**. An increased pressure gradient makes it harder to breathe when wearing a mask, and increases the chances of too much air flowing in and out of the sides of the mask. This decreases the contact between the face and the mask, which overall decreases the efficacy of the mask. The relationship between pressure gradient and filtration is diagrammed in the “Evidence-based mask making” section below.

The study concluded that although **protective masks do not eliminate the risk of infection**, they may help to **reduce the likelihood of infection**.

Another [study](#), entitled “Professional and Home-Made Face Masks Reduce Exposure to Respiratory Infections among the General Population,” came to the conclusion that although individual subjects are not always optimally protected by the use of handmade masks compared to surgical masks, the use of masks could **decrease overall viral transmission** from a public health point of view. Although wearing a mask cannot guarantee your individual safety, it can help keep the general public healthier overall.

[This paper](#) also proposed that the level of protection offered by hand-made masks may reduce viral exposure, while allowing people enough exposure to begin mounting an effective immune response over time.

Finally, a [third study](#), “Face Mask Use and Control of Respiratory Virus Transmission in Households,” found that **adherence to mask use significantly reduces the risk of influenza-like infections within households**, but that this reduction was greatly affected by how often individuals within a household are wearing a mask. The study concluded that although the use of masks within households is not indicated for the seasonal flu, **during a severe pandemic there may be a larger role for household mask use**.

The efficacy of masks in the spread of illness is nuanced: it depends how the mask is made, how often it is worn, and the context it is worn in. **However, previous research and international COVID-19 prevention strategies indicate that wearing a mask likely helps to decrease overall transmission risk.**

Evidence-based mask making

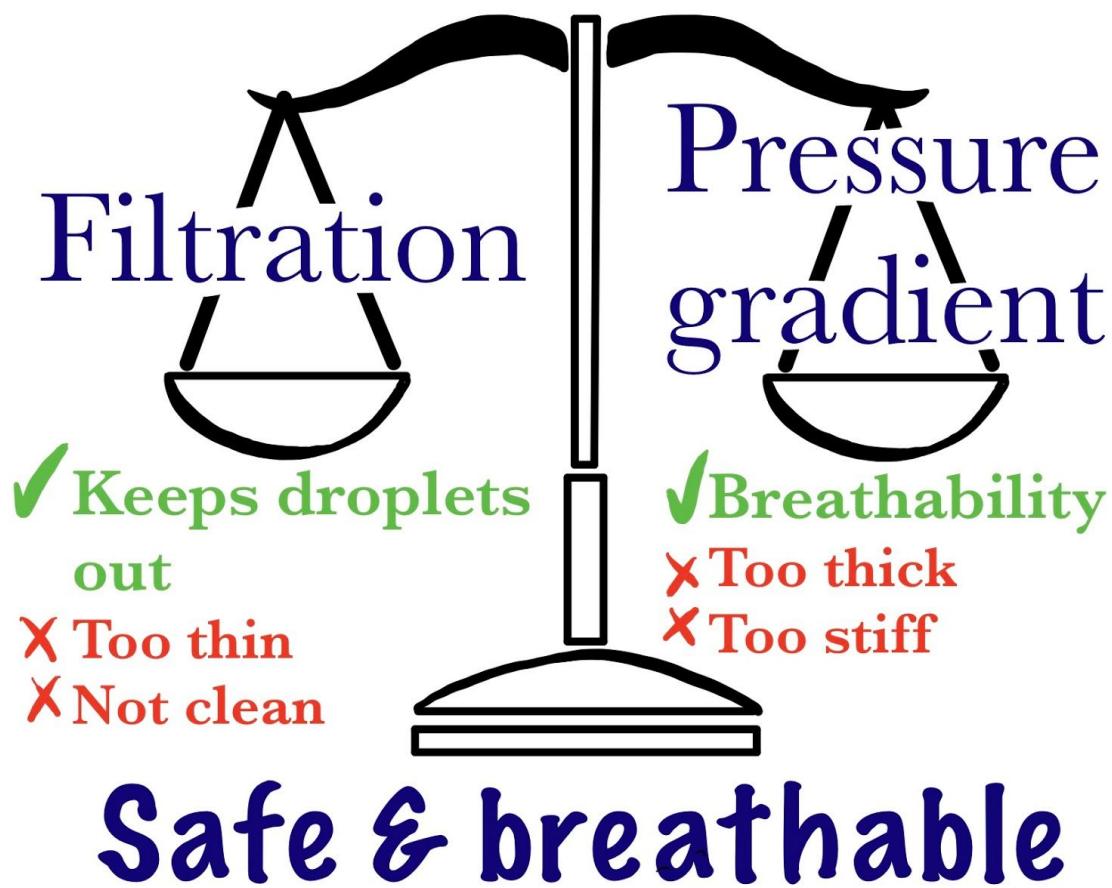
There are 2 main principles in mask-making:

