Title: The Potential for Cloth Masks to Protect Healthcare Providers from SARS-CoV-2: A Rapid Review

Co-Authors:
Ariel Kiyomi Daoud, BA
Ariel.Daoud@cuanschutz.edu
University of Colorado School of Medicine
Jessica Kole Hall, BA
Jessica.2.Hall@cuanschutz.edu
University of Colorado School of Medicine
Haylie Petrick, BA
Haylie.Petrick@cuanschutz.edu
University of Colorado School of Medicine
Anne Strong, BA
Anne.Strong@cuanschutz.edu
University of Colorado School of Medicine
Corresponding Author:
Cleveland Piggott, MD, MPH
Assistant Professor
University of Colorado Department of Family Medicine
Aurora, CO
Cleveland.Piggott@cuanschutz.edu

Support: No funding was received to support this work.
Prior Presentation: N/A
Word Count: 2857
Number of Tables: 2
Number of Figures: 1
Number of Appendixes:1

Abstract

Purpose: The COVID-19 pandemic has led to a scarcity of personal protective equipment including medical masks for healthcare providers (HCP), especially those in primary care settings. The objective of this review is to summarize current evidence on cloth masks to prevent respiratory viral infections, such as SARS-CoV-2, in HCPs.

Methods: We searched five databases, the CDC (cdc.gov), and reference lists of identified articles on April 3, 2020. All identified publications were independently screened by two reviewers. Two authors independently extracted data and graded the studies. The randomized control trial (RCT) was graded using the CONSORT checklist, and the observational and non-human subject studies were graded using 12 domains common across frequently used critical appraisal tools. All discrepancies were resolved by discussion and consensus.

Results: Our search resulted in 136 original publications. Nine studies met inclusion criteria. We performed a qualitative synthesis of the data from these studies. Four non-randomized trials, three laboratory studies, one single-case experiment, and one RCT were identified. Laboratory studies found cloth materials provide measurable levels of particle filtration but are less efficacious at blocking biologic material than medical masks. The RCT found cloth masks were associated with significantly higher viral infections than medical masks.

Conclusions: Current literature suggests cloth materials are somewhat efficacious in filtering particulate matter and aerosols but provide a worse fit and inferior protection compared to medical masks in clinical environments. The quality and quantity of literature addressing this question is lacking. Cloth masks lack evidence for adequate protection of HCPs against respiratory viral infections.

Introduction

In December 2019, the novel coronavirus SARS-CoV-2 emerged in Wuhan, China and quickly became a global pandemic as the COVID-19 respiratory syndrome. At the time of this article's writing, more than 1,800,000 cases were reported worldwide with over 115,000 deaths.[1] In the United States, healthcare providers (HCPs) are faced with a scarcity of personal protective equipment (PPE) including N95 respirators and disposable medical masks.[2] While the nation focuses primarily on supporting large urban hospitals to care for the surge of severely ill patients, primary care offices experience severe PPE shortages. During the week of this article's writing 58% of primary care providers reported resorting to use of homemade and used PPE in a national survey.[3]

Hospitals, healthcare systems, and the National Strategic Stockpile have insufficient supply to provide adequate PPE for HCPs. This leaves primary care practices and other resource-limited organizations such as rural hospitals to determine how to protect their HCPs. Conflicting information from the popular media, messaging from various healthcare systems, and constantly changing societal guidelines complicate decisions around appropriate mask usage in clinical settings during times of scarcity. Creative solutions include rationing supplies, extending use of PPE, recycling masks, and devising alternative face protection.[2] The United States Centers for Disease Control and Prevention (CDC) states homemade masks, including bandanas or scarves, may be used by HCPs when facemasks are not available.[4] However, the CDC does not offer information regarding the degree of protection a cloth mask may provide a HCP compared to a medical mask. Furthermore, there is no recommendation for what the best design of a cloth mask may be in the face of a shortage of PPE. This rapid review summarizes current

evidence on the efficacy and effectiveness of cloth masks compared to medical masks to prevent respiratory viral infections in HCPs.

