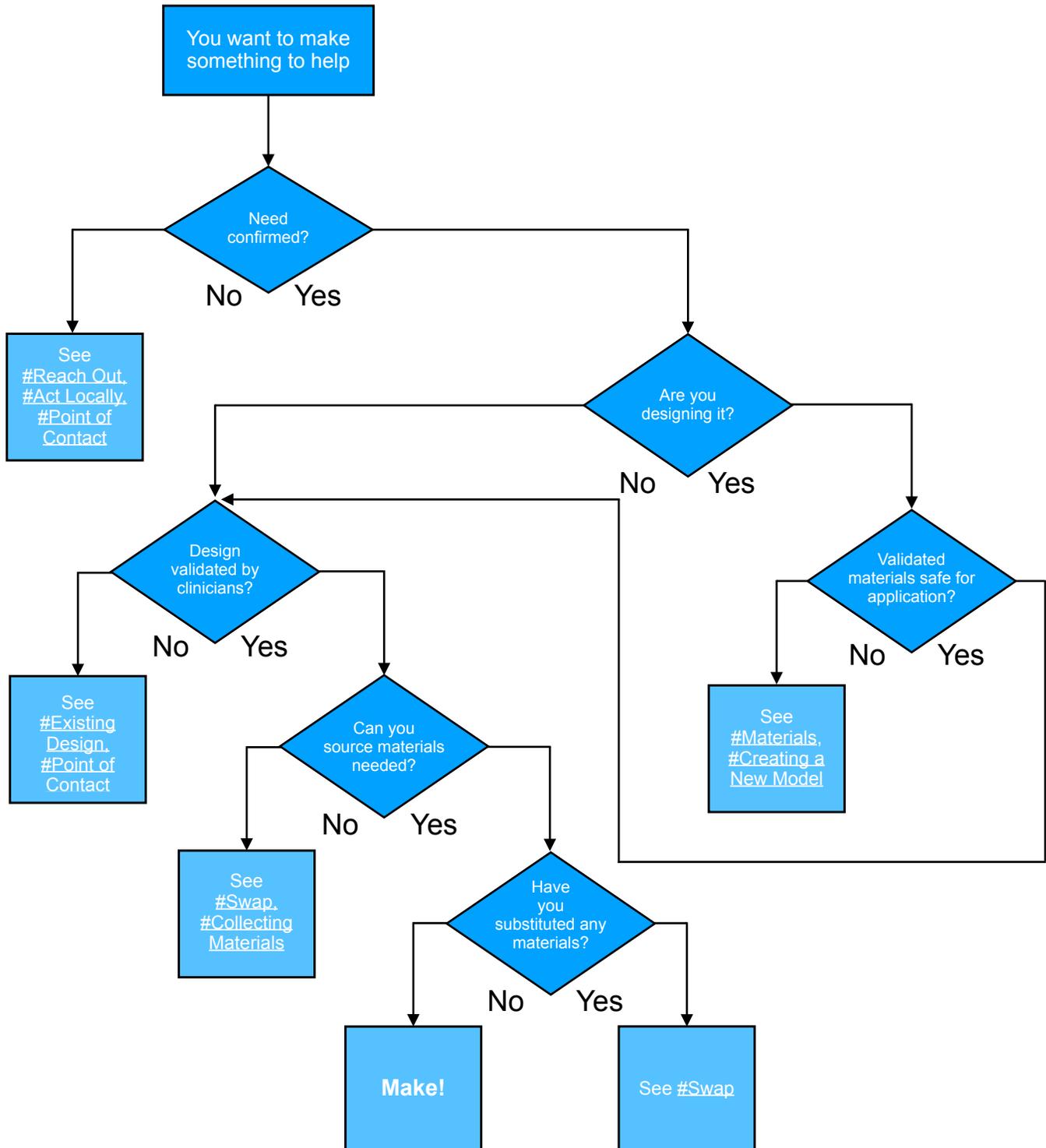# PAN-FAB

FLOWCHART FOR RAPID MANUFACTURING

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You want to make something to help

Need confirmed?

No → See #Reach Out, #Act Locally, #Point of Contact

Yes → Are you designing it?

No → Design validated by clinicians?

Yes → Validated materials safe for application?

No → See #Materials, #Creating a New Model

Yes →

Design validated by clinicians?

No → See #Existing Design, #Point of Contact

Yes → Can you source materials needed?

No → See #Swap, #Collecting Materials

Yes → Have you substituted any materials?

No → Make!

