American Society of Dermatologic Surgery Association (ASDSA) and American Society for Laser Medicine & Surgery (ASLMS) Guidance for Cosmetic Dermatology Practices During COVID-19

Based on information available as of 11 January 2021

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While dermatology practices have always followed optimal safety measures to protect and minimize infections for both patients, staff, and providers, the present COVID-19 environment with a variety of new (and changing) federal, state, and local health authority regulations encouraged the development of this document. Procedures should be performed in a manner that minimizes the risk of transmission of COVID-19. Evidence is sparse in certain areas regarding steps to reduce transmission risk. Even when limited evidence is available, it is not directly relevant to outpatient dermatology cosmetic procedures. Vaccines are now being distributed which will change the landscape of these recommendations over the next several months. Moreover, since individual cosmetic practices vary considerably, in terms of their typical patients, types of procedures performed, office physical plant, and other features, no detailed uniform guidance would be appropriate.

In general, it is recommended that patients and healthcare providers wear at least surgical or homemade masks when possible. Additionally, routine handwashing by healthcare providers is recommended. Beyond these recommendations, the evidence for enhancing infection control beyond what has always been practiced is uncertain to absent, and no strong recommendations can be made.

Please note that the following recommendations should be interpreted in light of any applicable rules and guidance in your jurisdiction. The ASDSA (advocacy@asds.net) has developed resources detailing the U.S. local, state, and federal guidance/orders on elective and non-urgent procedures. ASDSA and ASLMS will make every reasonable effort to update the information contained in this resource as it becomes available. It does not constitute legal advice or substitute for medical decision-making.

RECOMMENDATIONS AND OPTIONS

In each section below, a declarative statement in bold is followed by a grade of evidence and a strength of recommendation based on the GRADE framework. Explanatory text then follows. Strong recommendations may be relevant to most practitioners. Weak recommendations and options may be considered by certain practitioners in certain settings but are of uncertain benefit due to absent, very limited, or even contradictory evidence.

There is a significant possibility that future evidence may show weak recommendations to be unjustified. As such, weak recommendations should be viewed as options rather than recommendations and may or may not be considered by healthcare providers in particular situations. Even strong recommendations may be impractical or inappropriate in certain clinical circumstances. The treating healthcare practitioner is best qualified to decide what is best for patients and the clinical team.

It is recommended that patients and healthcare providers use masks to reduce risk of transmitting COVID-19 (GRADE level of evidence: moderate; strength of recommendation: strong).

Pre-symptomatic SARS-CoV-2 transmission may occur through generation of respiratory droplets or indirect transmission. Speech and other vocal activities such as singing have been shown to generate air particles, with the rate of emission corresponding to voice loudness. In addition, a small fraction of individuals behave as "speech superemitters," who consistently release an order of magnitude more particles than their peers.[1] This may pose an inhalation threat even at considerable distances and in enclosed spaces, especially those with poor ventilation.[2] News outlets have reported that during a choir practice in Washington on March

10, pre-symptomatic transmission may have played a role in SARS-CoV-2 transmission to approximately 40 to 60 choir members.[3,4]

Normal speaking also produces thousands of oral fluid droplets with a broad distribution of size (1 um to 500 um). Whereas large droplets fall quickly to the ground, small droplets can dehydrate and linger as droplet nuclei (≤5 μm in diameter) in the air, where they behave like an aerosol and thereby expand the spatial extent of emitted infectious particles.[5] These particles are of a size that may be inhaled into the lower respiratory tract (<5 μm in diameter).[6] Further, a recent study in the journal *Cell* demonstrated that the highest angiotensin-converting enzyme (ACE-2) expression was in the nose with decreasing expression levels throughout the lower respiratory tract, paralleled by a significant gradient of SARS-CoV-2 infection in proximal (high) vs. distal (low) pulmonary epithelial cultures.[7] High viral loads of SARS-CoV-2 have been detected in oral fluids of COVID-19 positive patients[8], including asymptomatic ones.[9] Leung recently showed that surgical masks can reduce coronavirus detection and viral copies in large respiratory droplets and in aerosols.[10] Jefferson et al demonstrated in a meta-analysis through six case-control studies that wearing non-N95 masks (0.32, 0.25-0.40; NNT=6, 4.54-8.03) was highly effective in preventing the spread of SARS-CoV-1.[11]

In 2003, a case-control study in five Hong-Kong hospitals, with 241 non-infected and 13 infected staff with documented exposures to 11 index patients with SARS-CoV-1 was performed. All participants were surveyed about use of mask, gloves, gowns, and hand-washing, as recommended under droplets and contact precautions when caring for patients with SARS. Sixty-nine staff who reported use of all four measures were not infected, whereas all infected staff had omitted at least one measure ($p = 0.0224$). Fewer staff who wore masks ($p = 0.0001$), gowns ($p = 0.006$), and washed their hands ($p = 0.047$) became infected compared with those who did not, and stepwise logistic regression was significant only for masks ($p = 0.011$).[12]

Liang et al performed a systematic review and meta-analysis of literature examining the efficacy of face masks in preventing respiratory virus transmission was recently performed. A total of 21 studies were included. Meta-analyses suggested that mask use provided a significant protective effect (Odds Ratio, OR = 0.35, 95% CI = 0.24-0.51). Use of masks by healthcare workers and non-healthcare workers can reduce the risk of respiratory virus infection by 80% (OR = 0.20, 95% CI = 0.11-0.37) and 47% (OR = 0.53, 95% CI = 0.36-0.79), respectively. Interestingly, the protective effect of wearing masks in Asia (OR = 0.31) appeared to be higher than that of Western countries (OR = 0.45). Masks had a protective effect against influenza viruses (OR = 0.55), SARS (OR = 0.26), and SARS-CoV-2 (OR = 0.04). The authors noted that in the subgroups based on different study designs, protective effects of wearing masks were significant in cluster randomized trials, case-control studies, and retrospective studies. However, there continues to be a lack of ordinary RCTs (controlled, randomized, and blinded) regarding mask use, and hence none were included in this study. Further, there was insufficient data for subgroup analysis of different mask types.[13,14]