1. Filtration
2. Pressure Gradient

FILTRATION is how well the material prevents viruses and bacteria from moving through it. This offers protection to both the wearer and people around them.

PRESSURE GRADIENT describes how hard a person needs to breathe to get air in and out of the mask. Too high a pressure gradient affects the seal of the overall mask, because blowing air out from the sides of the mouth while breathing removes the mask from directly contacting the face. This leaves the wearer susceptible to a virus entering and exiting from the sides of the mask.

The key is having a **BALANCE** between filtration and pressure gradient.



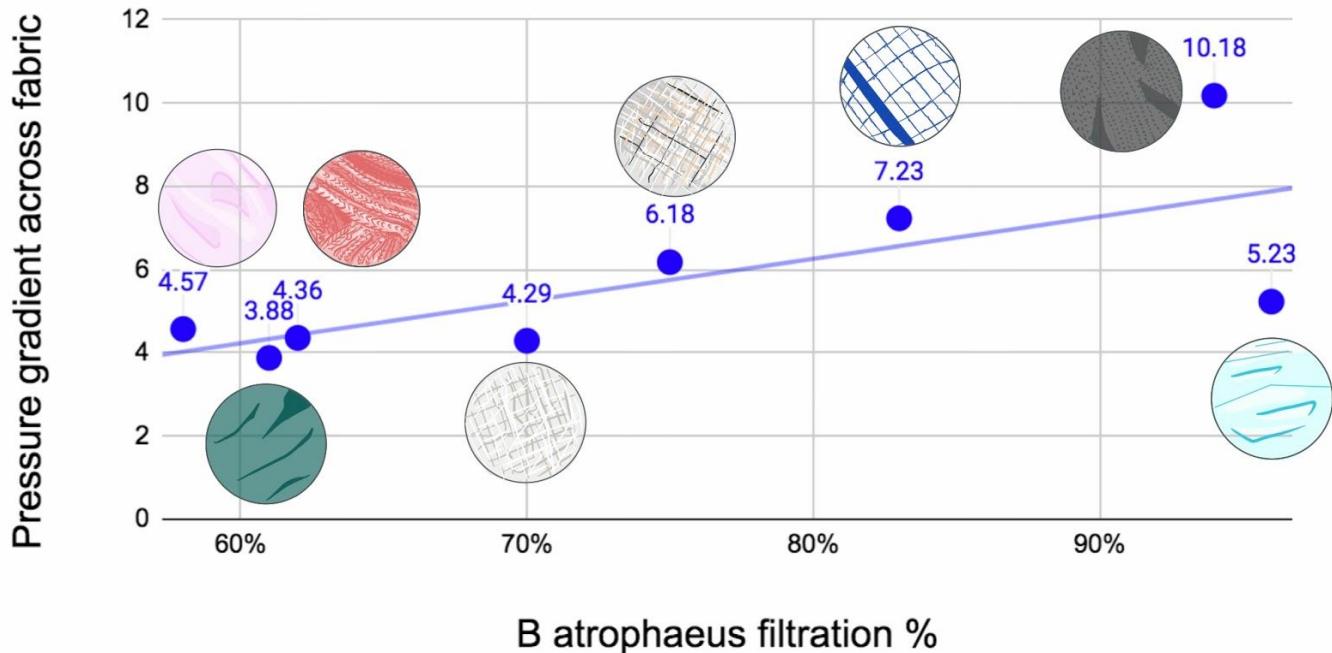
Too high a pressure gradient due to an overly stiff, thick filtration material causes the mask to come off the face as the wearer breathes in and out with force. **Space between the face and mask can let SARS-CoV-2 particles in and out.**



The graph below shows findings from the [study](#) “Testing the Efficacy of Homemade Masks: Would They Protect in an Influenza Pandemic?”.

