Narrative Review

Homemade masks in the COVID-19 pandemic: recommendations, physical characteristics, disinfection and efficacy*

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Abstract

Objective: To describe the recommendations, physical characteristics, disinfection methods and efficacy of the use of homemade face masks to reduce COVID-19 transmission. **Methods:** We searched MEDLINE, SciELO, and Google Scholar, in addition to the official recommendations for the use of masks. **Results:** Thirty-one references were included. Fabric filtration efficiency ranged from 5% to 98%. The filtration efficacy of three layered 100% cotton fabric face masks ranged from 70% and 99% *in vitro* studies. Homemade, surgical, and respirator masks showed breathability between 2.2 and 3.0 Pascal. The capacity to reduce the spread of microorganisms by people wearing homemade face masks was three times lower when compared to those wearing surgical masks, although this capacity was higher when compared to those who did not wear masks. **Conclusion:** The breathability of homemade masks proved to be adequate, while the filtration ability seemed to be lower than that of surgical masks, but it was better than not wearing any masks at all. There is no evidence to support the efficacy and effectiveness of homemade masks.

Keywords: Betacoronavirus; Coronavirus infections; Respiratory Infections; Face Masks; Respiratory Protective Equipment; Review.

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Introduction

COVID-19 is an infectious disease, which mainly affects the lungs, caused by a newly discovered coronavirus, causing a severe acute respiratory syndrome (SARS-CoV-2). The first recorded cases occurred in China in December 2019, and the World Health Organization (WHO) declared COVID-19 to be pandemic on March 11, 2020.[1]

> *Non-pharmacological interventions are recommended to reduce the spread of COVID-19, including the use of masks by the general public. Although homemade face masks are not considered personal protective equipment, they are also recommended.*

In January 2021, there were more than 90 million people infected, more than 1.5 million died and 219 affected countries. The United States, India, and Brazil had the highest number of cases.[2,3]

Non-pharmacological interventions were recommended to reduce the spread of the disease, in addition to the use of masks by the general public, including asymptomatic individuals.[4-8] The use of medical masks, such as surgical masks and respirators, by the general public can result in shortage of these materials for health care professional working at the front line treating and caring for patients. Therefore, it has been recommended the use of homemade masks, although they are not considered personal protective equipment and have not undergone quality control tests after their manufacture.[9,10]

This review aimed to describe the recommendations for use, physical characteristics, disinfection methods and efficacy of homemade masks in reducing COVID-19 transmission.

Methods

This was a narrative literature review. Searches were conducted in MEDLINE (via PubMed), SciELO and Google Scholar (100 first results), in the quest for *in vitro* experimental study, clinical trials, and observational studies. The terms used in these searches were 'cloth mask', 'homemade mask', 'cloth mask breathability', 'homemade mask breathability', 'cloth mask disinfection', 'homemade mask disinfection' and 'mask', associated or not with the term 'COVID-19'. Studies that evaluated the physical characteristics of fabrics and masks (filtration efficiency, breathability and influence of adequate fit on filtration capacity), methods for disinfection of homemade face masks, and efficacy and effectiveness of the use of homemade face masks were considered eligible.

Searches related to recommendations on the use of homemade face masks were also conducted at the Brazilian Ministry of Health, the National Health Surveillance Agency (ANVISA), WHO, the United States Centers for Disease Control and Prevention (US. CDC) and the European Centre for Disease Prevention and Control (ECDC). The searches were conducted by October 29, 2020. Three authors (Sousa ITC, Pestana AM, and Pavanello L) were responsible for reading the titles and abstracts, for initial selection, and reading the complete texts. They also assessed the eligibility of the studies identified. The Rayyan platform (https://rayyan.qcri.org) was used during this stage.

Results

195 articles were retrieved, of which 15 were duplicated and 165 excluded, after reading the title and abstract. A total of 15 articles were included, in addition to 16 references from official institutions.

Official recommendations

Regulatory agencies and public health organizations have recommended the use of homemade masks by the general public when there is a need to leave home, given that masks can provide a physical barrier, reducing the spread of infectious droplets and aerosols from the control of the source of infection: infected, asymptomatic or pre-symptomatic individuals.[4,5,7,9-14] According to WHO, homemade cloth masks must include three layers of fabric: an innermost layer of a hydrophilic material (cotton); an outermost layer made of hydrophobic material (polyester, polyester hybrid and cotton, polypropylene); a middle hydrophobic layer which has been shown to enhance filtration or retain droplets (polypropylene or polyester).[12] The US CDC indicates that masks

including two layers of fabric should block light when held up to bright light source.[14] Box 1 shows the main recommendations for the use of homemade, surgical and respirator masks, while Box 2 shows the fabrics recommended for making masks.

