



Homemade Masks in Geriatric Health Care during the COVID-19 Pandemic – A Review of Current Evidence and Clinical Considerations

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Abstract

The spread of the COVID-19 pandemic requires health care settings outside the treatment of COVID-19 patients to improve their processes to protect patients and health care professionals. As the pandemic has led to a worldwide supply shortage of Personal Protective Equipment (PPE), with facemasks as its core component, alternative protective solutions are strongly needed in order to slow down the exponential spread of the virus. The aim of this clinical review is to synthesize the current findings on the protective value of homemade masks and to discuss their use in geriatric healthcare settings (e.g. nursing homes, geriatric departments, geriatric psychiatry, and home care). Although, homemade masks cannot provide the same protection as professional masks, their use might be an appropriate solution to overcome the current shortage of PPE during the COVID-19 pandemic and may offer a helpful alternative for persons who do not tolerate the material of PPE for health reasons. Taking the clinical considerations regarding target groups, supply, handling and organization, adherence and potential risks into account, homemade masks seem to be appropriate to encounter transmission of SARS-CoV-2 in geriatric health care.

Keywords: Coronavirus; SARS-CoV-2; Protective measures; Geriatric care; Infectious disease

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Introduction

The COVID-19 pandemic, caused by the novel coronavirus SARS-CoV-2, threatens the health care systems of many countries. Across the world, measures to slow down the spread of the virus are undertaken, including widespread face masking in public and health care facilities [1,2]. Different types of masks and respirators are used for external or internal protection, depending on the degree of protection required. In the context of the COVID-19 pandemic, the following face masks are mainly discussed: Surgical or medical masks prevent the wearer from spreading large particles (droplets) to the environment and thus primarily serve for the protection of others. Filtering Face Piece (FFP) 2 respirators (similar to N95 respirators) reduce the exposure of the wearer to very small airborne particles or contaminants (aerosols) and thus serve to protect the wearer [3].

For the first time, the COVID-19 pandemic has led to a worldwide shortage of Personal Protective Equipment (PPE) with masks as its core component. In order to maintain the supply of adequate PPE for the treatment of infectious patients, the World Health Organization (WHO) recommended the use of face masks initially only in case of taking care of a person with (suspected) COVID-19 infection or in case of showing symptoms like coughing or sneezing [4]. Single case reports and studies on the transmission dynamics of SARS-CoV-2 in the first stages of the pandemic, identified pre- or oligo-symptomatic and asymptomatic persons as potential sources of COVID-19 infection [5,6] and reported incubation periods of four to seven days before onset of symptoms [7]. In fact, the authors of a recent review and meta-analysis indicate, that about 15% of the people infected with SARS-CoV-2 do not show symptoms at all [8]. Furthermore, recent findings indicate that more than 40% of the transmissions of SARS-CoV-2 occur from pre- or oligosymptomatic respectively asymptomatic individuals [9,10].

This is particularly worrying with regard to health care facilities, in which high risk groups are being attended or treated (e.g. in nursing homes, geriatric psychiatry, geriatric departments, home care) as there is the constant risk of an pre-, oligo-, or asymptomatic individuals bringing SARS-

CoV-2 to the facilities [2]. Recent findings indicate that surgical facemasks can effectively reduce the emission of a coronavirus in large respiratory droplets and in aerosols [11]. A universal use of face masks in high risk facilities may narrow the chance of SARS-CoV-2 transmission from pre-, oligo-, or asymptomatic individuals to others [2,11].

However, an immediate identification of alternative solutions to bridge the intermittently critical supply shortage of masks with any filtering level is urgently needed [12]. In order to protect PPE resources for the treatment of COVID-19 patients, the use of homemade masks as a temporary solution is currently under discussion with no standardized guidelines probably due to the low level of evidence [13,14]. The use of homemade masks may help to protect PPE resources and may offer an alternative solution for people, who experience skin irritations or allergic reactions due to the material of surgical masks.

This article aims to synthesize the present findings on the protective value of homemade masks and to point out clinical considerations, which should be taken into account before implementing a universal use of homemade masks in geriatric health care.