As filtration increases, the fabric becomes harder to breathe through. The pressure gradient of 10.18 on the graph above represents the vacuum bag, which has similar protection to a surgical mask. The surgical mask is the gold-standard for protection because it has both good filtration and a low pressure gradient of 5.23. The vacuum bag provides similar filtration, but double the pressure gradient.

Pressure gradient across fabric vs. Bacillus atrophaeus filtration %



A separate, unstudied but creative solution to this problem is utilizing a HEPA filter with a cotton mask. As the above studies did not show that doubling up on fabric made masks more effective, a [modified version of the pocket filter mask](#) shown above removed one layer of fabric and added a HEPA filter. This mask style also added an extra copper wire near the chin, to make sure the mask has optimal contact with the face. This helps the wearer breath easily, while maintaining a good seal and filtration.

Ensuring a tight, comfortable seal using high-filtration material will decrease chances of contracting and transmitting COVID-19.

For the individual mask-maker, this means you need to determine what combination of masks and materials make sense to offer the protection you need given the time and materials you have access to.

If you have the fortune of access to those two resources, please help to ensure as many individuals as possible have access to masks.

Innovations in mask-making: new materials

Although the following masks have not been formally studied yet, they have been worked on by expert material and medical scientists for widespread use during the COVID-19 pandemic. These are provided to broaden the scope of materials utilized by mask-makers internationally.

Maker Mask

1. “**Cover**”: non-woven polypropylene shopping bag
2. “**Surge**”: NWPP bags

“The MakerMask project team has reviewed extensive literature on the science and manufacturing of NIOSH-approved respirators. We selected a multi-layered design that balanced increased filtration capabilities with permeability for breathing. Spunbonded non-woven polypropylene (NWPP) outer layers use the same material as used in medical-grade commercial masks, providing a tightly structured filtration layer with water-resistance for blocking droplet transmission. While a meltblown polypropylene inner filter is ideal, international supply chains are disrupted due to the current crisis, so we have substituted a third layer of NWPP. To improve usability for communities with latex allergies against common elastic, as well as to facilitate sterilization, we use finished strips of bias tape or NWPP for tying the mask around the head.

We believe our designs offers a substantial step beyond cotton alternatives and are pursuing rigorous testing to provide data on particle filtration efficiency, fluid penetration resistance, and breathing resistance. Because these are do-it-yourself designs, we cannot control the manufacturing of the masks, but we have worked to ensure that the designs are simple and backed up with good science to ensure the best solution in this circumstance. Even a simple NWPP layer fit over other masks may help reduce instantaneous penetration of aerosols.[3]”

“Cover”: non-woven polypropylene shopping bag

Retrieved from MakerMask:

<https://makermask.org/>

Download the PDF:

<https://makermask.org/wp-content/uploads/2020/03/MakerMask-Cover-Sewing-Guide-rev0-10.pdf>



Materials and Tools

- Pattern (see final page)
- Clean non-woven polypropylene shopping bag (warm wash & low heat dry)
- Straps/Bias tape, 1/2" double folded
- Sewing machine
- Thread
- Scissors, pins, etc.

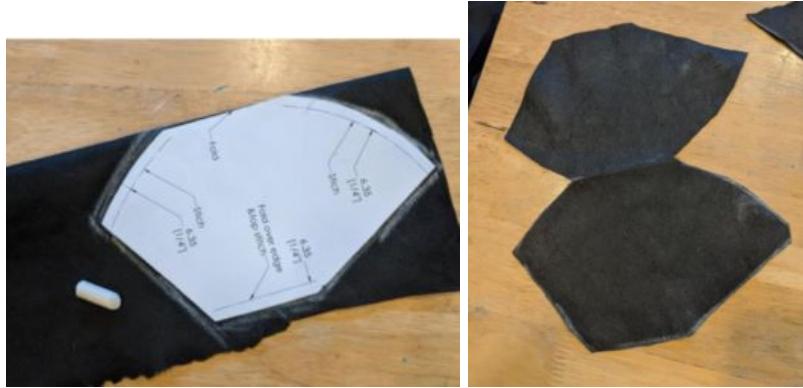
Step 1: Print and prepare the pattern

Print out the mask pattern on Letter-sized (8.5" x 11") paper. Check that the measurements shown on the reference square of the printed page are accurate – otherwise you may need to adjust your printer's scale settings.