Cheng at al assessed the effect of community-wide mask usage to control COVID-19 in the Hong Kong Special Administrative Region (HKSAR). The results showed that within the first 100 days (31 December 2019 to 8 April 2020), 961 COVID-19 patients were diagnosed in HKSAR. The COVID-19 incidence in HKSAR (129.0 per million population) was significantly lower ($p<0.001$) than that of Spain (2,983.2), Italy (2,250.8), Germany (1,241.5), France (1151.6), U.S. (1,102.8), U.K. (831.5), Singapore (259.8), and South Korea (200.5). The compliance of face mask usage by HKSAR general public was 96.6% (range: 95.7%-97.2%). They observed 11 COVID-19 clusters in recreational 'mask-off' settings compared to only 3 in workplace 'mask-on' settings ($p = 0.036$ by Chi square test of goodness-of-fit).[15]

In addition, a systematic review and meta-analysis of 4 randomized controlled trials offered lower certainty evidence that medical masks (also known as surgical masks) and N95 respirators offered similar protection against viral respiratory infection including coronavirus in healthcare workers (HCWs) during non-

aerosol generating care.[16] In comparison, another recent systematic review and meta-analysis (that included data for SARS-CoV-2, SARS-CoV, and MERS) found that face mask-use could result in a large reduction in risk of infection (n=2,647; aOR 0.15, 95% CI 0.07-0·34, RD −14.3%, −15.9 to −10.7; low certainty), with stronger associations with N95 or similar respirators compared with disposable surgical masks or similar (e.g., reusable 12–16-layer cotton masks; $p_{interaction}$=0·090; posterior probability >95%, low certainty).[17]

A recent case report demonstrated the effectiveness of masks and respirators for health care workers who took care of a patient with severe pneumonia before the diagnosis of COVID-19 was confirmed.[18] Through contact tracing, 41 health care workers were identified as having had exposure to aerosol-generating procedures (e.g. endotracheal intubation, extubation, noninvasive ventilation) for at least 10 minutes at a distance of less than 2 meters from the patient. All 41 health care workers were placed under home isolation for 2 weeks. They had nasopharyngeal swabs scheduled on the first day of home isolation, which could have been day 1, 2, 4, or 5 after last exposure to patient, and a second swab scheduled on day 14 after their last exposure. None of the exposed health care workers developed symptoms, and all PCR tests were negative. All of the above described health care workers were either wearing a surgical mask or an N95 mask. Four HCWs were wearing surgical masks during endotracheal intubation, while 6 were wearing N95s. Two were wearing surgical masks during extubation, while no one wore an N95. Twenty-five HCWs wore surgical masks during non-invasive ventilation in the ICU or in a high-dependency unit, while 0 wore an N95. Finally, during oral suctioning/exposure to aerosols in an open circuit, four wore surgical masks while no one wore an N95. [18]

A recent pre-print further discussed the use of homemade facemasks during the COVID-19 pandemic.[19] Generally available household materials had between a 49%-86% filtration rate for 0.02 μm exhaled particles whereas surgical masks filtered 89% of those particles.[20] In a laboratory setup, a tea cloth mask was found to filter 60% of particles between 0.02 μm to 1 μm, where surgical masks filtered 75%.[21] Dato et al designed and tested a mask made from heavyweight T-shirts and found that it "offered substantial protection from the challenge aerosol and showed good fit with minimal leakage".[22] Another pre-print showed, using laser-light scattering, that virtually no droplets were "expelled" with a homemade mask consisting of a washcloth attached with two rubber bands around the head, while significant levels were expelled without a mask.[23] Although cloth and surgical masks are primarily targeted towards droplet particles, some evidence suggests they may have a partial effect in reducing viral aerosol shedding.[24]

Taken together, the above-mentioned results have important implications for the control of COVID-19, suggesting that surgical and homemade face masks could reduce onward transmission. It was estimated that if at least 60% of the populations wore masks that were just 60% effective in blocking viral transmission (e.g. a well-fitting, two-layer cotton mask), the epidemic could be significantly mitigated.[19,25]

Physician and staff masking is recommended in particular for procedures near the nose and mouth as there is increased risk of contracting COVID-19 from procedures at these sites (GRADE level of evidence: moderate; strength of recommendation: strong).

Procedures on the head and neck may be associated with increased risk of contracting COVID-19 compared to procedures below the clavicle (GRADE level of evidence: low; strength of recommendation: weak).

N95 respirators may be more effective than surgical masks for protection of patients and/or physicians during prolonged skin procedures that entail close contact with the patient's nose and mouth (GRADE level of evidence: low; strength of recommendation: weak/option).

The first reported physician fatality related to COVID-19 in Wuhan, China was that of an otolaryngology physician on 25 January 2020.[26]

Human-to-human spread occurs through respiratory secretions so health care personnel that manage patients with diseases of the aerodigestive tract (dentists, otolaryngologists, head and neck surgeons, gastroenterologists, pneumonologists, respiratory therapists, speech therapists, and infectious disease physicians) or ophthalmologists are the most susceptible health care workers to become infected (risk ratio of 2.13).[27]

There is currently no information regarding any potential risk for electrocautery smoke or transoral laser resection generated smoke but it would be reasonable to take appropriate precautions in these settings too.[27]

There are no studies of the effect on transmission of N95 masks versus standard surgical masks in dermatology or cosmetic dermatology procedures, or during other similar minor procedures in an office setting.