Despite the recommendations for use, WHO[4] and ECDC[10] warned of risk of contracting SARS-CoV-2 for inadequate use and handling of masks, a false sense of security, with neglect of other essential measures, such as physical distancing and hand hygiene practices.[4,10]

Filtration ability and facial fit

Most initiatives that verified filtration ability of face masks were *in vitro* studies that used droplet generator (>5 µm) or aerosols (≤5 µm) through masks or fabrics to assess their blocking potential.[15-21] Several substances were used for the production of the particles, such as sodium chloride[15,17,18] fluorescent nanoparticles[16] and polystyrene particles,[20] in addition to microorganisms such as avian influenza virus,[18] bacteriophage MS2[22], *Staphylococcus aureus*[19] and *Bacillus atrophaeus*.[22]

Some combinations of different fabrics including multiple layers showed a higher filtration ability: masks made of one or two layers of 600 threads per inch 100% cotton (over 98%); face masks of one layer of 200 threads per inch 100% cotton, (96%);[16] masks of one layer of cotton silk blend fabrics, (over 94%);[17] masks of one layer of 70% cotton and 30% polyester, (93%);[16] non-woven face masks, two layers (93%);[19] and masks of one layer of polyester and four layers of kitchen paper (95%).[18] Other fabrics and different combinations showed poor results, such as face masks of one, two or four layers of natural silk fabric, (54% to 88%), two layers of 80 threads per inch cotton, (9% to 49%)[14] and non-woven of one layer (42%).[19] Surgical masks showed filtration efficacy between 76% and 98%.[17-19]

Assays with assessment of particles of different sizes (20 to 1,000 nm) and velocity dispersion (5.5 cm/s and 16.5 cm/s) showed that 100% cotton, 100% polyester and fabrics made of cotton blends had instantaneous penetration level (the opposite of filtration), between 40 and 90%, with increased penetration according to the increase in the air velocity used.[15] At a flow 8 L/min and 19 L/min, homemade masks with plastic and latex valves had filtration efficacy above 60%, while two other homemade masks ranged from 10% to 90%.[21] At a flow of 32 L/min, cotton fabrics of weight between 157 and 360 g/m^2 showed filtration efficiency between 5% and 25%; masks of silk, 4%; surgical masks, 33%; and respirators, 95%.[20]

An *in vitro* study[22] to assess the filtration efficiency of the fabric in a condition of complete seal, showed that the filtration efficiency for aerosols containing *Bacillus artophaeus* was 69% for 100% cotton fabrics (one layer), 60% for linen (one layer) and 96% for surgical masks. For MS2 bacteriophage, filtration capacity was 50% for 100% cotton fabric (one layer), 54% for linen (one layer) and 89% for surgical masks. Two layers of 100% cotton fabric was tested only for *Bacillus artophaeus*, the filtration efficiency was 70%.[22]

The same study[22] simulated the use of masks in healthy people (n=21) to determine the effect of masks in preventing the dispersion of microorganisms. The volunteers wearing surgical and homemade masks (100% cotton fabric) or no mask, coughed twice into a mobile sampling chamber. The capacity to reduce the spread of microorganisms by volunteers wearing homemade masks was three times lower than that of those wearing surgical masks. However, this capacity was higher when compared to those that did not wear masks.[21]

The influence of sealing was also assessed in assays related to filtration efficacy of homemade and surgical masks and respirators.[17] Inadequate fit, that is, gaps between the mask and the face, can reduce the protection provided.[14] Nonmedical masks must cover your nose, mouth and chin, which is called breathing zone. Do not choose masks that have exhalation valves or vents. Check to be sure the mask fits snugly over the nose, mouth and under the chin and that there are no gaps around the sides (Figure 1). They should also be designed in such a way as to be put on and removed easily, avoid tight-fitting masks.[23]

An assay that simulated situations related to fit and leakage of masks and respirators, for different particle sizes, showed that the filtration efficacy was 99% (for particles larger than 300 nm), 85% (for particles smaller than 300 nm) for N95 respirators. The presence of an orifice corresponding to 1% of the respirator surface area reduced filtration efficacy to 34%. For surgical masks the filtration efficiency was 99% (particles >300 nm – adequately fitted face mask), 76% (particles <300 nm – adequately fitted face mask) and 44% to 50% (with the presence of an orifice corresponding to 1% of the surface area of the mask, improper fit).