Cut the pattern out. Please note this pattern's seam allowance is 1/4" (6mm).

Step 2: Cutting

Fold the fabric in half. Place the pattern on the folded edge where indicated. Cut mask pattern out of the fabric.



Step 3: Sewing mask body

Sew from the top of the fold to the top of the mask, stitching $\frac{1}{4}$ inch from the edge. Then sew seam from the bottom of the fold to the bottom of the mask.

Fold over and sew side hems.



Step 4: Sewing the straps

Note: These instructions are for double-folded fabric tape material creating the strap. If you don't have bias tape, you can make your own straps.

Cut two 36" (91.4cm) long pieces of $\frac{1}{2}$ " (1.2cm) double-fold bias tape for the head ties.

Unfold the bias tape and position the middle of the tape to the middle of the mask. Sew to the inside of the mask cover, $\frac{1}{4}$ inch from edge.



Fold the bias tape over to the outside of the mask and top stitch the full length of the tape to make finished straps.

Repeat for the lower edge of the mask.



Additional Information

The MakerMask:Cover is designed to wear over other masks as a droplet cover to reduce the level of moisture reaching the primary mask. This can help prolong the use of commercially available N95 masks.

Sterilize before use

Masks should be sterilized before use. While autoclaving is ideal, home users can submerge the masks in boiling water for 10 minutes.

Non-woven polypropylene (NWPP) Bags

Despite being called “non-woven”, NWPP is pressed with a cross pattern that gives it a woven appearance. A common source of NWPP is reusable shopping bags. Look for reusable grocery bags with a cross-hatch pattern, no insulation or waterproofing. Hold it up to your nose / mouth, you should be able to breathe through it. NWPP bags can be safely laundered.

Fabric Ties

For securing the mask to the face, bias tape is a great option and commonly found at craft stores. Alternatively, ties may be fashioned from clean strips of NWPP, shoelaces, or other available material that is machine washable and long enough to tie around the head. Elastic may cause severe reactions in individuals with a latex allergy, does not generally hold up as well to the heat of sterilization, and therefore should not be used.



“Surge”: NWPP bags

Retrieved from MakerMask:

<https://makermask.org/>

Download the PDF:

https://makermask.org/wp-content/uploads/2020/03/MakerMask_SewersGuide_0.1.pdf



Required Materials:

- Sewing machine
- Freshly washed NWPP bags
- Bias tape or other ties
- Pipe cleaners or coated paper clips
- Scissors and pins
- Measuring tape or ruler

Gather your materials





Sheets should be 8 inches high by 9 inches wide. Top stitch three layers. Sew 1/4 inch from the edge all the way around. Turn both sides and the bottom in

Fold three sides in approximately 1/2 inch, as shown, leaving the top open for the nose band.

Stitch a seam on these three folds, approximately 1/4 inch from the edge.



Twist two pipe cleaners together

This will allow the mask to be pressed down over the bridge of the nose, forming an acceptable seal.

You can also use coated paper clips for this step.



Cut the pipe cleaners to length



Trim your nose bridge material just shorter than your mask is wide. If sharp ends remain, consider folding over the tips to prevent injury to users.



Fold the unstitched top over the twisted pipe cleaners

Lay the pipe cleaners 1/2 inch from the top edge, fold the fabric over them, and stitch this in place. Stitch the channel closed on both ends.

Make three folds to pleat the mask for expansion



Pleats should be approximately 1/2 inch wide. If it helps, mark lines on your fabric at 1 ½, 2 ½, 3, 4, 4 ½, and 5 ½ inches from the bottom of your mask.

Fold the 1 ½ inch line up to meet the 2 ½ line, crease, and if helpful pin in place on each side. Repeat by folding the 3 inch line up to the four inch line. And finally, the 4 ½ inch line up to the 5 ½ inch line.