Methods

Criteria for Considering Studies for this Review

This review follows Cochrane rapid review methods.[5] All studies examining the efficacy and or effectiveness of cloth masks at filtering biological materials or comparing a cloth mask to an industrial medical or surgical mask were included. Efficacy refers to the performance of mask materials in a laboratory setting (ie., filtration, fit factor, pressure gradient), while effectiveness considered the performance of masks when used by human subjects in clinical environments (ie., infection rate). Biological materials were defined as bacteria or viruses. The term cloth was applied broadly and included any type of woven non-synthetic material or woven polyester fabric that may be used to create a homemade cloth mask. Studies examining filtering ability of cloth masks against environmental exposures such as diesel particles, foundry exposure, welding fumes, or pollution were excluded. Reviews, opinion pieces, letters to the editor, commentaries, research briefs, and anecdotes were excluded.

Main Outcome Measures

Inclusion in this review required at least one outcome measure listed below.

1. Efficacy or effectiveness of cloth masks.
2. Respiratory illness/infection rate of HCPs wearing cloth masks.
3. Filtration efficiency of cloth masks in comparison to medical or surgical masks.
4. Percentage aerosol penetration of cloth masks in comparison to medical or surgical masks.
5. Comparison of mask fit between cloth and medical or surgical masks.

Search Methods

We performed a search of Ovid Medline, the Cochrane Library, EMBASE, CINAHL EBSCO, and the Web of Science databases on April 3, 2020, to identify relevant studies for this review. Grey literature was briefly searched via the CDC (cdc.gov). Reference lists of identified studies were consulted for additional publications. Publication dates prior to 1970 were not considered. No exclusion criteria were applied based on study quality grade or language. A health science librarian was consulted for identification of appropriate databases and assistance with search term definitions. See Table S1, Supplemental Appendix for search strategies.

Data Collection and Analysis

Selection of Studies

All studies retrieved via database search were downloaded into citation manager software. Duplicates were removed. Two review authors independently screened identified studies via title and abstract content. Two authors then independently reviewed full text publications of the screened studies. Any discrepancies in eligibility were resolved through discussion and consensus between the independent reviewers and additional authors as needed.

Data Extraction and Management

Two authors independently extracted data from the final list of eligible studies into separate spreadsheets. Data was compared and discrepancies were resolved through discussion and consensus, including additional author(s) when necessary. Two reviewers independently appraised each study and discrepancies were resolved through discussion and consensus. Study appraisal was implemented to

identify flaws in methodology and assess bias. Randomized control trials were appraised using the CONSORT checklist.[6] The diversity of study type included prevented implementation of a single critical appraisal tool. Reviewers considered observational and non-human subjects studies using 11 domains common across frequently used critical appraisal tools and considering additional sources of bias.[7] Appraisal details are in Table 1.

Results

Publication Identification

Our search of five databases and grey literature yielded 136 non-duplicate original publications. Ten of the publications required title or available abstract translation from non-English languages; all were irrelevant to our study question and were excluded. Thirty-six articles were identified for full text evaluation, and 27 were excluded (Table S2, Supplemental Appendix). Nine studies were included for analysis after screening and selection. Four non-randomized trials, three laboratory efficacy studies, one single-case experiment, and one randomized control trial (RCT) were included (Table 2). We excluded several studies that investigated cloth mask protection against air pollution or industrial debris. Although these studies may provide insight into the physical characteristics of cloth materials, we chose to only include studies that explicitly considered mask use to prevent disease or measured particles of biologic significance such as bacteria, viruses, or particles intended to be similar size as respiratory droplets or aerosols. The flow chart (Figure 1) provides details regarding the screening and full text appraisal of these studies.