Box 1 – Recommendations from health agencies and organization consulted on the use of homemade masks, surgical masks and respirators

Homemade masks	Healthy, asymptomatic or pre-symptomatic people in areas with confirmed COVID-19 cases, when there is a need to leave home.[4,7-10,12]
Surgical masks	Healthcare workers in their clinical practice, receptionists, people diagnosed or with symptoms of COVID-19 and individuals at high risk of getting seriously ill, such as the elderly and people with comorbidities.[3-5,7,10,12,38]
Respirators	Healthcare workers on the front line fighting COVID-19, exposed to aerosol-generating procedures, such as dental care, nebulization, cardiopulmonary resuscitation maneuvers or procedures involving upper airway instrumentation.[5-7,10,12,38]
Face shields can be used as an option for people with mental disorders, and children, for whom wearing masks may not be feasible. Children under two years old should not wear masks, as they are unable to remove the mask without assistance.[3,4,9]	

Box 2 – Best fabrics for making homemade masks

Institution[a]	Types of fabrics	Number of layers
Ministry of Health[11]	Vacuum bag	2
	Hybrid: 55% polyester and 45% cotton	
	100% cotton	
	Antimicrobial tissue pillowcases	
National Health Surveillance Agency[5]	100% cotton	3
	Hybrid cotton-spandex, composed of at least 90% cotton	
	Non-woven fabric	
World Health Organization[4,12,13]	100% cotton	3
	Polyester	
	Cellulose	
	Silk	
	Nylon	
	Polypropylene	
Centers for Disease Control and Prevention[9]	Cotton	2

a) European Centre for Disease Prevention and Control (ECDC) does not have a fabric specification and number of layers of homemade masks.

For homemade masks, such as silk cotton blend fabric, this variation was 98% (particles >300 nm) to 94% (particles <300 nm) and 37% (with the presence of an orifice corresponding to 1% of the surface area of the mask, simulating an improper fit).[17]

Homemade cloth masks were less effective in terms of filtration and face mask fit when compared to surgical masks and respirators.[24,25] An assay assessed the protection factor (PF) calculated, which considered the ratio of particles filtered by masks in children (n=11) and adults (n=28).[24] This factor was obtained initially considering the filtration rate: %F = (number of particles in the air inside the mask per cm^3/number of particles in the air outside the mask per cm^3) x 100. Once the value of %F was obtained, the PF was calculated, which is the inverse of the filtration rate, divided by 100 (FP =%F/100)-1.[24]

In adults, the PF of masks (median and interquartile interval) when tested in short term inward protection was 2.5 (2.1 – 2.9) for homemade masks, 4.1 (3.1 – 7.2) for surgical masks and 113.0 (26.0 – 210.0) for N95 respirators. In children, the PF was 2.2 (1.5 – 2.2) for homemade masks, 3.2 (2.2 – 4.1) for surgical masks and 18.0 (6.1 – 165.0) for N95 respirators.[24] In general, homemade masks provided 50 times less protection than FFP-2 respirators (European equivalent

Note: Homemade masks should cover the nose, mouth and chin (called breathing zone), properly fitted; exhalation or vents valves are not recommended.

Figure 1 – Breathing zone protection of the nonmedical mask

of a N95 masks) and 25 times less than surgical masks, presenting lower protection factor in children.[24]

An *in vitro* study assessed the filtration efficacy and fit of surgical masks (n=3), N95 respirators (n=3) and two layered cotton masks (n=10) through fitting tests. A volunteer was recruited for the experiment. A portable counter of all free floating particles in the air via an electrostatic particle classifier and counter was used. It can register particles floating in the air with sizes between (0.02 µm to 1 µm) outside and inside the mask for one minute. The filtration values obtained were compared between masks and respirators: two layered cotton mask presented filtration efficacy of less than 60%, and consequently, an inadequate fit, according to the face fitting test. Surgical masks with nose clip showed filtration greater than 75%; and N95 respirators, considered personal protective equipment and checked by the face fitting tests, presented filtration greater than 99%.[25] Adding a layer of nylon stocking over the homemade masks, in order to improve the facial fit and reduce the gaps between the face and the mask, resulted in increased filtration efficiency greater than 70%.[25]