Handwashing is recommended to reduce the risk of COVID-19 transmission (GRADE level of evidence: moderate; strength of recommendation: strong).

SARS-CoV-2 is primarily transmitted through respiratory droplets and aerosols[28] ; however, there is also potential for other routes of transmission including body fluid routes, and fecal-oral transmission.[29,30] SARS-CoV-2 was recently shown to remain viable, on average, for approximately 6.8 hours on plastic surfaces and 5.6 hours on stainless steel surfaces, and viable virions were detected up to 72 hours after application to these surfaces, suggesting possible fomite transmission.[31] However, the Centers for Disease Control and Prevention (CDC) states that even though it may be possible that a person can get COVID-19 by touching a surface or object that has virus on it and then touching their own mouth, nose, or possibly their eyes, they do not think this is the main way the virus spreads, but further studies are needed.[32] In addition, Riddell et al found that viable virus was isolated for up to 28 days at 20 °C from common surfaces such as glass, stainless steel and both paper and polymer banknotes. Conversely, infectious virus survived less than 24 hours at 40 °C on some surfaces.[33] Further, a recent *in vitro* study demonstrated that the survival time of SARS-CoV-2 on the human skin is approximately 9.04 hours in comparison to Influenza A which was found to be 1.82 hours.[34]

A study performed in 2001 at a large Navy training center reported a 45% reduction in total outpatient visits for respiratory illness after implementation of a handwashing program. Military trainees self-reported fewer respiratory illness episodes when compared to infrequent handwashers. The handwashing program consisted of directive from the commanding officer that recruits would wash hands at least 5 times daily, installation of liquid soap dispensers at all sinks in the training spaces, provision for the ongoing purchase of liquid handwashing soap, monthly education of drill instructors by preventive medicine personnel on the importance of handwashing, and monthly inspections of barrack spaces to include assessment of soap and sink availability, and to reinforce the handwashing message.[35] Jefferson et al demonstrated in a meta-analysis through six case-control studies that handwashing more than 10 times daily (odds ratio 0.45, 95% CI [0.36-0.57]; number needed to treat = 4, 95% CI [3.65-5.52]) was highly effective in preventing the spread of SARS-CoV-1.[11]

The CDC recommends washing your hands for at least 20 seconds.[36] This recommendation is based primarily on a study done for the food industry. Researchers placed a harmless strain of Enterobacter *aerogenes* on the hands of subjects and had them wash their hands in a controlled environment for various periods of time. When subjects washed their hands for 5 seconds, 97.6% of bacteria was removed. When they washed for 10 seconds, 99.3% was removed, at 20 seconds that increased to 99.7%, and at 40 seconds it actually dropped to

99.6%. While there was no statistically significant difference between washing for 10, 20, or 40 seconds, the recommendation was made for 20 seconds.[37] Another study compared washing hands for 10 seconds to washing for 3 minutes. Interestingly they found that while washing for 10 seconds reduced bacteria significantly, washing for 3 minutes actually had significantly higher bacteria counts of naturally occurring bacteria than washing for only 10 seconds. Researchers suggested that the extended washing time may have released bacteria otherwise not accessible to the swabbing technique.[38]

According to the CDC, washing your hands with soap and water is the best way to get rid of germs in the majority of the situations. However, if soap and water are not readily available, then alcohol-based hand sanitizers that contain at least 60% alcohol (located on product label) can be used. [36] In contrast, the WHO recommends these two alcohol-based sanitizer formulations to prevent the spread of general pathogens: 1. ethanol — 80% by volume (vol/vol), glycerine (also known as glycerol) — 1.45% vol/vol, hydrogen peroxide — 0.125% vol/vol and 2. isopropanol (also known as 2-propanol or isopropyl alcohol) — 75% vol/vol, glycerine — 1.45% vol/vol, hydrogen peroxide — 0.125% vol/vol.[39] Either way, it is important to note that alcohol-based hand sanitizers do not get rid of all types of germs and may not be as effective when hands are visibly soiled.[36,40]

Eye protection may reduce the risk of contracting or transmitting COVID-19 (GRADE level of evidence: moderate; strength of recommendation: moderate).

Theoretically, the nasolacrimal system can act as a conduit for viruses to travel from the upper respiratory tract and vice versa.[41] Hence, ocular tissue and fluid may represent a potential source of SARS-CoV-2. In a study conducted on 38 COVID-19 positive patients, 2 patients yielded positive findings for SARS-CoV-2 in their conjunctival as well as nasopharyngeal specimens.[42] On the other hand, a small study of seventeen COVID-19 patients examined SARS-CoV-2 shedding in tears. A total of 64 samples were obtained over the study period, with 12, 28, and 24 samples obtained from the first, second, and third week of initial symptoms, respectively. Their results did not find any evidence of SARS-CoV-2 shedding in tears through the course of the disease.[43]