The nine studies that met inclusion for analysis were then appraised. The one RCT by MacIntyre et al.,[8] closely followed CONSORT guidelines, but notably did not include a control group without masks due to the clinical setting. Further, the authors did disclose a former relationship with *3M* which produces commercial masks. Though, they reported *3M* was not involved in this RCT, it remains a source of potential bias.

Overall quality assessment and appraisal details of the observational and non-human subject studies are illustrated in Table 1. The 11 domains[7] in which each study was considered were not equally weighted for determination of overall study quality. The "low" quality studies[9,10] had small trial numbers, did not report statistical significance, failed to address potential sources of bias, and did not report funding sources. The "moderate" quality studies[11,12] had higher quality methods but did not fully discuss limitations. The most commonly neglected criteria among the "high" quality studies[13-16] was lack of a no-mask control for comparison to cloth masks. We considered these appraisal findings when reporting results and drawing conclusions from each publication.

Filtration

Seven publications addressed the filtration efficacy of commercial cloth masks or materials used to create homemade masks, such as polyester, cotton, tea towel, and scarves in a laboratory setting.[8,9,11-15] These studies used various experimental techniques to investigate filtration of aerosolized virus,[12,13] aerosolized particles,[8,15] or bacteria.[11,13,14] Of the studies that evaluated pathogen penetration, four detected viable pathogens via colony formation,[9,11,13,14] and one detected post filtration virus via PCR.[12] Regardless of the filtered substance or detection method, all conclude cloth materials prevent some level of penetration, but cloth generally had lower filtration efficiency and had higher variability than medical masks. These findings suggest some, though highly variable, filtration by cloth mask materials.

Only two of the identified studies investigated the impact of multiple layers of material on viral filtration.[12,13] Both reported that use of multiple layers increased the viral filtration efficacy of cloth mask material. Ma et al. also specifically selected experimental material for physical similarity to SARS-CoV-2.[12] This study concluded that one layer of polyester combined with four layers of kitchen paper was similarly efficacious to a medical mask.[12] Both mask types blocked ~95% of viral particles similar in size to SARS-CoV-2 detected by PCR. However, the authors of the study considered this insufficient protection for HCPs and suggested use of N95 masks.[12,13]

Fit and Airflow

Four studies investigated fit, particle leakage, or airflow of cloth masks in human volunteers.[10,13,14,16] One study used a commercial fit testing system for cloth masks that were constructed and worn by volunteers,[13] and another quantified fit by measuring inward particle leakage of homemade tea cloth masks compared to medical masks.[16] These investigations concluded cloth masks provide a measurable barrier but have worse fit and higher level of particle leakage compared to medical masks.[13,16]

Limited airflow across cloth materials can contribute to breathing difficulties and particle leakage. Thus, it is an important consideration in cloth mask design. Airflow was assessed in two studies.[13,14] The materials with the highest filtration efficacy (vacuum bag and tea towel) were countered by very low airflow which made breathing difficult and limits use of these materials.[13,14]

Infection Risk

Two studies evaluated cloth mask effectiveness outside of laboratory conditions.[8,10] The only RCT published to date reports the differences in infectious outcomes among standardized use of cloth masks, medical masks, and "usual practice," and calls in to question their effectiveness in clinical environments.[8] Usual practice in this study included variable cloth mask use, so there was no true unmasked control. Both intention-to-treat and post hoc analysis adjusting for compliance and confounders demonstrated higher rates of influenza like illness (ILI) in the cloth mask arm compared to the medical mask arm. Of note, the relative risk of ILI was 13.25 and the 95% confidence interval ranged widely, from 1.74 to 100.97. Comparing participants from all arms who exclusively wore medical masks to those who only wore cloth masks, ILI and laboratory-confirmed virus were significantly higher in HCPs who used cloth masks. The RCT's authors could not definitively determine whether these results reflected superior protection from medical masks or a harmful effect of cloth masks. However, considering their previous findings of negligible effect of medical masks against viral infection when compared to N95s[17,18] and that the medical mask used had particularly poor filtration, they concluded the increased rates of ILI in cloth mask users may be due to a detrimental effect of cloth masks.