Breathability of homemade masks

The acceptable breathability of a surgical mask should be below 49 Pa/cm^2. For homemade masks, an acceptable pressure difference should be below 100 Pa/cm^2.[26]

The unlimited combination of fabrics and materials used resulted in variable filtration and breathability, and it is recommended to include at least two to three layers of fabrics for homemade masks.[4,5,9,11]

A study conducted with 24 children between 8 and 11 years old, when comparing three types of homemade masks designed to protect them against exposure to air pollution, observed for all masks, breathability was one of the negative criteria. The perception that the masks affected their ability to breathe, led the children to remove them during walking and running activities.[27]

An *in vitro* study[17] assessed breathability using differential pressure in 15 types of fabrics used to make homemade masks, and compared it with the corresponding values found for respirators and surgical masks. Homemade masks showed filtration and breathability values similar to those of surgical masks and respirators, according to the type of fabrics:

one or two layers of 100% cotton fabric, presented filtration efficacy greater than 98% and breathability of 2.5 Pascal (Pa), results similar to those of respirators (99% filtration and 2.2 Pa breathability) and surgical masks (99% filtration and 2.5 Pa breathability). They also showed results similar to those of cotton silk fabric blend (98% filtration and breathability 3 Pa), cotton polyester spandex fabric (98% filtration and Breathability of 3 Pa) and cotton polyester fabric (96% filtration and 3 Pa breathability).[17]

Disinfection of homemade masks

Masks should be handled with caution to avoid cross-contamination with other items,[4] washed and disinfected whenever it gets dirty or at least daily.[28] As for the hygiene of homemade masks, wash them with hot water[4,7,23] or cold water,[11,23,28-30] using laundry detergent or soap (Box 3);[4,5,7,11,28] enzymatic detergent was also indicated in the washing process, as an alternative to laundry detergent.[23] Some organizations recommended immersion of the mask in solution with sodium hypochlorite for 5 to 30 minutes,[5,11,28] or chlorine for 1 min.[4] The use of the washing machine with hot water (60 ºC) has been suggested, in addition to the use of iron[5] (Box 3).

An *in vitro* study conducted in 2020 presented tests that were performed in triplicate using moist heat (in a rice cooker or other kitchen steamer, for 15 minutes) and dry heat (in an oven, 100 ºC for 15 minutes) to assess the disinfection of homemade masks, N95 respirators and surgical masks after having their outer and inner surfaces inoculated with methicillin-resistant *Staphylococcus aureus* (MRSA) and bacteriophage MS2.[31] The moist heat treatment resulted in a greater than 5 log reduction in MRSA and MS2 bacteriophage, whereas dry heat did not result in a greater than 3 log reduction of either organism, regardless the type of mask. No visible changes were observed after five cycles of decontamination, in the masks.[31]

Efficacy and effectiveness of use in the prevention of respiratory infections

In 2011, a randomized controlled trial with 1,607 doctors and nurses from 15 hospitals in Vietnam found that the incidence of respiratory infection was statistically higher in the group of homemade masks, compared to that of surgical masks.[32] Infections were based on clinical symptoms or laboratory confirmation through real-time reverse transcription polymerase chain reaction (RT-qPCR) for 17 respiratory viruses, including severe acute respiratory syndrome virus, (SARS-CoV-2 was not included).

In the period from December 31, 2019 (first day, no confirmed cases in Hong Kong) to April 9, 2020 (with 961 confirmed cases), compliance of face mask usage and the number of laboratory-confirmed cases in Hong Kong was compared to that of representative countries in North America, Europe, and Asia. The diagnosis of COVID-19 was performed using RT-qPCR and the monitoring of face mask usage was carried out by counting the number of people not wearing masks on three consecutive days (10,500 people were monitored).[33] The average of face masks usage in Hong Kong was 96%, and the transmission rate of COVID-19 was 129 people infected per 1 million inhabitants, while in South Korea, the compliance of face mask usage was 50% and the incidence of COVID-19 was 200.5 per 1 million habitants.[33] Other countries, such as Spain (2,983.2 infected people/1 million inhabitants) and Italy (2,250.8 infected people/1 million inhabitants) had higher proportion of infected people/1 million inhabitants. However, the percentage data of face mask usage for both European countries were not available, only the information on populations from regions where the use of face masks was not universally adopted.[33]

Discussion

The use of homemade face masks to prevent the spread of COVID-19 has been recommended by the health agencies and organizations consulted, in situations where there is a need to leave home. Fabrics used to make homemade masks may present adequate filtration, although variable, they are always inferior to surgical masks. Studies assessing the use of homemade face masks during the pandemic caused by SARS-CoV-2 are still scarce, and inconclusive. There was a possible reduction in the incidence of infection with the use of homemade face masks. With regard to disinfection methods, washing the masks with soap and water, as well as the use of 2-2.5% hypochlorite solution are the main recommended actions.