However, a recent preprint examined 10 postmortem eyes and five surgical samples of conjunctiva from patients who did not have the coronavirus. The post-mortem eyes and surgical specimens were analyzed for expression of ACE2 (the receptor for SARS-CoV-2) and TMPRSS2, a cell surface-associated protease that facilitates viral entry following the binding of the viral spike protein to ACE2. Across all eye specimens, immunohistochemical analysis revealed expression of ACE2 in the conjunctiva, limbus, and cornea, with especially prominent staining in the superficial conjunctival and corneal epithelial surfaces. Surgical conjunctival specimens also showed expression of ACE2 in the conjunctival epithelium, especially prominent in the superficial epithelium, as well as the substantia propria. All eye and conjunctival specimens also expressed TMPRSS2. Finally, western blot analysis of protein lysates from human corneal epithelium obtained during refractive surgery confirmed expression of ACE2 and TMPRSS2.[44] Further, Yan et al recently published a case report that showed the presence of the SARS-CoV-2 nucleocapsid protein antigen intracellularly in the ocular tissue of a patient previously infected with COVID-19 infection, demonstrating evidence that SARS-CoV-2 can infect ocular tissues in addition to respiratory tissues.[45] Together, these results indicate that ocular surfaces including the conjunctiva are susceptible to infection by SARS-CoV-2, and could serve as a portal of entry.[44,45]

At this time, there is no direct evidence from randomized trials that eye protection equipment alone prevents transmission of COVID-19. However, anatomically, the conjunctiva of the eye is easily exposed to infectious droplets and fomites during close contact with infected individuals and contaminated hands. A recent

systematic review and meta-analysis (that included data for SARS-CoV-2, SARS-CoV, and MERS) found that eye protection was associated with less infection (n=3713; aOR 0.22, 95% CI 0.12 to 0·39, RD −10.6%, 95% CI −12.5 to −7.7; low certainty).[17] Some respiratory viruses such as human adenovirus and avian influenza virus (H7) frequently cause highly infectious conjunctivitis or keratoconjunctivitis. Hence, the conjunctiva is proposed to be an important portal of entry for respiratory viruses, while tear and conjunctival secretions may contain virus and spread viral infection.[46,47] Zeng et al found in an observational study that among a group of 276 patients admitted to a hospital in Suizhou, China with laboratory-confirmed COVID-19, the proportion of patients who reported routinely wearing eyeglasses more than 8 hours per day was lower than in the general population. From these data, the authors concluded that wearing eyeglasses more than 8 hours per day may be protective against SARS-CoV-2 infection, and they hypothesized that this may be due to eyeglasses acting as a barrier that reduces the frequency with which people touch their eyes. However, there were several limitations to this study and the results may be influenced by confounding factors.[48,49] In July 2020, Baylor St. Luke's Medical Center added a mandatory requirement that all healthcare personnel wear face shields upon entry to the facility. Researchers subsequently found that from April 17 to July 5, before face shields were required, Baylor St. Luke's weekly positive SARS-CoV-2 infection rates among HCP rose from 0% to 12.9%. From July 6 to July 26, the first few weeks after face shields were required, the positive SARS-CoV-2 infection rate dropped to 2.3%.[50]

On January 22, 2020, a Chinese respiratory specialist who visited Wuhan as a member of the national expert panel on pneumonia claimed that he was infected by SARS-CoV-2 despite being fully gowned with a protective suit and N95 respirator. His first clinical manifestation was unilateral conjunctivitis, followed by fever and catarrhal symptoms 2 or 3 hours later. He postulated that SARS-CoV-2 probably first infected the conjunctiva, then spread and caused the viral pneumonia.[41,51] However, a retrospective cohort study that included an individual whose presenting symptom of SARS-CoV-2 was conjunctivitis showed that he had a negative conjunctival sac SARS-CoV-2 test. In addition, of the 63 COVID-19 positive patients included, only one had a positive conjunctival PCR result.[52]

Further investigations have revealed that highly infectious human CoVs (mainly SARS-CoV and 2019-nCoV) are rarely detected by RT-PCR and never isolated by virus culture in tears and conjunctival secretions from SARS and CoVID-19 patients. Hence, it is hard to assess the infectivity of tears and conjunctival secretions and their roles in virus transmission.[41]

Vaccination is a significant step to protect ourselves and others from COVID-19. All healthcare workers including office and support staff eligible to receive the COVID-19 vaccine without contraindications should be encouraged to receive vaccination according to CDC protocol. (GRADE level of evidence: moderate; strength of recommendation: strong).

There are currently two COVID-19 vaccines authorized for use in the U.S.- the Pfizer-BioNTech COVID-19 vaccine and Moderna's COVID-19 vaccine. Other COVID-19 vaccines currently undergoing large-scale clinical trials are being developed by AstraZeneca, Janssen, and Novavax.[53] The Pfizer and Moderna vaccines are messenger RNA (mRNA) vaccines. Briefly, mRNA vaccines contain SARS-CoV-2 genetic material (mRNA) that gives our cells instructions on how to make a harmless piece of the spike protein that is found on the surface of the SARS-CoV-2 virus. After the cells produce the protein in our body, the mRNA from the virus/vaccine is destroyed. However, our immune system recognizes that this spike protein is foreign and will be activated to clear the protein. The end result is that our bodies are left with a supply of "memory" T-lymphocytes and B-lymphocytes that will remember how to fight the virus in the future.[54]

The Pfizer-BioNTech vaccine is indicated for people of 16 years of age and older and requires 2 doses separated by 21 days.[55] Second doses administered up to 4 days before the recommended date (4-day grace period) are still considered valid. Both doses are necessary for protection, and efficacy of a single dose has not been systematically evaluated. Contraindications to the vaccine include severe allergic reaction (e.g. anaphylaxis) or immediate allergic reaction after a previous dose of the mRNA COVID-19 vaccine or any of its components, or an immediate allergic reaction of any severity to polysorbate. While it is not a contraindication, precaution should be taken in those with a history of an immediate allergic reaction to any other vaccine or injectable therapy (except those related to a component of mRNA COVID-19 vaccines or polysorbate). If a person was infected with SARS-CoV-2 within the last 90 days, they may defer vaccination until after a 90-day period, or if they were treated with monoclonal antibodies or convalescent plasma within the last 90 days, vaccination should be deferred. Patients on immunosuppressive medications can be vaccinated but must be counseled about the unknown vaccine safety profile and effectiveness in immunocompromised populations.[55]