Sellers et al evaluated cloth mask effectiveness in the transmission of Foot and Mouth Virus. This study compared viral transmission of Foot and Mouth Virus in exposed subjects wearing industrial gauze and cotton masks, cloth surgical masks, or paper masks. They concluded the industrial and cloth masks minimally decreased total virus inhalation, and paper masks had no effect.[13]

Discussion

The current COVID-19 pandemic caused a shortage of PPE worldwide. Communities across the United States are mobilizing efforts to provide HCPs with homemade cloth masks[19] as a reusable and accessible

last-resort face covering. Primary care physicians must decide how to protect themselves and their colleagues when medical masks are no longer available. Several publications during this pandemic address the effectiveness of cloth mask use in the community to prevent viral spread,[20-22] however, the use of cloth masks for protection of healthcare providers has not been thoroughly explored. This rapid review identifies the relevant literature and brings together these disparate variables to evaluate the potential for cloth masks to protect healthcare providers.

Filtration

Our qualitative synthesis suggests cloth materials provide a measurable level of particle filtration. On this basis alone, cloth masks are superior to complete lack of face protection as an HCP. However, this cannot serve as reassurance of sufficient protection for HCPs using cloth masks. The level of filtration provided is highly variable and consistently inferior to standard medical masks.[9,11-15] Studies included in this review that considered protection for the wearer suggested the filtration capabilities of cloth masks would not adequately protect HCPs against viral infections.[8,12,16] For HCPs treating patients with COVID-19, it is notable that none of the studies in this review specifically tested SARS-CoV-2 transmission, and only one study selected experimental bioaerosols for physical similarity to SARS-CoV-2.[12] Additionally, conclusions regarding filtration are based on investigations of aerosolized particles including non-corona viruses,[10,12,13,15] bacteria,[8,9,12] and simulated biologic particles.[9,16] According to the WHO, contact and respiratory droplets are the primary method of SARS-CoV-2 spread[23] and aerosols are thought to play a smaller role.[21]The majority of efficacy studies examined here investigate filtration of aerosolized particles or virus rather than droplet or contact protections. Thus, we must interpret these results with caution in the context of COVID-19.

Fit and Airflow

When considering a cloth mask as opposed to medical masks or a bandana or scarf, fit and airflow are essential elements to consider. These are also elements which distinguish medical masks from N95s. Poor fit decreases protection as particles can pass through gaps between the wearers face and the mask, while poor airflow causes breathing difficulty causing compliance issues.[12,13] No current studies compared variable designs of cloth masks for fit or airflow, but multiple studies demonstrate inferior fit of cloth masks compared to medical masks. Two included studies found that the studied designs and materials of cloth masks limit both proper fit and airflow, leading to decreased protection and breathing difficulties.[8,13] This poses significant challenge to cloth mask use and presents an opportunity for future research and development.

Clinical Effectiveness

Though multiple studies indicated cloth masks may be somewhat efficacious, the single clinical investigation suggests they provide inferior protection in clinical settings and may even increase risk to HCPs. While this work suggests HCPs should exercise caution when choosing to use cloth masks, there are no similar real-world studies to support or refute this conclusion nor investigations into why cloth masks may have increased risk of viral infection. Though they considered poor filtration, moisture retention, ineffective cleaning, and reuse of cloth masks as possible contributors, the authors did not detail how HCPs used their five provided cloth masks over their eight-hour shifts. This prevents conclusions regarding length of use and moisture retention. The author's noted that 80% of cloth mask wearers washed their masks at home with, "soap and water," rather than hospital-grade laundry.[9] Further, this RCT isolated human metapneumovirus, rhinoviruses, and influenza B virus, which differ in transmission and pathogenic properties from SARS-CoV-2.[21]

Strengths and Limitations

To our knowledge, this is the only contemporary review of cloth facemasks for HCP protection. Strengths of this rapid review include a comprehensive search of high-yield databases in consult with a health sciences librarian. Due to the limited number of eligible articles, studies of all grade scoring were included. This review excluded studies considering environmental contaminants, such as diesel particles. The body of literature on environmental contaminants may provide additional insight into the protective qualities of cloth masks that were not addressed by this review. Other considerations remain unstudied, including virus viability on masks or mask materials, and behavior change associated with mask use.[24] Given the lack of quantity and quality of literature available, this review cannot remark definitively on protection for HCPs from COVID-19 by cloth masks.