Box 3 – Recommendations for washing and disinfection of homemade masks

Institution	Recommendation for washing and disinfection
World Health Organization[4]	Water temperature at 60 ºC + soap/laundry detergent or water at room temperature with soap / laundry detergent and then boiled, or water with 0.1% chlorine. Masks should soak for 1 minute and then be rinsed with water at room temperature.
Centers for Disease Control and Prevention[28]	Immerse the mask in 2.0-2.5% sodium hypochlorite and water at room temperature for 5 minutes, then rinse it with water at room temperature, and dry with hot air or outdoors; in washing machines, use soap and hot water.
European Centre for Disease Preventions and Control[7]	Laundry detergent at 60 ºC.
Ministry of Health[11]	Immerse the mask in 2.0-2.5% sodium hypochlorite and water in the proportion at 1:50 for 30 minutes. It should be rinsed with water and washed with soap and water. After drying, iron it.
National Health Surveillance Agency[5]	Previous washing with water and neutral soap. Immerse the mask in 2.5% sodium hypochlorite solution (or other disinfectant) and water for 20 to 30 minutes. Rinse with water and then, after drying, iron it. In washing machine, program the complete wash cycle with water temperature at 60 ºC.

The recommendations for the use of homemade face masks presented here, took into consideration only the official publications from five health institutions (Anvisa, Brazilian Ministry of Health, CDC/USA, ECDC and WHO), which is a limitation for this review. Furthermore, no studies were found on the assessment of filtration efficacy of homemade face masks or efficacy of methods for mask disinfection regarding SARS-CoV-2: the conclusion with regard to the effectiveness of filtration and disinfection of different masks were based on the results of studies that simulated – inanimately – SARS-CoV-2, or that used other viruses and bacteria.

Health agencies and organizations recommended that homemade face masks should be made from the following materials: 100% cotton fabric,[4,9,5,11] non-woven[5] and hybrid cotton polyester fabric.[11] These fabrics were effective *in vitro* in terms of particle filtration efficiency against aerosols, presenting filtration rates between 93% and 98%.[16,17,19] However, methodologically similar researches[15,20,21] presented different results, with filtration values below 40%. Notwithstanding, these studies did not make it clear[15,20,21] the number of layers or even the constitution of the fabric used to make the masks. In general, masks made up of two cloth layers were more effective regarding filtration efficacy than single-layered masks.[17-19] In addition to the type of fabrics used, variations in the experiments on filtration efficacy, such as the size of aerosol particles, airflow velocity employed and whether the masks were adequately fitted or not, may influence the results, making it difficult to compare studies.[16-22]

The breathability and fit of the homemade masks are factors that influence the filtration efficiency of the masks.[27] Homemade masks are able to present adequate breathability, similar to surgical masks and respirators, [16,17,22] although they may have a poorer fit.[21,22] It is important to highlight: homemade and surgical masks unlike respirators, are not designed to provide sealing. The presence of gaps between the face and the mask, although adequately fitted, can reduce filtration efficacy.[17,21,22]

Water, soap and/or laundry detergent and disinfectant such as hypochlorite are the most recommended products for disinfection of homemade masks.[4,7,9,11,23] Chemical and physical methods of disinfection, such as the use of 70% ethanol,[34] sodium hypochlorite[35] and heat inactivation,[36] also showed, *in vitro*, that they were capable of potentially reduce SARS-CoV-2 transmission, although they were not used in homemademasks.[37] Studies aimed at assessing the impact of disinfection methods on the physical parameters of homemade masks, were not found, although it has been suggested that you can reuse and wash your masks up to 30 times.[5] Studies assessing the efficacy of mask disinfection, mainly related to SARS-CoV-2 contamination, are still needed.

As for the efficacy and effectiveness of the use of homemade masks by the general public, prediction studies based on mathematical models estimated that the use of low efficacy masks, can reduce by up to 45%

the deaths caused by SARS-CoV-2, in 2 month forecast horizon.[38-40] An observational study conducted in 2020 concluded that the use of masks significantly reduced the spread of SARS-CoV-2 among the population.[33] However, the types of masks used were not specified, and the influence of other factors, such as hand hygiene process and physical distancing was not taken into account. In the hospital environment, professionals wearing homemade masks were more susceptible to respiratory infections when compared to those wearing surgical masks.[32] It is worth noting that factors such as handling and duration of wearing of homemade masks, or the risk of infections from outside the hospital environment, were not controlled.