Patients with a history of Guillain-Barre syndrome and Bell's palsy may be vaccinated. Cases of Bell's palsy have been reported following vaccination in both the Pfizer-BioNTech and Moderna COVID-19 vaccine clinical trials. [55] However, the FDA does not consider these to be at higher frequency than expected in the general population and has not concluded that these cases were caused by vaccination. The most common adverse reactions reported after vaccination in clinical studies include pain at injection site, fatigue, headache, muscle pain, chills, joint pain, fever, injection site swelling and redness, nausea, malaise, and lymphadenopathy.[55] As of 6 January 2021, the CDC has reported 29 cases of anaphylaxis following administration of the COVID-19 vaccine (Pfizer-BioNTECH and Moderna vaccines).[56]

A pregnant or lactating person may receive the vaccine. Pregnancy is an immune suppressed state and COVID-19 infection can be more severe than age matched non pregnant person.[57] They should be counseled about the lack of data about the vaccine during pregnancy or the effects on breastfed infants or milk production/excretion.[55] The mRNA vaccines are generally not thought to be a risk to the breastfeeding infant. Persons with a history of an immediate allergic reaction of any severity to a vaccine or injectable therapy and persons with a history of anaphylaxis due to any cause should be monitored for 30 minutes after vaccination, while all other persons should be monitored for 15 minutes. Preliminary data suggest high vaccine efficacy (95.0%)[58] in preventing COVID-19 following receipt of the two doses of the Pfizer-BioNTech COVID-19 vaccine.[55]

The Moderna vaccine is indicated for people of 18 years of age and older and requires 2 doses separated by 28 days. All other contraindications, precautions, and side effects are similar to those of the Pfizer-BioNTech COVID-19 vaccine. Preliminary data suggest high vaccine efficacy (94.1%) [59] in preventing COVID-19 following receipt of the two doses of the Moderna COVID-19 vaccine.[59,60]

The ASDS recently published guidance on dermal filler reactions after SARS-CoV-2 mRNA vaccine administration. Review of the FDA data from the Moderna vaccine trial revealed that a total of three participants out of 15,184 patients who received at least one dose of the Moderna vaccine developed facial or lip swelling presumed to be related to dermal filler placement. All events resolved after treatment. Time of dermal filler placement prior to vaccine was variable ranging from 2 weeks to six months prior. These rare adverse events respond to treatments such as oral corticosteroids and hyaluronidase, and often resolve without treatment.[61,62] This has been previously reported after other vaccinations such as influenza.[63]

Size of procedure room may influence risk of contracting COVID-19, with larger rooms possibly associated with lower risk (GRADE level of evidence: low; strength of recommendation: weak/option).

Recent work has demonstrated that exhalations, sneezes, and coughs are primarily made of a multiphase turbulent gas cloud that carries within it clusters of droplets on a continuum of droplet sizes. Given various combinations of an individual patient's physiology and environmental conditions, such as humidity and temperature, the gas cloud and its payload of pathogen-bearing droplets of all sizes can travel 23 to 27 feet.[64]

Current CDC recommendations include staying at least 6 feet away from other people.[65] However, this 6 foot rule does not mean respiratory droplets cannot travel further.[25] Originally, public-health guidelines, in fact, set the at-risk distance at three feet based on experiences in previous outbreaks.[66] However, during the SARS epidemic in 2002, after several cases documented more distant spread, the authorities doubled the at-risk distance from three to six feet.[25] In one instance, a man with SARS on a three-hour flight from Hong Kong to Beijing infected twenty-two people. Eight of the 23 passengers in the same row or three rows in front of the index patient fell ill. However, people seven rows away, around 18 feet, developed SARS too.[67] A systematic review and meta-analysis (that included data for SARS-CoV-2, SARS-CoV, and MERS) found that transmission of viruses was lower with physical distancing of 1 m or more, compared with a distance of less than 1 m (n=10,736, pooled adjusted odds ratio [aOR] 0.18, 95% CI 0.09-0.38; risk difference [RD] −10.2%, 95% CI −11.5 to −7.5; moderate certainty); protection was increased as distance was lengthened (change in relative risk [RR] 2.02 per m; $p_{interaction}$=0·041; moderate certainty).[17]

Taking similar data into account, a new editorial suggests that instead of a single fixed physical distance rule, a graded recommendation should be given that combines multiple factors to determine risk. The factors included levels of occupancy, mask wearing, ventilation, outdoors or indoors, and activity (i.e. silent, speaking, or shouting/singing). However, as the authors state, further research is needed on the cut-off duration of exposures in relation to the indoor condition, occupancy, and level of viral shedding, which is not completely supported by evidence at this time. In addition, research is lacking on the airflow patterns with respect to the infected source, and the airflow patterns' competition with average ventilation.[68]

Given physical plant limitations, larger rooms may not be available, or such rooms may be impractical for particular procedures performed. Also, there are no studies of the beneficial effect, if any, of larger room size when patients and physicians are in close proximity or direct contact during a procedure. Please see below for additional information on forced air cooling and the use of HEPA filters.

Longer patient contact time, including time in the procedure room and time spent in the waiting room, may increase risk of contracting COVD-19 (GRADE level of evidence: low; strength of recommendation: weak/option).