Recommendations

Current CDC guidelines recommend using an N95 for care of patients with COVID-19[25] as medical masks cannot provide the same level of protection against aerosolized particles. While there is some evidence of SARS-CoV-2 aerosol transmission,[21,23] protective measures against droplet transmission should also be considered. For a primary care provider without access to medical masks, our qualitative synthesis of the literature suggests it is better to wear a cloth mask than no mask, but not without careful consideration of harm reduction. Furthermore, the psychological theory of "risk compensation," refers to the concept that humans may behave less conservatively when they believe their risk to be decreased.[24] This is essential to consider when creating policies around use of cloth masks and messaging to HCPs about their risks when wearing cloth masks.

Given the literature's lack of attention to droplet transmission, we include the CDC's recommendation of pairing cloth masks with a plastic face shield.[4] Considering the findings of MacIntyre, et al.[8] it is important to address the potential for increased risk of viral infection to the wearer. We recommend frequent cloth mask changes to reduce risk of moisture retention and wash with hospital laundry standards to reduce risk of ineffective cleaning.

Conclusion

Review of the current literature suggests cloth materials are somewhat effective in filtering particles and aerosols, but cloth masks provide inferior protection with poorer fit and airflow when compared to medical masks. Some data also suggest a potential harm to HCPs using cloth masks for extended periods in a clinical setting. Cloth masks should not be considered equivalent to medical masks, and if HCPs choose to use them, level of fit, type of material and number of layers should be considered. Overall, we conclude cloth masks lack evidence for adequate protection of HCPs against viral respiratory infections, and HCPs should use caution when deciding whether to use cloth masks for extended clinical work.

Additional research is needed to provide a complete understanding of cloth mask effectiveness in healthcare environments. Future work should include systematic comparison of different cloth mask designs and cloth types against standard surgical and N95 masks in a controlled lab setting to optimize fit and material properties. Additional RCTs are required to assess the realities of cloth mask use by HCPs.

Acknowledgments

Kristen DeSanto, MSLS, MS, RD, AHIP, for her support in designing search strategy and defining search terms.

Austin Jolly, BA, for his editing support.

Conflicts of Interest Statement
The authors have no conflicts of interest to report.