Stitch these in place by sewing both sides 1/4 inch in from the edge again.

Measure cloth ties for a snug fit. Ties should be long enough to tie behind the head (~12 inches) and hold the mask comfortably to the face. Sew ties to the front of the mask, 1/4 inch from the edge.



Sterilize before each use. While autoclaving is ideal, home users can simply submerge the masks in boiling water for 10 minutes.

University of Florida medical fabric masks

*difficult construction, medical-grade materials

1. Prototype 1
2. Prototype 2

As of May 31, 2020

The makeshift masks use Halyard H600 two-ply spun polypropylene that cannot be penetrated by water, bacteria, or particles. It **blocks 99.9% of particulates**, making the masks about **4% more effective at blocking particulate material than the N95 masks**, according to Bruce Spiess, M.D., a professor of anesthesiology in the UF College of Medicine, who made that calculation based on the manufacturer's specifications.

Both prototypes have been fit tested. We are still refining our designs and assessing which work better for different types of faces. We will update this as we gain experience.



MUST DOs

Demarcate each mask with an ID tag that does not pierce the material. No writing on the material secondary to the degradation of material.

Do not use pieces of fabric that are ripped.

Minimize the use of pins: Better alternatives are paper clips/sewing clip.

The surgical mask information is provided as research information only and has not been tested for commercial use. The design is bare bones and materials should be locally available at hospitals that sterilize equipment. This design is for an **adult mask** for anyone at a higher risk for coronavirus, exposure or concern thereof. The mask Information is experimental in nature and the safety or efficacy for use in humans has not been proven. It has been tested using the standard N95 fit test and can fit test pass most people. It should not be used without the wearer N95 fit testing before use. If reused it is advised to use one of the standard CDC N95 mask reuse protocols. The design, and masks built in accordance with the design, have not been approved by the FDA or NIOSH.

Prototype 1

Retrieved from: University of Florida Department of Anesthesiology

<https://anest.ufl.edu/clinical-divisions/alternative-n95-mask-production/#prototype1>

Video tutorial: https://youtu.be/bxA8Xw_S1Go

This mask consists of two layers of HALYARD H600 medical fabric. The blue side is the right side and will face out.

The mask has passed the Respirator Fit Test. Please note that the masks will be sterilized after they are returned to the hospital.



Supplies

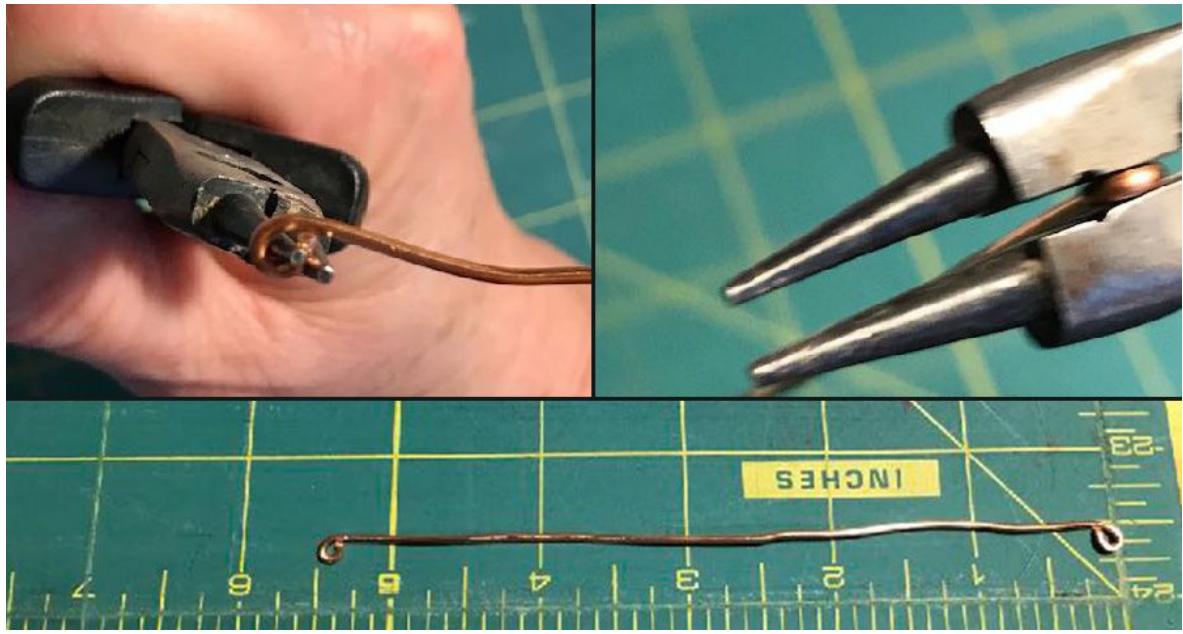
- Medical grade fabric (Halyard H600) supplied by hospital
- One piece of 16-gauge wire (not aluminum as it is too soft)
- 100% Acrylic yarn, size medium # 4 (used for ties)
- Cutting mat, ruler, rotary cutter if available
- Sewing machine, thread, scissors, sewing clips/paperclips, seam ripper (NOTE: please use pins sparingly to avoid holes)
- Jewelry pliers or needle nose pliers and wire cutters