Currently, we are still unsure of how long of an exposure is needed to infect another person. In a report published by the CDC, among the first ten patients with travel-related confirmed COVID-19 reported in the U.S., a total of 445 people were identified who had close contact with one of the ten patients on or after the date of patients' symptom onset. Nineteen (4%) of the 445 contacts were members of a patient's household, and five of these 19 contacts continued to have household exposure to the patient with confirmed COVID-19 during the patient's isolation period; 104 (23%) were community members who spent at least 10 minutes within 6 feet of a patient with confirmed disease; 100 (22%) were community members who were exposed to a patient in a health care setting; and 222 (50%) were health care personnel. During the 14 days of active symptom monitoring, 54 (12%) close contacts developed new or worsening symptoms deemed by local public health authorities to be concerning for COVID-19 and were tested for SARS-CoV-2. Only two persons who were household members of patients with confirmed COVID-19 tested positive for SARS-CoV-2.[69] Consequently, less than 10 minutes of exposure to a COVID-19 patient makes spread unlikely. On the other hand, as mentioned previously, the choir

practice in Washington was ninety minutes long.[3] Given an average incubation period of five days, a single unchecked case can lead to more than 20,000 infections, and a hundred deaths over two months.[25]

Recently, for the general public, the CDC has updated their guidelines to define close contact as "someone who was within 6 feet of an infected person for a cumulative total of 15 minutes or more over a 24 hour period starting from 2 days before illness onset (or, for asymptomatic patients, 2 days prior to test specimen collection) until the time the patient is isolated."[70]

Use of air suction/HEPA filters during procedures may reduce risk of contracting COVID-19 (GRADE level of evidence: moderate; strength of recommendation: weak/option).

A study by Guo et al tested surface and air samples from an intensive care unit (ICU) and general coronavirus ward at Huoshenshan Hospital from Feb 19 to Mar 2 to detect evidence of SARS-CoV-2. Eight of 12 ICU air vent swabs (66.7%) tested positive, as did 1 of 12 (8.3%) general ward air vent swabs. In addition, COVID-19 aerosol was found near air vents (5/14 [25.7%]), in patient rooms (8/18 [44.4%]), and in the doctor's office area (1/8 [12.5%]), indicating that aerosolized virus was concentrated near and downstream of patients. However, the upstream area also posed a risk, and based on the detection of virus in the doctor's office, approximately 4 meters from patients.[71]

The filtering capacity of masks, respirators, and respirator cartridges is denoted by a letter and numeric value. Filters are marked as either N, R, or P. The filters marked N are not resistant to oil, R are somewhat resistant to oil, and P are strongly resistant to oil. The number associated with each filter denotes its filtering capacity for particles 0.3 microns in size. A respirator designated "95" filters at least 95% of particles 0.3 microns in size. A mask designated "99" filters at least 99% of particles 0.3 microns in size. A mask designated "100" filters at least 99.97% of particles 0.3 microns in size. Thus, respirators or masks with N95 filtering capacity are non-resistant to oil and are able to filter out 95% of 0.3-micron particles. These are considered the lowest level of approved respiratory protection for airborne SARS viruses by the Centers Disease Control and Prevention. In comparison, P100 filters are oil proof and filter 99.97% of 0.3-micron particles. They are considered the highest level of protection against SARS viruses by the CDC. The filters used within powered air purifying respirators (PAPRs) and controlled air-purifying respirator (CAPRs) are designated as High-Efficiency Particulate Air (HEPA) filters. They filter out 99.97% of 0.3-micron particles and are considered equivalent to P100 level filters.[72]

A recent study found that in a cough from a healthy volunteer, there were two distinct types of droplets, large droplets (100–1000 μm in diameter) and small droplets (1–10 μm), with the small droplets being much more prevalent. During speech, only the small droplets were found. Large droplets were observed to fall onto the ground rapidly. They also found that while the speed of the drops ranged from 2–7 m/s at the start of the cough, the visible large drops (typically 500 μm in diameter) did not travel far before their trajectory bent down due to gravity and fell rapidly onto the ground within 1 second. Droplets coming from the nasal cavity were also investigated, and that with normal breathing, no droplets were detected above the background noise level (2.3 [SD 1.5] droplets, and 2.6 [1.7] droplets for nasal breathing). From a sneeze, they found mostly very large drops, originating from both the buccal and nasal cavities, that were not persistent. With simulated small droplets from a cough, in the best ventilated room, after 30 seconds, the number of droplets had halved, whereas with no ventilation this took about 5 minutes. In a poorly ventilated room, the number of droplets was halved in 1.4 min.[73]

A recent investigation of SARS-CoV-2 transmission amongst bus riders in Eastern China back in January 2020 illustrated the importance of good ventilation. This cohort study examined a community of 128 lay Buddhists from the Zhejiang province who took two buses (60 on bus 1 and 68 on bus 2) on a 100-minute

trip to attend a 150-minute worship event. The source patient was a passenger on bus 2. In both buses, central air conditioners were in indoor recirculation mode. Not surprisingly, 24 of the 68 individuals on bus 2 were later diagnosed with SARS-CoV-2 infection, while none of the 60 individuals in bus 1 were infected. Passengers sitting closer to the index case did not have a statistically significant higher risk of COVID-19 than those sitting farther away. However, all passengers sitting close to a window remained healthy, with the exception of the passenger sitting next to the index case. In comparison, there were seven COVID-19 cases among 172 other people who attended the same 150-minute temple event, all of whom described having had close contact with the index case. Most importantly, the worship event occurred largely outdoors.[74]

Another outbreak was associated with a training workshop the took place on January 12-14 in Hangzhou city, Zhejiang province. There were 30 attendees from different cites, who books hotels separately, and did not eat together at the workshop facility. The workshop consisted of four 4-hour group sessions in two closed rooms of 49 m^2 and 75 m^2. An automatic timer on the central air conditioners circulated the air in each room for 10 minutes every four hours using "an indoor re-circulating mode." None of the workshop participants were known to have been symptomatic during the workshop. However, 15 of them were diagnosed with SARS-CoV-2 infection during January 16-22, 2020.[75]

