Steam Decontamination of N95 masks

Contingency planning for critical N95 mask shortage situations

Microwave Steam Bags

- Initial trials created steam in a commercial microwave; very effective for viral decontamination. (Fisher *et al.*, 2009)
    - Did not put the entire mask in. Used a coupon cut from the mask.
    - Soaked the coupon after steam and microwave looking for any active virus.
    - No active virus was found in tests lasting 45 sec.
- Follow up study used retail microwave steaming bags and off-the-shelf N95 masks (Fisher, Williams and Shaffer, 2011).
    - .These bags were designed to sterilize baby bottles and breast pumps.
    - Medela and Munchkin brands were tested.
    - These are pleated stand-up bags into which 60 ml of water and the equipment is placed.
    - No report of metal issues
    - did have some types of masks that held water too long after.
    - The study reported at least 99.9% reduction in virus (>3 logs).
    - Heating time was 90 seconds
- In our testing, occasional arcing occurred.
    - Corresponded with Ed Fisher at CDC/NIOSH at the National Personal Protective Technology Laboratory in Pittsburgh. His team did the original work and produced the paper. He reports that his team had no arcing, but that others had contacted him and noted the issue.
    - Fisher's 2011 paper recommends decreasing wattage and increasing duration.
    - Reducing power level to 90% and total time of 2 minutes resolved issue, with no arcing and 90 seconds of steam production observed
    - Our initial trials complicated by wet masks due to mask making contact with water in bottom of bag
    - In further trials, this issue was overcome placing a spacer into the bottom of the bag. Legos and plastic pop bottle caps were both effective.
    - Pizza saver 'tables' would likely also be effective
- CDC guidance lists mask types that are appropriate for this method. (CDC, 2020)
- Ziploc Zip and Steam is a similar microwave teaming bag product, although it lays flat. This may lead to increased wetting of the masks.


medela
quick clean™
micro-steam™ bag
Hot
medela
quick clean™
micro-steam™ bags

Commercial restaurant electric steam table

- Initial trials created steam in a commercial microwave; very effective for viral decontamination. (Fisher *et al.*, 2009)
- Microwave generation of steam is not necessary for viral decontamination per correspondence with Ed Fisher at CDC/NIOSH at the National Personal Protective Technology Laboratory in Pittsburgh
- Plan utilizes a 5 well electric steam table
    - 2 ½ inch deep drop-in perforated pans
    - standard covers
    - 90 second steam cycle
- Will utilize the U of Nebraska Mask marking and exchange process (Lowe *et al.*, no date)
- ND Department of Corrections and Rehabilitation has adapted and tested a steam table using the above method. Temperature measurements confirm 100 degrees Celsius. 3M 8000 masks were tested and did well, with no deformation on multiple cycles.

References

CDC (2020) *Filtering facepiece respirators (FFRs) decontamination and reuse*, *Centers for Disease Control and Prevention*. Available at: https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/decontamination-reuse-respirators.html (Accessed: 8 April 2020).

Fisher, E. *et al.* (2009) 'Development of a test system to apply virus-containing particles to filtering facepiece respirators for the evaluation of decontamination procedures', *Applied and environmental microbiology*, 75(6), pp. 1500–1507.

Fisher, E. M., Williams, J. L. and Shaffer, R. E. (2011) 'Evaluation of microwave steam bags for the decontamination of filtering facepiece respirators', *PloS one*, 6(4), p. e18585.

Lowe, J. J. *et al.* (no date) 'N95 Filtering Facepiece Respirator Ultraviolet Germicidal Irradiation (UVGI) Process for Decontamination and Reuse'. Available at: https://www.nebraskamed.com/sites/default/files/documents/covid-19/n-95-decon-process.pdf.

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