Directions

1. Cut two pieces of the Halyard fabric 7" x 8" (mask body) and two pieces 1" x 36" (tie/binding fabric). The blue side will be the outer side of the mask and the white side the inside of the mask. The 7" sides will be the width across the top and the bottom of the mask. The 8-inch sides will be pleated. Three pleats will make the final mask 4" deep.

2. Layer the 2 pieces of 7" x 8" fabric on top of each other. Sew a 1/4" inch seam on the 7" sides.

3. Turn the mask right side out. Finger press and clip, topstitch 1/4" from both edges on the sides you just clipped.



4.
For
the

nose piece, cut the wire into a 6" piece. Make a small loop on each end of the wire and press flat. See image 1. The loops should be facing the same way. Insert the prepared wire into the 1/4" seam on one of the sides you top stitched. Center the wire. This is now the TOP of the mask.

5. Mark 2" down from the TOP edge of the mask on both sides. Make three accordion-style pleats along the 8" side as follows: Make the 3 half-inch pleats starting at the 2" mark and clip each pleat. Space the pleats one after the other and clip them to make the mask 4" wide.

6. Adjust the pleats accordingly. The pleats do not have to be perfect as long as the mask is 4 inches wide. This is VERY important because if the mask is too short, it won't go under the chin in some cases, and if the mask is too long, it could leave too much of a gap on the side of the face. Do not change the number of pleats as the bottom pleat is especially important to the

curvature of the mask under the chin. See image 2.



6. Sew the pleats down by sewing 1/4" seam. Repeat on the other side. When finished, the pleats will all be going down.

7. Cut four pieces of yarn 36" long. Mark the center of the yarn and clip to the center of the mask where the pleats are. Mark the center of the 36" strip and place under the edge of the mask where the yarn is. You want it halfway under the edge. Fold the side of the fabric strip over the top and clip in place (this is the "binding"). Start sewing where the pleats are. As you sew you need to scoot the yarn into the fold of the tie/binding fabric. Use a 3/8" seam and stitch down the edge of the mask. Keep folding the fabric in half lengthwise and stitch all the way to the end. Flip it over and sew the 3/8" seam all the way to the other end of the strip. To reinforce, sew a second line of stitching on both sides of the mask where the pleats are. Repeat on the other side. Note: the medical fabric does not fray so a single fold is sufficient. See image 3.

Prototype 2

Retrieved from: University of Florida Department of Anesthesiology

<https://anest.ufl.edu/clinical-divisions/alternative-n95-mask-production/#prototype1>

Video tutorial: <https://youtu.be/gImBd704uxE>

This mask is made of 2 layers of HALYARD H600 medical fabric. It has a roundish shape and darts to snug the mask under the chin. There is no binding on this mask. The raw edges are topstitched after insertion of the nose wire and attachment of the ties.

The mask has passed the Respirator Fit Test. Please note that the masks will be sterilized after they are returned to the hospital.