Taking these results, it can be concluded that the filtration and breathability efficacy of the fabrics, from which the homemade masks are made, is variable and, in some situations, comparable to that of surgical masks. However, in situations related to the use and considering the influence of factors such as adequate fit, the homemade mask can promote filtration and protection against respiratory infections lower than those observed in surgical masks and respirators, although better than no masks at all. Methods of disinfection with soap and water and/or laundry detergents, or with disinfectant such as hypochlorite, are recommended even without scientific evidence of its effectiveness in homemade masks. Further studies are needed to assess disinfection methods, efficacy and effectiveness of the use of homemade masks in preventing COVID-19.

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Authors' contribution

Sousa ITC and Cogo-Müller K collaborated with the study conception. Sousa ITC, Pestana AM, Pavanello L, Franz-Montan M and Cogo-Müller K collaborated with data analysis and interpretation, drafting and critical reviewing of the manuscript intellectual content. All authors have approved the final version of the manuscript and declared themselves to be responsible for all aspects of the work, including ensuring its accuracy and integrity.

References

1. Ministério da Saúde (BR). O que é COVID-19? [Internet]. Brasília, DF: MS. 2020 [acesso 29 ago. 2020]. Disponível em: https://coronavirus.saude.gov.br/sobre-a-doenca#o-que-e-covid
2. World Health Organization. WHO coronavirus disease (COVID-19) dashboard [Internet]. [Geneva]: WHO; 2020 [acesso 29 out. 2020]. Disponível em: https://covid19.who.int/
3. World Health Organization. Coronavirus disease (COVID-19) pandemic [Internet]. [Geneva]: WHO; 2020 [acesso 29 ago. 2020]. Disponível em: https://www.who.int/emergencies/diseases/novel-coronavirus-2019
4. World Health Organization. Coronavirus disease (COVID-19) advice for the public [Internet]. [Geneva]: WHO; 2020 [acesso 29 ago. 2020]. Disponível em: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public
5. Agência Nacional de Vigilancia Sanitária. Orientações gerais: máscaras faciais de uso não profissional [Internet]. Brasília, DF: Anvisa; 3 abr. 2020 [acesso 29 ago. 2020]. Disponível em: https://www.anvisa.gov.br
6. Centers for Disease Control and Prevention. Coronavirus disease 2019 (COVID-19) [Internet]. [Highway]: CDC; 2020 [acesso 29 ago 2020]. Disponível em: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html
7. European Centre for Disease Prevention and Control. Considerations for infection prevention and control measures on public transport in the context of COVID-19 [Internet]. [Solna]: ECDC;29 Apr 2020 [acesso 29 ago. 2020]. Disponível em: https://www.ecdc.europa.eu/en/publications-data/covid-19-prevention-and-control-measures-public-transport
8. Ministério da Saúde (BR). Como se proteger [Internet]. [Brasília, DF]: MS; 2020 [acesso 29 ago 2020]. Disponível em: https://coronavirus.saude.gov.br/sobre-a-doenca#como-se-proteger
9. Centers for Disease Control and Prevention. How to make masks [Internet]. Centers for disease

control and prevention. [Highway]: CDC; 2020 [acesso 29 ago. 2020]. Disponível em: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-to-make-cloth-face-covering.html

10. European Centre for Disease Prevention and Control. Infographic: using face masks in the community [Internet]. [Solna]: ECDC; 2020 [acesso 29 ago. 2020]. Disponível em: https://www.ecdc.europa.eu/en/publications-data/infographic-using-face-masks-community

11. Ministério da Saúde (BR). Nota informativa n. 3/2020-CGGAP/DESF/SAPS/MS [Internet]. [Brasília, DF]: MS; 2020 [acesso 29 ago. 2020]. Disponível em: https://www.saude.gov.br/images/pdf/2020/April/04/1586014047102-Nota-Informativa.pdf

12. World Health Organization. Advice on the use of masks in the context of COVID-19: Interim guidance [Internet]. [Geneva]: WHO; 6 April 2020 [acesso 29 ago.2020]. Disponível em: https://apps.who.int/iris/handle/10665/331693

13. World Health Organization. Mask use in the context of COVID-19: Interim guidande [Internet]. [Geneva]: WHO; 1 December 2020 [acesso 14 mar. 2020]. Disponível em: https://apps.who.int/iris/handle/10665/337199

14. Centers for Disease Control and Prevention. Type of masks: cloth masks [Internet]. [Highway]: CDC; 19 Apr 2021 [acesso 14 mar. 2021]. Disponível em: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/types-of-masks.html

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):789-98. doi: https://doi.org/10.1093/annhyg/meq044.