Current Evidence on the Effects of Homemade Masks

Van Sande et al. [15] investigated the protective potential of three different face masks in a sample of healthy adults and children: (1) a FFP2 mask, (2) a surgical mask, and (3) a homemade mask, made of tea cloths. The inward protection, defined as the effect of mask wearing to protect the wearer from the environment, as well as the outward protection, defined as the effect of a mask on protecting the environment from the emission of aerosols by a person were assessed [15]. The results showed that all types of mask reduced aerosol exposure. FFP2 masks provided 50 times more inward protection as compared to homemade masks and 25 times more inward protection as compared to surgical masks. Surgical masks provided about twice as much protection as compared to homemade masks. Regarding the outward protection, the homemade masks only provided marginal protection, while protection offered by a surgical mask and FFP2 mask did not differ [15]. The authors concluded, that homemade masks may offer a significant degree of protection, albeit less strong than surgical masks or FFP2 masks. However, homemade masks would not suffer from limited supplies, and would not need additional resources to provide at large scale during a pandemic [15]. The results of van Sande et al. [15] are in contrast to other results, suggesting, that surgical face masks are only able to provide a certain amount of outward protection, but are not able to protect the wearer from inhaling virus-aerosols [11]. Davies et al. [16] determined the outward protection capacity of homemade mask by comparing the number of microorganisms isolated from coughs of 21 healthy volunteers wearing a homemade mask, a surgical mask, or no mask. The results show, that both, the surgical mask and the homemade mask reduced the total number of microorganisms expelled when coughing. However, surgical masks were found to be generally more effective in reducing the number of microorganisms than the homemade mask, particularly at the lowest particle sizes. Recently, Ma et al. [17] evaluated the inward protection efficacy of N95 masks (similar to FFP2 masks), surgical masks and homemade masks in blocking an influenza virus (similar in size and structure to the SARS-CoV-2) in aerosols. The results show, that the N95 masks were the most efficient, blocking nearly all the virus. Surgical masks

blocked approximately 97% of the virus, whereas homemade masks blocked approximately 95% of the virus. The authors concluded that homemade masks of certain materials might be used as helpful alternatives during the COVID-19 pandemic when medical masks (FFP2 and surgical masks) are in shortage or not tolerated.

Bae et al. [14] evaluated the effectiveness of surgical and cotton masks in blocking SARS-CoV-2 from coughs of four patients suffering from COVID-19. Neither surgical masks, nor homemade cotton masks were able to effectively filter SARS-COV-2. Furthermore, greater contamination on the outer mask surface was found when compared to the inner mask surface [14].

Up to now, there is limited scientific evidence on the effectiveness of homemade masks regarding their potential effects on spread-protection. The available studies involve only small sample sizes [14-16], testing the filtering effectiveness of the masks under idealized conditions and/or with mock-viruses [16,17]. The findings indicate, that a homemade mask can protect the wearer from spreading potential infectious droplets when coughing [16], and might also provide a certain amount of inward protection [15,17]. However, both protection effects are smaller when compared to surgical masks and respirators. To the best of our knowledge, there is only one trial investigating the protective effects of masks with COVID-19 patients, indicating that homemade as well as surgical masks are not able to effectively filter SARS-COV-2 during coughing. Nevertheless, it remains unclear, whether surgical and homemade masks shorten the travel distance of droplets during coughing or can generally decrease the transmission of virus from pre-, oligo-, or asymptomatic individuals [14]. Beyond this, evidence regarding the applicability and effectiveness of face masks in geriatric health care is lacking.

Clinical Considerations

Regarding the constant risk of SARS-CoV-2 transmission by pre-, oligo-, or asymptomatic health care professionals to high-risk populations (e.g. patients in geriatric health care), implementing any measures that could possibly provide protection should be taken into consideration. Therefore, and taking intermittently critically supply shortage of surgical masks and respirators into account, an extended use of homemade masks in geriatric health care facilities as a protective measure should be considered. The following clinical considerations regarding target groups, supply, handling, organization of cleaning, replacement and reuse of masks as well as the adherence to the mask and potential risks should be considered (Figure 1).

Target groups

Patients in geriatric health care facilities belong to the group of persons with the highest risk of developing COVID-19 with a serious course of the disease [18] and are particularly in need of protection from exposure to the virus. A universal use of masks in health care professionals, other health care facility staff, visitors and patients' relatives could be an additional measure to contribute to the protection of these patients by providing reverse isolation [2,11]. To further protect fellow patients and health care professionals from exposure to SARS-CoV-2, a universal use of masks in geriatric health care patients is also conceivable. Here, the patient's cognitive capacity and willingness to cooperate, as well as the possibilities for taking other protective measures (e.g. physical distancing) should be taken into account.