Supplies

- Halyard H600 FABRIC supplied by the hospital.
 - Cut 2 pieces 10" x 6.5"
 - Cut 4 pieces 1" x 20" (these are for the ties)
- MASK TEMPLATE provided for a pattern
 - Thick card stock or other material to make a firm template for tracing
- 100% ACRYLIC YARN, size medium #4
 - Cut 8 pieces 20" (used for the ties)
 - Note: We are testing materials to make this easier, but for now this is how we are doing it. The strength of the ties is critical to get a snug fit. (We have tested Double zig zag stitching without yarn and it does not work...)
- 16 GAUGE CRAFT WIRE for the nose wire.
 - Cut 1 piece 5". Make a loop at each end of the wire. All loops should face the same way. Press the loops flat with your pliers to make sure there are no sharp edges sticking up. (Loops are needed to keep the wire from poking through the fabric.)
 - Note: If you don't have 16-gauge wire, use 20-gauge wire, but cut 3 pieces, make a loop on all ends.

TOOLS

- Sewing machine that can do a straight stitch and zig zag stitch. Your presser foot needs to be able to accommodate the zig zag stitch.
- Ruler
- Scissors
- Pins or clips
- Jewelry pliers that have tapered round ends and cutter or needle nose pliers and wire cutters
- Ink pen to trace the pattern onto the fabric
- EXTRA HELPFUL: cutting mat, long ruler and rotary cutter!

MACHINE: Setting: 2.5 stitch length or whatever the “normal” stitch is for your machine. The zigzag stitch setting used is 2.0 length and 7.0 for width. If your machine does not go to 7 for a width, use the widest setting.

Directions

Step 1: Mask Template.

Print the template and glue to a thin cardboard such as a cereal box or card stock or use template plastic. The thin “cutting mats” are also good template material. Trace the pattern onto a 10” x 6.5” piece of fabric. Carefully cut it out. There are cutouts for the 2 darts. Cut out the darts on the solid line. DO NOT CUT OUT THE TIE PLACEMENT MARKINGS. Layer the 2 mask pieces and clip.

Step 2: Making the mask ties and attaching to the mask.

Take a piece of the 20” x 1” medical fabric and 2 pieces of yarn. You will be folding the fabric in half lengthwise, tucking the yarn into the fold and sewing with a 3/8” seam. As you sew, continue tucking the yarn into the fold until you reach the end. Repeat until you have 4 ties. (We like to sew at an angle across the end of the tie to secure the yarn. Do not worry about the first end as it will be sewn into the mask.)

Step 3: Set your machine for ZIGZAG stitch to attach the ties.

We used 2.0 for the stitch length and 7.0 for the stitch width. The darts should be cut out and you should have markings for placement of the ties.

Tip: Make a second template and only cut out the tie placement marks. Lay it on the blue side, making marks for easier placement of the ties.

Place the squared end of the tie 3/4" in from the edge, between the 2 layers at the notch, LOOK at the template to make sure you place it in the correct place. Hold together and place under the presser foot. Zigzag stitch from the outside edge of the mask to the end of the tie that's between the layers; reverse stitch back to the starting point of the stitching. Carefully place and zigzag stitch each tie.



Ties Attached

Darts Sewn

Step 4: Darts and partial topstitch of the mask.

Next, sew the darts. **NOTE: SEW THE DARTS ON THE BLUE SIDE!** The dart seams will show on the outside of the mask. Fold and sew each dart using a tapering seam from the narrow point of the dart to the bottom ending with 1/4" seam. Backstitch at the beginning and end.

When the darts are completed, sew a 1/4 topstitch from one corner of the mask around to the other corner folding the darts up toward the top as you sew. (Sew from point A through AB and to point B). **The other seams are left until last so the nose wire can be inserted.**

Step 5: Insert the wire.

Your prepared wire should be about 4.5" long. If it is longer, you may need to adjust it as it needs to fit between the ties sewn into the mask. Push it all the way up to the seam made when you topstitched the two layers together and used clips to hold it there. Now you will CAREFULLY sew a 3/8" topstitch from Point C to Point D between where the top 2 ties are sewn in. Position the presser foot so the right edge is on the line of the 1/4" topstitching so that you are encasing the nose wire within the 3/8" seam. You want to go slowly so you can control where the wire is. You don't want a broken needle!