16. Aydin O, Emon B, Cheng S, Hong L, Chamorro LP, Saif TA. Performance of fabrics for home-made masks against the spread of COVID-19 through droplets: a quantitative mechanistic study. Extreme Mech Lett. 2020;40:100924. doi: https://doi.org/10.1016/j.eml.2020.100924.

17. Konda A, Prakash A, Moss GA, Schmoldt M, Grant GD, Guha S. Aerosol filtration efficiency of common fabrics used in respiratory cloth masks. ACS Nano. 2020 May 26;14(5):6339-47. doi: https://doi.org/10.1021/acsnano.0c03252.

18. Ma XQ, Shan H, Zhang H-L, Li G-M, Yang R-M, Chen J-M. Potential utilities of mask: wearing and instant hand hygiene for fighting SARS-CoV-2. J Med Virol. 2020;92(9):1567-71. doi: https://doi.org/10.1002/jmv.25805.

19. Wang D, You Y, Zhou X, Zong Z, Huang H, Zhang H, et al. Selection of homemade mask materials for preventing transmission of COVID-19: a laboratory study. PLoS One. 2020 Oct 15;15(10): e0240285.doi: http://dx.doi.org/10.1371/journal.pone.0240285.

20. Zhao M, Liao L, Xiao W, Yu X, Wang H, Wang Q, et al. Household materials selection for homemade cloth face coverings and their filtration efficiency enhancement with triboelectric charging. Nano Lett. 2020 Jul 8;20(7):5544-52. doi: http://dx.doi.org/10.1021/acs.nanolett.0c02211.

21. Shakya KM, Noyes A, Kallin R, Peltier RE. Evaluating the efficacy of cloth facemasks in reducing particulate matter exposure. J Expo Sci Environ Epidemiol. 2017;27(3):352-357. doi: http://dx.doi.org/10.1038/jes.2016.42.

22. Davies A, Thompson K-A, Giri K, Kafatos G, Walker J, Bennet A. Testing the Efficacy of homemade masks : would they protect in a influenza pandemic? Disaster Med Public Health Prep. 2020;7(4):413-8. doi: http://dx.doi.org/ 10.1017/dmp.2013.43.

23. Associação Brasileira de Normas Técnicas. Máscaras de proteção respiratória de uso não profissional: guia de requisitos básicos para métodos de ensaio, fabricação e uso [Internet]. Rio de Janeiro: ABNT; 2020 [acesso 29 ago. 2020]. Disponível em: http://www.cvs.saude.sp.gov.br/up/Guia_0994632_ABNT_Pratica_Recomendada_para_Mascaras_de_Uso_Nao_Profissional_compressed (3).pdf

24. 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 Jul 9;3(7):e2618. doi: http://dx.doi.org 10.1371/journal.pone.0002618.

25. Mueller A, Fernandez L. Assessment of fabric masks as alternatives to standard surgical masks in terms of particle filtration efficiency. medRxiv 2020.04.17.20069567; doi: https://doi.org/10.1101/2020.04.17.20069567. Now published in Matter. doi: 10.1016/j.matt.2020.07.006

26. Jung H, Kim JK, Lee S, Lee J, Kim J, Tsai P, et al. Comparison of Filtration efficiency and pressure drop in anti-yellow sand masks, quarantine masks,

medical masks, general masks, and handkerchiefs. Aerosol Air Qual Res. 2014;14(3):991-1002. doi: https://doi.org/10.4209/aaqr.2013.06.0201.

27. Smart NR, Horwell CJ, Smart TS, Galea KS. Assessment of the wearability of facemasks against air pollution in primary school-aged children in London. Int J Environ Res Public Health. 2020 Jun 2;17(11):3935. doi: https://doi.org/10.3390/ijerph17113935.

