

INTRODUCTION

Abstract

- Commonly used respirators in healthcare settings are mostly disposable
- During a public health disaster such as the ongoing COVID-19 pandemic, respirator supply shortages may prove to be a significant problem for most healthcare organizations
- The reuse of disposable N95 respirators might be necessary, even if not preferable, due to supply chain issues
- Challenges of reusing masks raises questions regarding proper disinfectant treatment
- Elastomeric half-mask respirators (EHMRs) and powered air-purifying respirators (PAPRs) also need to be disinfected due to their repeated use or used by multiple workers
- It is currently not well-known what decontamination and disinfection methods are most effective for disposable and reusable respirators

Objective

- To conduct a systematic literature review and evaluate what methods worked the best to decontaminate and disinfect respirators

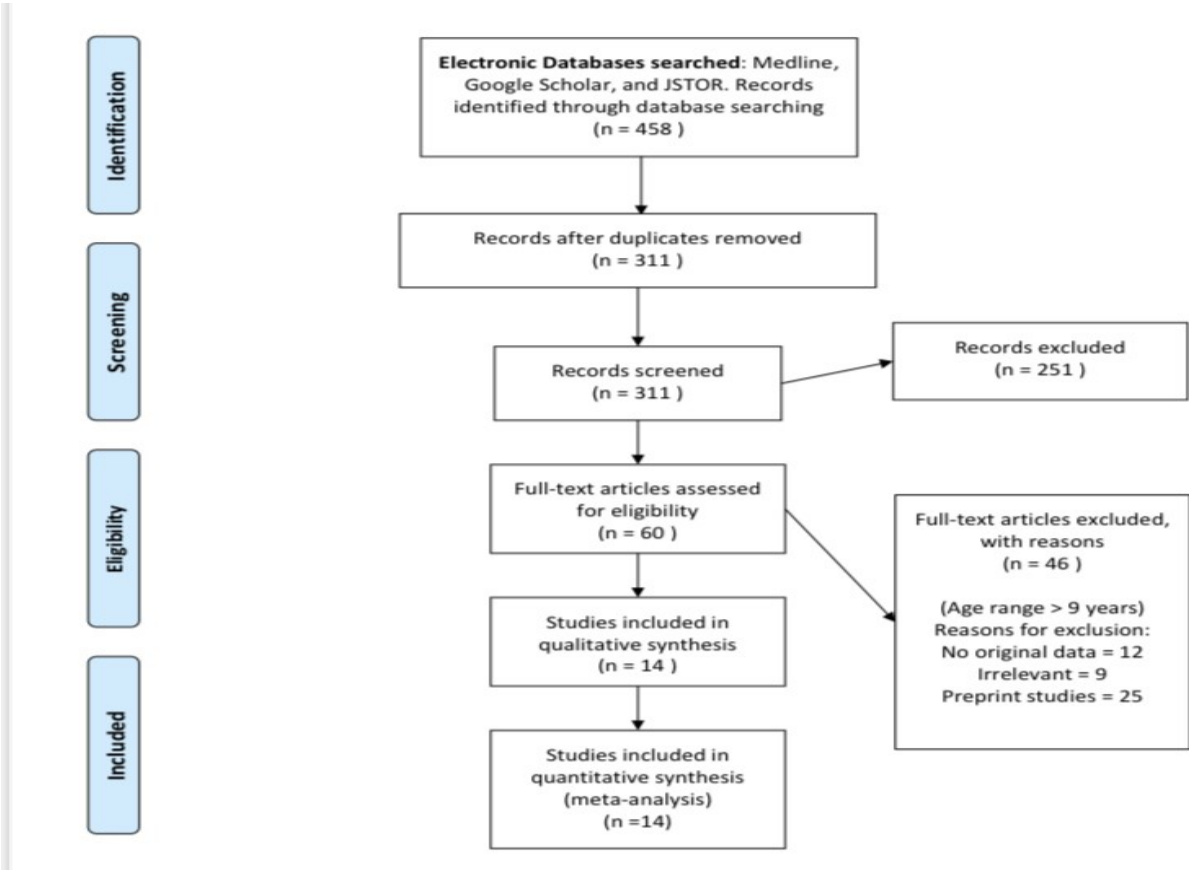
Impact

- Effective cleaning and disinfection methods allow N95 respirators to be reused
- CDC recommended EHMRs and PAPRs be used, but disinfection is needed