Note: If using 20-gauge wire, be sure to make that loop at each end of all wires and push and clip all 3 into position. All ends must have a loop: We don't want to injure health care providers!

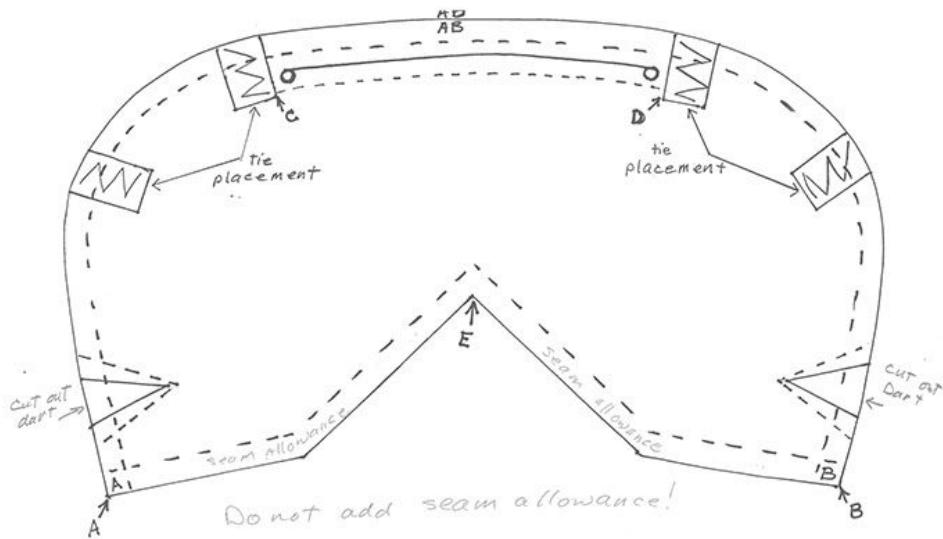
The wire is inserted between the top two ties. Stich a 3/8" seam to encase the wire.

Step 6: Sew the outside seams.

You are going to sew on the blue side so that the seams will be on the outside of the mask. Slightly bend the nose wire so you can line up the remaining seams and clip, blue side out.

Using a 1/4" seam, backstitch at the beginning (Point E), sew to 1/4" from the corner, turn the mask and sew to the end and backstitch. Trim the seam to 1/8" inch to trim it up a little.

Now you will sew a 1/4" topstitch on the outside edge from one dart across the seam you just made and across the other dart. You are done!



Donations and Resources

Please reach out to local hospitals, shelters, clinics, places of worship, community centers, and trusted NGOs for information on how to donate your hand-made PPE. Although the schemas used in this manual have been requested by hospitals nationally, local regulations, needs, and resources may differ.

Comprehensive information on which hospitals are accepting handmade masks:

<https://docs.google.com/document/d/12a5YO0Z9RpHZk9Zkzl4NOj9CbjzhFfoKjPLFFC-21LU/edit>

Tutorial on how to verify real N95s:

https://docs.google.com/document/d/1ZShy_hrXvgddyX-zFIxFTscosOII4GPvg7pCP3WYhts/edit

Guiding Principles for Avoiding Disability Discrimination in Treatment Rationing:

http://www.bazelon.org/wp-content/uploads/2020/04/4-3-20-Guidance-to-States-Hospitals_FINAL.pdf

Project LETS (Let's Erase the Stigma) is a national grassroots organization and mutual aid network which advocates for Disability Justice. Reach out to support or be supported:

<https://www.letserasesthetigma.com/>



JOANN Fabric is giving out free materials: Call local JOANN Fabric stores to receive PRECUT masks,

MATERIALS AND ELASTIC INCLUDED. Take as many as you like. When you have finished making the mask, drop them off at the same store. They will take them to the hospital for you. #wereallinthistogether

As of 4/4/20

There is no national-level or global effort to ensure every individual has masks.

If you are an organizer, a political figure or a mask creator, please consider facilitating sanitary mask distribution.

Contact information

Thank you for reading & saving lives.

For resource, suggestions or other inquiries, please email

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For general information regarding the Harvard Medical School Student Covid Student Response, please visit <https://covidstudentresponse.org/>