Supply

Homemade masks are largely independent of limited supplies and

<p>Target groups</p> <ul style="list-style-type: none"> • Health care professionals • Other facility staff • Geriatric Patients with respect to their cognitive capacity, pre-existing condition and compliance • Relatives • Visitors <p>Supply</p> <ul style="list-style-type: none"> • Procurement: production and delivery times, financial and personnel expense • Template and fabrics • Fabrics: tight weaves with low porosity, several layers of fabrics with different filtering properties 	<p>Handling Organization and Adherence</p> <ul style="list-style-type: none"> • Provision of precise hygiene instruction for all target groups • Compliance observations • Organization of cleaning, replacement and reuse <p>Potential risks</p> <ul style="list-style-type: none"> • Higher risk of infection due to inappropriate use of masks • Patients response to treatment by masked health care professionals • Mask usage by patients with respiratory diseases (e.g. COPD) • Creation of a false sense of security • Neglect of other protective measures
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Figure 1: Universal usage of homemade masks in geriatric health care: Clinical considerations.

do not need additional resources to provide a large scale. However, the production requires time, personnel and financial resources, a template with a comfortable and proper fit as well as suitable materials. Recent findings indicate that there are differences in the filtering properties of different materials [17,19]. Fabrics with tight weaves and low porosity (e.g. cotton sheets with high thread count) should be used preferably in homemade masks [19]. Furthermore, combining layers of different fabrics with different filtering properties (e.g. silk and cotton) to form homemade masks, may also be an effective approach to increase the protective value of homemade masks [19].

Handling, organization and adherence

In addition to the filtering properties of the mask material, its fit and corresponding air leakage, the protective value of a mask depends on its appropriate handling [15]. An improper use of the masks might lead to an increased risk of infection [20]. Therefore, it is essential to provide all target groups with precise hygiene instructions for mask use. Compliance observations should be implemented to ensure that the instructions are adequately put into practice. If necessary, personnel and patients should be trained and reinstructed in correct mask usage.

Furthermore, strategies to organize the cleaning, replacement and reuse of masks are required, in order to maintain the protective value of the masks. Besides these external factors, the protective value of a mask depends on the wearer's compliance to it [15]. To achieve continuous wearing of the mask by health care professionals, the mask should be as comfortable as possible. An appropriate balance between mask fitting and the materials filtering properties is essential. A homemade mask manufactured from materials with the best filtering properties will probably be worn less consistently if it's fitting is uncomfortable or the wearer can only breathe poorly through it. A universal mask use in geriatric health care patients should only be considered for patient groups that are expected to understand the purpose of the protective measure and comply with the hygiene regulations. Compliance observations help to evaluate up to which degree of cognitive impairment the wearing of a mask seems reasonable and whether homemade masks might lead to a higher adherence as the sensation of their tissue might be more familiar compared to the material of a surgical mask.

Potential risks

There are potential risks that need to be taken into account when considering the implementation of a universal mask use in geriatric health care settings. Firstly, it is unclear how patients with mental

disorders (e.g. schizophrenia, depression) will respond to a treatment by masked health care professionals. Secondly, it is unclear how wearing a mask affects patients with respiratory and cardiovascular diseases (e.g. COPD, angina pectoris). Although these patients are particularly vulnerable to COVID-19 infection, it is conceivable that wearing a mask could cause symptoms such as shortness of breath in those patients. Thirdly, an inappropriate mask usage might lead to an increased risk of infection. Finally, it needs to be considered that a universal use of homemade masks can lead to a false sense of security and thus to other important protective measures being neglected. Measures like vigorous screening for COVID-19 symptoms of all patients coming to a facility and daily screening of all admitted patients, immediate testing and isolation of patients with even mild symptoms, having employees to confirm that they are symptom-free each day before starting work, physical distancing and increasing the frequency and reliability of hand hygiene should not be disregarded by a universal use of masks [2].

Conclusion

Although homemade masks do not provide the same protection as FFP2 or surgical masks, together with other protective measures (e.g. hand hygiene, isolation of symptomatic patients and health care personnel) they provide a helpful solution to bridge the shortage of PPE during the COVID-19 pandemic. Furthermore, homemade masks can serve as helpful alternative for groups of people where the material of surgical masks causes health problems. Therefore, we recommend considering the use of homemade masks in geriatric health care in the above mentioned situations. Based on our clinical expertise and the discussed considerations, a universal use of homemade masks in geriatric health care can be recommended to protect high-risk patients from COVID-19 infection.

Author Contribution

Conceptualization: RT, TF and PH; Literature Research, RT; Original Draft Preparation: RT; Revising the original draft critically for important intellectual content: TF, VS, FM, JH and PH; All authors have read and agreed to the published version of the manuscript.

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