The CDC recently posted guidelines for office buildings, stressing the importance of improving ventilation in office buildings. The recommendations included: increasing the percentage of outdoor air (e.g. using economizer modes of HVAC operations) potentially as high as 100%, considering using natural ventilation (e.g. opening windows if possible and safe to do) to increase outdoor air dilution, increasing air filtration to high as possible (MERV 13 or 14), and considering using portable HEPA fan/filtration systems to enhance air cleaning, especially in higher risk areas.[76,77]

There are no studies of the benefits of PAPRs or similar units in reducing risk of contracting COVID in a dermatology setting, a cosmetic dermatology setting, or other comparable low-risk outpatient medical procedure settings. Moreover, these devices are expensive as well as cumbersome to wear and use and may impede or obstruct the technical performance of certain procedures.

Use of upper-room germicidal ultraviolet (GUV) in the reception and during procedures may reduce risk of contracting COVID-19 (GRADE level of evidence: moderate; strength of recommendation: weak/option).

Nardell and Nathavitharana have made the argument that upper room disinfection by GUV coupled with adequate ventilation can significantly reduce risk of contracting COVID-19.[78] In its most recent guidelines regarding office buildings, the CDC did state that ultraviolet germicidal irradiation (UVGI) could be considered as a supplement to help inactivate the virus.[76]

In general, there are two UVGI strategies for air disinfection: 1) installation into air handlers or ventilation ducts and 2) irradiation of the upper air zones of occupied spaces with shielding of the lower occupied spaces since UV is harmful to room occupants. Other strategies utilized in certain healthcare situations include in-room radiation of unoccupied spaces and occupied spaces (e.g. operating suites) when personnel have appropriate personal protective equipment (PPE).[79]

Use of UV in HVAC systems may help but is not as immediate in treating air throughout a room.[80] Upper-room GUV may also reduce risks from breathing any viral plume during certain laser procedures. If careful application is utilized, upper-room GUV can be performed without an increase in the incidence of UV overexposure side effects including eye and skin irritation, and be used in public and high-traffic areas such as waiting rooms.[79,81-83] The fixtures are typically mounted at least 7 ft above the floor, with at least 1 ft of space above the fixture for decontamination to occur. Upper-room GUV is typically recommended when ventilation

rates are low, because when air change rates are greater than 6 per hour, it may be less effective in comparison to particle removal by ventilation because particles may have less residence exposure time to UV.[79]

It is uncertain whether forced air-cooling during laser procedures increases risk of contracting COVID-19 versus using contact cooling (GRADE level of evidence: very low; strength of recommendation: weak/option).

During January 26–February 10, 2020, an outbreak of 2019 novel coronavirus disease in an air-conditioned restaurant in Guangzhou, China, involved 3 family clusters. Virus transmission in this outbreak could not be explained by droplet transmission alone. The distances between patient A1 and persons at other tables, especially those at table C, were all >1 m. However, strong airflow from the air conditioner could have propagated droplets from table C to table A, then to table B, and then back to table C. Thus, the airflow direction prompted by the air-conditioned ventilation was consistent with droplet transmission.[84]

In a clinical setting, it is also possible that directed airflow *away* from the procedure, the patient and the physician may conversely mitigate transmission risk. Neither forced airflow toward or away from personnel performing cosmetic procedures has been studied.

ADDITIONAL CONSIDERATIONS

In each section below, a declarative statement in bold is followed by a level of evidence. In each case, no recommendation is provided. Explanatory text then follows.

Procedures of the skin and hair appear to have low risk of transmitting COVID-19 (GRADE level of evidence: very low; strength of recommendation: none).

A recent study in the Journal of Investigative Dermatology confirmed the presence of a high expression of ACE2 on keratinocytes in human skin indicating that percutaneous transmission may be a potential risk route for SARS-CoV-2 infection, especially in conditions characterized by skin barrier dysfunction.[85] In a case report of a digitate papulosquamous eruption occurring during a SARS-CoV-2 infection, a skin biopsy of one of the lesions was performed. RT-PCR of the fresh skin biopsy specimen was negative for SARS-CoV-2.[86] In a second case report of a diffuse fixed erythematous blanching maculopapular rash, PCR on a whole-skin biopsy specimen was negative for SARS-CoV-2.[87] In contrast, a skin biopsy of a pediatric patient's chilblains, who was negative for SARS-CoV-2 from nasopharyngeal and oropharyngeal swabs, was found to have viral particles within endothelial cells in the lesional skin biopsy confirmed by immunohistochemistry and transmission electron microscopy.[88] Similarly, Magro et al found that in patients with severe COVID-19 infection and retiform purpura, extensive SARS-CoV-2 envelope and spike proteins were detected in the endothelial cytoplasm in thrombosed and normal-appearing blood vessels, but no viral RNA was detected in the skin biopsies.[89]

There is no documented risk of contracting COVID-19 from exposure to blood during procedures. (GRADE level of evidence: very low; strength of recommendation: none).

There is no evidence to show that cautery increases risk of contracting COVID-19 (GRADE level of evidence: very low; strength of recommendation: none).

There is no evidence to show that ablative laser procedures increase risk of contracting COVID-19 (GRADE level of evidence: very low; strength of recommendation: none).