References

1. Coronavirus disease (COVID-19) outbreak situation. World Health Organization. https://www.who.int/emergencies/diseases/novel-coronavirus-2019. Published 2020. Updated April 5, 2020. Accessed April 13, 2020.
2. Ranney ML, Griffeth V, Jha AK. Critical Supply Shortages - The Need for Ventilators and Personal Protective Equipment during the Covid-19 Pandemic. *N Engl J Med.* 2020.
3. *Quick COVID-19 Primary Care Survey: Series 4 Fielded April 3-6, 2020.* Primary Care Collective and the Larry A. Green Center.
4. Strategies for Optimizing the Supply of Facemasks. Centers for Disease Control and Prevention. https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/face-masks.html. Published 2020. Updated March 17, 2020. Accessed April 5, 2020.
5. Garritty C GG, Kamel C, King VJ, Nussbaumer-Streit B, Stevens A, Hamel C, Affengruber L. *Cochrane Rapid Reviews.* March 2020.
6. Moher D, Hopewell S, Schulz KF, et al. CONSORT 2010 Explanation and Elaboration: updated guidelines for reporting parallel group randomised trials. *BMJ.* 2010;340:c869.
7. Quigley JM, Thompson JC, Halfpenny NJ, Scott DA. Critical appraisal of nonrandomized studies-A review of recommended and commonly used tools. *Journal of Evaluation in Clinical Practice.* 2019;25(1):44-52.
8. MacIntyre CR, Seale H, Dung TC, et al. A cluster randomised trial of cloth masks compared with medical masks in healthcare workers. *BMJ Open.* 2015;5(4):e006577.
9. Quesnel LB. The efficiency of surgical masks of varying design and composition. *British Journal of Surgery.* 1975;62(12):936-940.
10. Sellers RF, Donaldson AI, Herniman KAJ. Inhalation, persistence and dispersal of foot-and-mouth disease virus by man. 1970;68(04):565.
11. Furuhashi M. A study on the microbial filtration efficiency of surgical face masks--with special reference to the non-woven fabric mask. *Bull Tokyo Med Dent Univ.* 1978;25(1):7-15.
12. Ma QX, Shan H, Zhang HL, Li GM, Yang RM, Chen JM. Potential utilities of mask wearing and instant hand hygiene for fighting SARS-CoV-2. *J Med Virol.* 2020.
13. Davies A, Thompson KA, Giri K, Kafatos G, Walker J, Bennett A. Testing the efficacy of homemade masks: would they protect in an influenza pandemic? *Disaster Med Public Health Prep.* 2013;7(4):413-418.
14. Liu Z, Yu D, Ge Y, et al. Understanding the factors involved in determining the bioburdens of surgical masks. *Ann Transl Med.* 2019;7(23):754.
15. Rengasamy S, Eimer B, Shaffer RE. Simple respiratory protection--evaluation of the filtration performance of cloth masks and common fabric materials against 20-1000 nm size particles. *Ann Occup Hyg.* 2010;54(7):789-798.
16. van der Sande M, Teunis P, Sabel R. Professional and home-made face masks reduce exposure to respiratory infections among the general population. *PLoS One.* 2008;3(7):e2618.
17. Macintyre CR, Wang Q, Seale H, et al. A Randomized Clinical Trial of Three Options for N95 Respirators and Medical Masks in Health Workers. *American Journal of Respiratory and Critical Care Medicine.* 2013;187(9):960-966.

18. Macintyre CR, Wang Q, Cauchemez S, et al. A cluster randomized clinical trial comparing fit-tested and non-fit-tested N95 respirators to medical masks to prevent respiratory virus infection in health care workers. *Influenza and Other Respiratory Viruses.* 2011;5(3):170-179.
19. 100 Million Mask Challenge. American Hospital Association. https://www.100millionmasks.org/. Accessed April 8, 2020.
20. Bae S, Kim M-C, Kim JY, et al. Effectiveness of Surgical and Cotton Masks in Blocking SARS–CoV-2: A Controlled Comparison in 4 Patients. *Annals of Internal Medicine.* 2020.
21. Leung NHL, Chu DKW, Shiu EYC, et al. Respiratory virus shedding in exhaled breath and efficacy of face masks. *Nature Medicine.* 2020.
22. *Rapid Expert Consultation on the Effectiveness of Fabric Masks for the COVID-19 Pandemic.* National Academies of Sciences, Engineering, and Medicine; Aprill 8, 2020 2020.
23. *Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations.* World Health Organization; March 27, 2020 2020.
24. Braun CC, Foust JW. Behavioral Response to the Presence of Personal Protective Equipment: Implications for Risk Compensation. 1998;42(15):1058-1062.
25. *Using Personal Protective Equipment (PPE).* Centers for Disease Control and Prevention;2020.