Yes → See #Swap

When meeting product shortages during an emergency crisis like the COVID-19 pandemic, initially we often think that something that might work is better than nothing at all. But, this is not necessarily true. In medicine, there is a key general principle: "first, do no harm." Thus, when making an important product such as personal protective equipment (PPE), we need to make sure it meets the main goal: protecting patients and healthcare workers during this difficult time without harming them. While it seems like a simple task at first, creating a product to protect healthcare workers is a very complicated process that usually takes hundreds of people and many years to accomplish. Our countries and communities have limited resources and people to meet this huge need, so we have developed this tool to help people better manage those scarce resources.

#Materials

When thinking about materials, take into account whether the product will be in contact with the human body for long periods of time. For the skin, it is important to choose materials that are safe to avoid allergies, inhalation or dermal absorption of toxic materials, and so on. Also, look for materials that hospitals can apply their usual sterilization, decontamination and cleaning procedures without highly degrading the integrity of your product or limiting its use to just a few times. Make sure the material does not release any toxic byproducts and present no harm to anyone who will interact with it during its different processes (donning [putting on], using, doffing [taking off], and decontamination).

If the materials are used in a FDA-approved product with the same manufacturing process, chemical composition, body contact, and sterilization method, you have met the biocompatibility requirements. If the answer is no, look for toxicologists/qualified individuals to determine if further testing is necessary.

Swap out Materials

When changing materials from the original project, keep in mind that this can be potentially problematic. As soon as you start to swap up materials, validate with local health care workers and hospital staff if the new material:

1. is safe to use;
2. can be decontaminated;
3. poses no harm to anyone who will interact with it;
4. meet physical structural integrity needs of application.

The new material must attend the four specifications above. Pay particular attention when working with 3D printed designs. Differences in printer technology, material (polymer) used, or even printer settings can all impact the material properties of the final part.

Go back to flowchart

#Existing Design

At this time, there are many designs available online with different purposes and materials. So it is easy to get lost among the many options. Therefore, it is important to filter the models available to find the ones which have been scientifically tested. If there is at least one that has been scientifically tested, filter for a design that has received feedback from workers at the front line that are directly working with them. You can look for models in this specific order: designs that have undergone scientific testing first, and then designs that have received feedback from healthcare workers. If possible, both filters should be applied. If no models have been tested, choose the one that has received some amount of user feedback.

It is interesting to explore your options and look for pre-prints and scientific papers. Further, you can always check validated models on the [PanFab](#) and [NIH 3D Print Exchange](#) websites.

Go back to flowchart

#Creating a New Model

When making a product or developing a new design, get in touch with local institutions and key people who can give you valuable feedback and ideas to make sure you fully understand the problem, and ensure that your design would be a useful solution for them. If possible, focus more locally in order to address the problems and needs in your region with its specificities and resources. If it's hard to get this kind of information with people in your region, reach out to people on social media. Remember, it is important to validate and test your product before producing and delivering them to hospitals and health care workers.

Go back to flowchart

#Collecting Materials

Make sure people in your region who have materials and the people who need them can get in touch and use the materials in an organized, responsible, and efficient way. It is possible to create a local network to organize this process. Also, don't be afraid to reach out to large suppliers of raw materials, they are often eager to help.

#Act Locally

It is important to form a local network, because most products are being delivered to healthcare workers and hospitals in major cities. If possible, establish points of contact to understand the needs of each institution and arrange the distribution in a fair way.

#Points of Contact

It seems most efficient to produce a model and then to directly deliver it to the hospital as soon as possible. However, if every maker in the community tries to follow this approach independently, it may end up overwhelming the hospitals and generating confusion. So, to streamline the process it is important to organize the local community as well as define one or some points of contact to collect and distribute the materials in an organized way. These points of contact can be a group of makers, a local medical association or organization, etc. Find a point of contact already in communication with hospitals in the region. This point of contact will be important to collect feedback to understand what the hospitals want.

#Reach Out

Try to find people in your region that are already involved with related projects, and try to amplify what they are doing. If you are the first person to get involved in your community, make sure people know about your work and can easily contact you.

#Take Home Messages:

You need to make sure:

- Your product REALLY protects the patient and the healthcare worker without imposing additional harm;
- Try and leverage medical/scientific expertise when possible to confirm your work and listen for ways to improve it for field use;
- Hospitals and healthcare workers need and can use your product;
- When your product arrives that it is distributed to front line workers in the most efficient way possible;
- Do the initial sterilization process before the products are delivered to hospitals. If this is not possible, inform the institution that the products need to be sterilized before the first use.

Access PanFab.org for more materials