METHODS

Systematic Literature Search

- Databases used: Medline, Google Scholar, JSTOR, etc.
- Years covered: 2011 to 2021
- Language: English
- Keywords used (in combination)
 - ☐ N95 decontamination and disinfection
 - ☐ Elastomeric half-mask respirator (EHMR) decontamination and disinfection
 - ☐ Powered air-purifying respirator (PAPR) decontamination and disinfection
 - ☐ Respirator reuse
- 458 recorded
- 311 retained
- 251 removed: after screening for relevance
- 60 remain
- 46 removed: more screening for relevance
- 14 left: for a final quantitative analysis



RESPIRATORS



RESULTS FOR N95 RESPIRATORS

Table 1 Decontamination/Disinfection methods and results for N95 respirators

Author	Year	Methods	Microbes	Effectiveness	Reduction	Comments
Fisher et al.	2010	UVC	MS2 coliphage	Yes	>4 log	Original study Lab and modeling
Lore et al.	2012	UV Microwave steam Moist heat	H5N1 virus	Yes to all	>4 log infective dose	Original study
Mills et al.	2018	UV	H1N1 virus	Yes	>3 log	Original study
Zulauf et.	2020	Microwave steam 1,100 W, single, 3 min	MS2 phage	Yes	5- ~ 6-log10 PFU (99.999%)	Original study
Ibáñez-Cervantes, et al.	2020	H2O2 plasma	SARS-CoV-2 Acinetobacter baumannii Staphylococcus aureus Inoculums of 10 ² to 10 ⁶ CFU	Yes	None detected	Original study
Cadnum et al.	2020	UVC box: 1 min; UVC room 230 min Disinfection cabinet (peracetic acid and hydrogen peroxide, and dry heat), 3 cycles, ~60 min Dry heat	Bacteriophages Phi6 MS2 Methicillin-resistant <i>Staphylococcus aureus</i> (MRSA)	Yes: cabinet No: UVC No: dry heat	Cabinet: reduction optimal	Original study
Rodriguez-Martinez et al.	2020	Various	Various	Yes: UV Yes: H2O2	Various	Systemic review
Jiang et al.	2021	Time, UVC dry heat	SARS-CoV-2, Bacteria, Fungi	Yes	Bacteria: reduced 8.6 colonies Viruses and fungi: 0	Field clinical trial
Seresinkachorn et al.	2021	UV Microwave steam Moist heat H2O2	Virus Bacteria	Yes		Systemic review

RESULTS SUMMARY

- N95 respirators:: heat and moisture, microwave-generated steam, ultraviolet germicidal irradiation (UVGI), particularly UVC, plasma peroxide or hydrogen peroxide vapor (VHP) sterilization are effective
- PAPRs: Few studies have been conducted
 - A recent laboratory study indicates methods that show a significant reduction in virus load
 - Another study had similar results
- EHMRs: ne study found a mean log reduction in viable influenza of 4.54 ± 0.97 log₁₀
- Not many studies taken place in hospital settings

FUTURE DIRECTIONS

- More research needs to be conducted in hospital settings
- More studies conducted with EHMRs and PAPRs
- More studies conducted with workers disinfecting respirators, not researchers
- Manufacturers must provide cleaning and disinfection methods based on sciences
- Make feasible and effective methods for community residents to use at home

CONCLUSIONS

- UV (UVC), dry and moist heat and VHP are effective methods for disinfecting N95 respirators
- More research needs to be done in work settings particularly healthcare settings with healthcare workers conducting the disinfection procedures
- More studies need to be conducted with EHMRs and PAPRs

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