PPE Website Webinar 2 Notes – 20200421 (updated on 4/23)

Handling the PPE Shortage: Update on Mask Design and Fabrication

Full Webinar: https://www.youtube.com/watch?v=sKqIghgaUvs&feature=youtu.be

Dr. Darryl Hwang (Reusable Filtered Mask)

- Full Webinar: 1:20 – 22:20
- Dr. Hwang's Presentation: https://viterbischool.usc.edu/wp-content/uploads/2020/04/Download-Darryl-Hwang-Presentation.pdf
- Asst. Prof. Research, Dept. Radiology @ Keck School of Medicine of USC and Dept BME @ Viterbi School of Engineering
- Goal is to provide protection better than a bandana
- Tentative name of "pseudo N95 masks" have been changed to "reusable filtered masks" -- a more accurate description
- Timeline
    - 3/22/2020: Joe Savoie (from east coast), Director of Imaging Services, texts 3D printed masks
    - 3/23/2020: Prototype printed overnight
    - 3/24/2020: Met with Infection Prevention
    - 3/25/2020: Fit test with Respiratory Support, asked on Facebook for people with 3D printers
    - 3/26/2020: Connect groups in LA, CRASH Space (https://blog.crashspace.org/), Sunweaver Creative, Iovine and Young Academy, USC School of Architecture, USC School of Engineering
- Reusable filtered mask
    - Can be sanitized in a hospital setting (reusable)
    - Provide filtration comparable to N95 or better (filtered)
    - Fit on a healthcare worker and be worn all day (mask)
- Disinfection
    - Step 1: 1.4% hydrogen peroxide, let it air-dry
    - Step 2: UV sanitation —> UV box or pulsed xenon robot
- Filter material
    - Not creating our own material, but assessing different material for efficacy and installation
    - Looking for quantitative analysis from laboratories
    - Required criteria
        - MERV 16 (lowest to hit the N95 requirement) or better
        - Must not have fiberglass —> can be an irritant, silicosis
        - Easy to adapt
    - We are currently using Honeywell filter (model: HRF-R1)
        - Different than the one shown in prior webinar
        - This one appears to be N95 or better (older one was not)
- ~300 printers are printing for Keck daily
- Design was selected because no support material is needed
- One roll of material: ~12-13 masks

- Finishing the mask
    - Frost King Premium Rubber Self-Stick Weather Seal and hot glue gun —> form a gasket between the mask and the user
    - Currently no 3D printed masks are being used because FDA says not to use these until actual PPE are used up
    - 2200 masks received so far (medium and large sizes)

Shawn Chapman (Production in Times of Crisis)

- Full Webinar: 22:23 – 33:24
- Shawn's Presentation: https://viterbischool.usc.edu/wp-content/uploads/2020/04/Download-Shawn-Chapman-Presentation.pdf
- Sunweaver Creative
- Problems
    - Shipment of PPE is unreliable
    - Shortage of normal materials
    - Lack of good data for new paths forward
    - Dire need to protect people
- Solutions
    - Set easy goals to achieve
    - Unify the vision forward
    - Begin rapid testing cycle
    - Avoid crowds (to find supplies)
- Design for mask based on Lafactoria from Spain
    - Generates little waste
    - Sterilized with hospital protocol
    - Minimal filter material
    - Material doesn't wick
    - Has a nose cone that allows one to put the mask down (unlike regular N95 masks)
    - Anyone can fabricate this mask (open source)
    - Working with the open source community
- In one month, we created over 8 prototypes of which 4 were put into production after testing
    - Currently on version 3
    - Making each version backwards compatible
    - Working with partners to ramp up their facilities for production
    - Molded silicone gasket so hot glue does not have to be utilized
- Need for masks is extreme
- Using version 5 face shield from USC
- Nasal swabs currently in development
- Also working on cloths masks (Halyard 600 masks)

Daniel Stemen

- Full Webinar: 33:30 – 42:40
- No PowerPoint presentation was given, so no document link

- Keck School of Medicine of USC, Manager of Respiratory and Interventional Pulmonary Services
- Current devices in need of potential substitutes
    - Normal surgical mask: isolate yourself from others but doesn't filter the air, only keeps droplets contained
    - N95 mask: filters air, breathe through it, statically charged to capture virus
    - PAPR/CAPR masks: positive pressure to apply filtration, highest degree of protection
- Healthcare staff have to get a fit test
    - Put the mask on (only two sizes available)
    - Spray liquid and see whether there is leakage
- Limitation of current N95 masks is that the whole mask is a filter
    - Cannot interact with it since in contact with aerosols or droplets
    - Aerosol does not fall and contaminate surfaces – trapped in a filter
    - Aerosol will contaminate the filter whereas gas permeates through after filtration
- 3M main manufacturing for N95, projected shortfall through August
    - About 40% shortage

Q & A Session

- Full Webinar: 42:40 – 58:05
- Please note that some questions were mentioned in the chatroom in the Zoom conference, so it won't necessarily reflect the webinar YouTube segment
- Janice: How many reusable filtered masks are in clinical use at USC currently? If they are being used in clinical settings, are they being used as true replacements for N95s?
    - Currently no 3D printed masks are being used because FDA says not to use these until actual PPE are used up
- Bingbing Li: If CSUN plans to join the efforts of printing reusable filtered masks, who to reach out?
    - Reach out to S. K. Gupta (guptask@usc.edu)
- Janice: What is USC doing about PAPR shields if at all?
    - Darryl: We have a pattern to laser cut replacement shields for the CAPRs. To create the shroud portion, we figured that you could use blue painter's tape and sheet plastic with elastic
- Amir H: Is the Haylard sterilization wrap as effective as the Honeywell filter you're using in your design?
    - Darryl: Halyard material not designed to make masks, design to keep sterile trays sterile. Needs to be tested for filtration function
- Robert Kearney: For the FFF printed masks, do we have any preliminary findings on how well these interfaces filter out aerosols? Perhaps the filter works, but is compromised by the FFF shell?
    - Darryl: Shell is good at not leaking and passes the taste/leak test
- Anonymous: Are you cleaning your 3D printed masks with hydrogen peroxide wipes? Or are you using UV?
    - Darryl: Sterilization plan is to wipe with hydrogen peroxide and then expose to UV light
- Anonymous: How often does the filter in your 3D printed design need to be replaced?
    - Daniel: Allow extended use of N95 up to 8 hours, staying inside regulatory recommendations

- Anonymous: Are you planning on disposing the elastic after single use?
    - Daniel: Guidelines for reusing N95 masks – not recommended at all. Reuse is only because of shortage of masks
- Anonymous: Is UV effective given it's not just a flat surface? How do you avoid a shadowing effect?
    - Darryl: UV systems have shadow effect. Robotic system moves light around. Could also rotate object within box
- Anonymous: Can Halyard 600 bias tape be used in lieu of elastic?
    - Shawn: Halyard material could be used in place of elastic bands
    - Darryl: Elective surgeries are reduced and so Halyard material more available. But does not recommend Halyard material for strapping because other materials are available. Does not recommend non-elastic material for a hard mask