Table 1. Observational and Non-Human Subjects Study Appraisal Results

Publication	Study Type	Overall Study Assessment*	Appropriate Study Design	Prospective Calculation of Study Size	Blinding of Patients and Personnel	Patient Selection/ Inclusion Criteria	Subject Comparability	Appropriate End Points	Assessment of Outcomes/ Exposure	Follow up/ Handling of Missing Data	Reporting	Confounding	Appropriate Statistical Analysis
Davies 2013	Non-Randomized Trial	high	yes	no	no	yes	yes	yes	yes	yes	yes	yes	yes
Liu 2019	Non-Randomized Trial	high	yes	no	no	no	yes	yes	yes	yes	yes	yes	yes
Rengasamy 2010	Laboratory Efficacy Study	high	yes	no	no	--	--	yes	yes	--	yes	yes	yes
van der Sande 2008	Non-Randomized Trial	high	yes	no	no	no	yes	yes	yes	yes	yes	yes	yes
Furuhashi 1978	Laboratory Efficacy Study	moderate	yes	no	no	--	--	yes	yes	--	yes	yes	yes
Ma 2020	Laboratory Efficacy Study	moderate	yes	no	no	--	--	yes	yes	--	yes	yes	yes
Quesnal 1975	Single-Case Experiment	low	yes	no	no	no	yes	yes	yes	yes	yes	yes	no
Sellers 1970	Non-Randomized Trial	low	yes	no	no	yes	no	yes	yes	no	no	no	yes

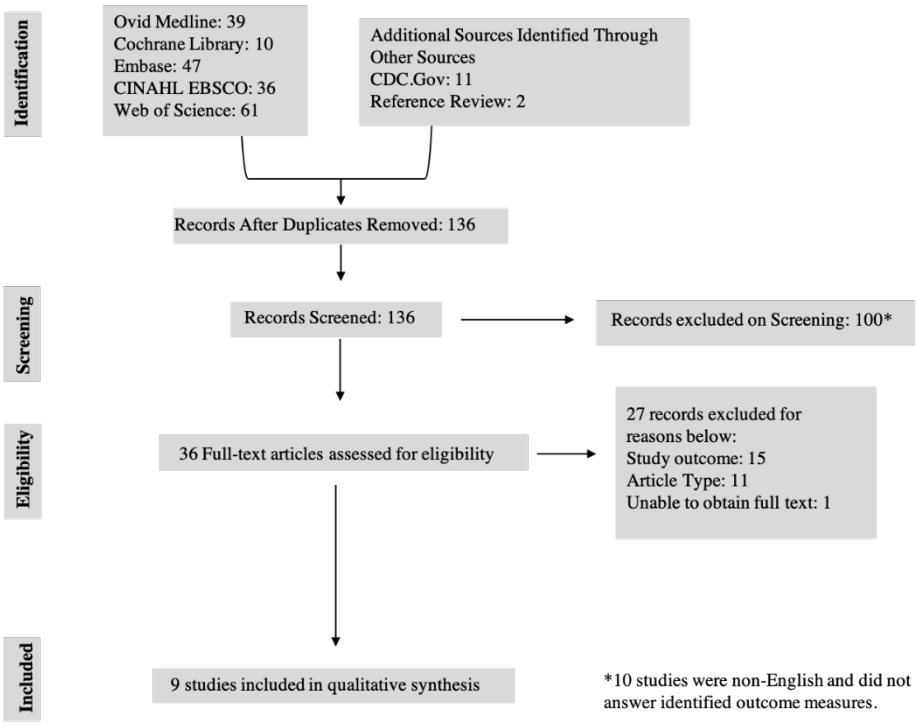
*Determined by review of 11 appraisal domains in context of study strengths and weaknesses.