28. Centers for Disease Control and Prevention. How to wash masks [Internet]. [Highway]: CDC; 2020 [acesso 31 ago. 2020]. Disponível em: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-to-wash-cloth-face-coverings.html

29. Agência Nacional de Vigilancia Sanitária. Nota técnica n. 26/2020/SEI/COSAN/GHCOS/DIRE3/ANVISA. Recomendações sobre produtos saneantes que possam substituir o álcool 70% na desinfecção de superfícies, durante a pandemia da COVID-19 [Internet]. [Brasília, DF]: ANVISA; 2020 [acesso 29 ago. 2020]. Disponível em: http://portal.anvisa.gov.br/documents/219201/4340788/SEI_ANVISA+-+0964813+-+Nota+Técnica.pdf/71c341ad-6eec-4b7f-b1e6-8d86d867e489

30. Agência Nacional de Vigilancia Sanitária. Nota técnica n. 47/2020/SEI/COSAN/GHCOS/DIRE3/ANVISA. Recomendações sobre produtos saneantes que possam substituir o álcool 70% e[m] desinfecção de objetos e superfícies, durante a pandemia de COVID-19 [Internet]. [Brasília, DF]: ANVISA; 2020 [acesso 29 ago. 2020]. Disponível em: http://portal.anvisa.gov.br/documents/219201/4340788/Nota+Técnica+47.pdf/242a3365-2dbb-4b58-bfa8-64b4c9e5d863

31. Li DF, Cadnum JL, Redmond SN, Jones LD, Donskey CJ. It's not the heat, it's the humidity: effectiveness of a rice cooker-steamer for decontamination of cloth and surgical face masks and N95 respirators. Am J Infect Control. 2020;48(7):854-5. doi: https://doi.org/10.1016/j.ajic.2020.04.012.

32. MacIntyre CR, Seale H, Dung TC, Hien NT, Nga PT, Chughtai AA, et al. A cluster randomised trial of cloth masks compared with medical masks in healthcare workers. BMJ Open. 2015 Apr 22;5(4):e006577. doi: https://doi.org/10.1136/bmjopen-2014-006577.

33. Cheng VC-C, Wong S-C, Chuang VW-M, So SY-W, Chen JH-K, Sridhar S, et al. The role of community-wide wearing of face mask for control of coronavirus disease 2019 (COVID-19) epidemic due to SARS-CoV-2. J Infect. 2020;81(1):107-14. doi: https://doi.org/10.1016/j.jinf.2020.04.024.

34. Leslie RA, Zhou SS, Macinga DR. Inactivation of SARS-CoV-2 by commercially available alcohol-based hand sanitizers. Am J Infect Control. 2021;49(3):401-402. doi: https://doi.org/10.1016/j.ajic.2020.08.020. Epub 2020 Aug 18.

35. Chan K-H, Sridhar S, Zhang RR, Chu H, Fung AY-F, Chan G, et al. Factors affecting stability and infectivity of SARS-CoV-2. J Hosp Infect. 2020;106(2):226-31. doi: https://doi.org/10.1016/j.jhin.2020.07.009. Epub 2020 Jul 9.

36. Auerswald H, Yann S, Dul S, In S, Dussart P, Martin NJ, et al. Assessment of inactivation procedures for SARS-CoV-2. bioRxiv 2020.05.28.120444. doi: https://doi.org/10.1101/2020.05.28.120444

37. Kampf G, Todt D, Pfaender S, Steinmann E. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. J Hosp Infect. 2020;104(3):246-51. doi: https://doi.org/10.1016/j.jhin.2020.01.022.

38. Ngonghala CN, Iboi E, Eikenberry S, Scotch M, Maclntyre RC, Bonds MH, et al. Mathematical assessment of the impact of non-pharmaceutical interventions on curtailing the 2019 novel Coronavirus. Math Biosci. 2020;325:108364. doi: https://doi.org/10.1016/j.mbs.2020.108364. Epub 2020 May 1.

39. Eikenberry SE, Mancuso M, Iboi E, Phan T, Eikenberry K, Kuang Y, et al. To mask or not to mask: modeling the potential for face mask use by the general public to curtail the COVID-19 pandemic. Infect Dis Model. 2020 Apr 21;5:293-308. doi: https://doi.org/10.1016/j.idm.2020.04.001. eCollection 2020.

40. Ministério da Saúde (BR). Saúde e segurança do trabalhador [Internet]. [Brasília, DF]: MS; 2020 [acesso 29 ago. 2020]. Disponível em: https://coronavirus.saude.gov.br/saude-e-seguranca-do-trabalhador-epi

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