Table 2. Summary of Included Studies

Characteristics				Outcomes			
				Efficacy			Effectiveness
Publication	**Study Type**	**Population**	**Pathogen/Particle**	**Filtration**	**Fit**	**Airflow**	**Infection**
MacIntyre 2015	Randomized Control Trial	Health care providers (HCP) in high risk wards in Vietnam (N=1607)	Viral respiratory infection* Aerosolized particles	Cloth < Medical	– –	– –	Medical < Cloth (↑ in Cloth)
Davies 2013	Non-Randomized Trial	Volunteers - general population (N=21)	Aerosolized Virus✦ Aerosolized Bacteria✦	Cloth < Medical	Cloth < Medical	Cloth < Medical	– –
Liu 2019	Non-Randomized Trial	Surgeons (N=50)	Bacteria✦	Cloth < Medical	– –	Cloth < Medical	– –
Sellers 1970	Non-Randomized Trial	Human subjects exposed to Foot and Mouth virus (N=8)	Picornavirus$^{\Sigma}$	– –	– –	– –	Medical = Cloth (↑ in both)
van der Sande 2008	Non-Randomized Trial	Volunteers - general population (N=39)	Particles 0.02 μm to 1 μm	– –	Cloth < Medical	– –	– –
Furuhashi 1978	Laboratory Efficacy Study	n/a	Bacteria✦	Cloth < Medical	– –	Cloth < Medical	– –
Ma 2020	Laboratory Efficacy Study	n/a	Aerosolized Virus$^{\times}$	Cloth = Medical	– –	– –	– –
Rengasamy 2010	Laboratory Efficacy Study	n/a	Aerosolized particles (20–1000 nm)	Cloth < N95	– –	– –	– –
Quesnal 1975	Single-Case Experiment	Single human test subject - general population	Bacteria✦	Cloth = Medical	– –	– –	– –

Pathogen Detection Method:
* Influenza like illness and/or pharyngeal swab multiplex PCR confirmed infection (Rhinovirus, hMPV, influenza etc.)
✦ Viable pathogen detected via post filter colony formation
∑ Viral colony formation from nasal swab
× Virus detected via post filtration PCR

Figure 1. Study Flow Chart for Selection of Articles
CINAHL = Cumulative Index to Nursing and Allied Health Literature



Supplemental Appendix

Table S1: Search Strategies

Database	Search Term
Ovid Medline	((homemade or home-made or handmade or hand-made or cloth or fabric) adj3 (mask* or facemask* or PPE)).mp.
The Cochrane Library	(homemade or home-made or handmade or hand-made or cloth or fabric) NEAR/3 (mask* or facemask* or PPE)
EMBASE	((homemade OR 'home made' OR handmade OR 'hand made' OR cloth OR fabric) NEAR/3 (mask* OR facemask* or PPE))
CINAHL EBSCO	(homemade or home-made or handmade or hand-made or cloth or fabric) N3 (mask* or facemask* or PPE)
The Web of Science	(“homemade” or “home-made” or “handmade” or “hand-made” or “cloth” or “fabric”) NEAR/3 (“mask*” or “facemask*” or “PPE”)
CDC.gov	Journal articles: “cotton face mask”

Table S2: Excluded Publications, and Reasons for Exclusion

Publication	Reason for Exclusion
Yao, 2019	Outcome
Lemmer, 2019	Outcome
Chughtai, 2016	Outcome
AJN, Editor's Note, 2018	Editor's Note
MacIntyre, 2015	Review Article
Hildwine, 2006	Article Style, Outcomes
Chughtai, 2015	Outcome
Chughtai, 2013	Outcome
Cooper, 1983	Unable to Obtain Full Text
Halacka, 1962	Outcome
Hubble, 1996	Outcome
Verbeek, 2019	Review Article
Chughtai, 2014, International Journal of Infectious Disease pg. 408	Outcome
Chughtai, 2014, International Journal of Infectious Disease pg. 417	Outcome
MacIntyre, 2012	Abstract
Seale, 2012	Outcome
Beaumont, 1997	Commentary
Belkin, 2000	Opinion
Brett, 2012	Outcome
Buregyeya, 2012	Outcome
Conner, 2001	Commentary
Cowperthwaite, 2015	Commentary
deKay, 2020	Commentary
Schwerin, 2019	Outcome
Van Wicklin, 2012	Commentary
Morishima, 2019	Outcome
Dato, 2006	Letter to the Editor