It has been demonstrated that thermal disruption of viable human cells results in the release of carbon particles, virus, bacteria, deoxyribonucleic, and toxic gases in all surgical plume, regardless of the energy source and in all types of surgical procedures except using lower-powered lasers.[90] This means that aerosolized blood, bloodborne pathogens, and pathogens found in the blood or other secretions can forcefully be ejected when the cell disrupts, and become airborne.[91]

SARS-CoV-2 RNA has been detected in blood and stool specimens, and SARS-CoV-2 virus has been isolated in cell culture from the stool of some patients, including a patient with pneumonia 15 days after symptom onset.[92]

A recent study by Corman et al examined the oral swabs, sputum, and blood samples of 18 patients with SARS-CoV-2 infection using RT-PCR testing. Whereas oral swabs or sputum from the lower respiratory tract tested RT-PCR positive in all patients, RNAemia was neither detected in 3 patients without symptoms nor in 14 patients with flu-like symptoms, fever, or pneumonia. The only patient with RNAemia suffered from acute respiratory distress syndrome (ARDS) and was artificially ventilated in an intensive care unit. Consequently, they concluded that the risk for SARS-CoV-2 transmission through blood components in asymptomatic SARS-CoV-2 infected individuals appeared negligible, but further large-scale studies are needed.[93]

There is no evidence to show that liposuction increases risk of contracting COVID-19. (GRADE level of evidence: very low; strength of recommendation: none).

A recent article proposed that adipocytes and adipocyte-like cells, such as pulmonary lipofibroblasts, may play an important role in the pathogenic response to COVID-19. Expression of angiotensin-converting enzyme 2 (ACE2 - the functional receptor for SARS-CoV-2) - is upregulated in adipocytes of obese and diabetic patients, which turns adipose tissue into a potential target and viral reservoir.[94]

Disclaimer

The guidance presented within this document is limited by present medical and scientific understanding of COVID-19. Therefore, any future changes in such understanding will need to be evaluated by healthcare providers in determining their continued utility. Due to the complexity and rapidly changing nature of the present circumstances, no declarations can be made in regard to when a procedure may be restarted in general practice. Many procedures considered "cosmetic" are also performed for medical reasons, which affects timing and recommendations in accordance with state/federal guidelines.

The information provided in this document is intended for use by expert medical providers, who must decide what is best for their patients. No information in this document should be construed to imply restrictions on when and how healthcare providers can provide care. Medical care is an essential service and should be available to all patients who can benefit. At times, there may be reasons to change the process of care delivery to best meet patient needs, and how this is done, and whether such changes are made are at the discretion of the treating medical provider, in consultation with the patient.

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References

1. Asadi S, Wexler AS, Cappa CD, Barreda S, Bouvier NM, Ristenpart WD. Aerosol emission and superemission during human speech increase with voice loudness. Sci Rep 2019;9:2348.
2. Meselson M. Droplets and Aerosols in the Transmission of SARS-CoV-2. The New England journal of medicine 2020.
3. A choir decided to go ahead with rehearsal. Now dozens of members have COVID-19 and two are dead 2020. (Accessed 21 May 2020, at https://www.latimes.com/world-nation/story/2020-03-29/coronavirus-choir-outbreak.)
4. Wei WE LZ, Chiew CJ, Yong SE, Toh MP, Lee VJ. Presymptomatic Transmission of SARS-CoV-2 — Singapore, January 23–March 16, 2020. In: Prevention CfDCa, ed. MMWR Morb Mortal Wkly Rep 2020:411-5.
5. Anfinrud P, Stadnytskyi V, Bax CE, Bax A. Visualizing Speech-Generated Oral Fluid Droplets with Laser Light Scattering. New England Journal of Medicine 2020;382:2061-3.
6. Frequently Asked Questions about Biosafety and COVID-19. 2020. (Accessed 21 May, 2020, at https://www.cdc.gov/coronavirus/2019-ncov/lab/biosafety-faqs.html.)
7. Hou YJ, Okuda K, Edwards CE, et al. SARS-CoV-2 Reverse Genetics Reveals a Variable Infection Gradient in the Respiratory Tract. Cell 2020.
8. Chan JF-W, Yip CC-Y, To KK-W, et al. Improved Molecular Diagnosis of COVID-19 by the Novel, Highly Sensitive and Specific COVID-19-RdRp/Hel Real-Time Reverse Transcription-PCR Assay Validated In Vitro and with Clinical Specimens. Journal of clinical microbiology 2020;58:e00310-20.
9. Wölfel R, Corman VM, Guggemos W, et al. Virological assessment of hospitalized patients with COVID-2019. Nature 2020.
10. Leung NHL, Chu DKW, Shiu EYC, et al. Respiratory virus shedding in exhaled breath and efficacy of face masks. Nat Med 2020;26:676-80.
11. Jefferson T, Foxlee R, Mar CD, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses: systematic review. BMJ 2008;336:77-80.
12. Seto WH, Tsang D, Yung RW, et al. Effectiveness of precautions against droplets and contact in prevention of nosocomial transmission of severe acute respiratory syndrome (SARS). Lancet (London, England) 2003;361:1519-20.
13. Liang M, Gao L, Cheng C, et al. Efficacy of face mask in preventing respiratory virus transmission: a systematic review and meta-analysis. medRxiv 2020:2020.04.03.20051649.
14. Liang M, Gao L, Cheng C, et al. Efficacy of face mask in preventing respiratory virus transmission: A systematic review and meta-analysis. Travel medicine and infectious disease 2020:101751.
15. Cheng VC-C, Wong S-C, Chuang VW-M, 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:S0163-4453(20)30235-8.
16. Bartoszko JJ, Farooqi MAM, Alhazzani W, Loeb M. Medical masks vs N95 respirators for preventing COVID-19 in healthcare workers: A systematic review and meta-analysis of randomized trials. Influenza and Other Respiratory Viruses 2020;n/a.
17. Chu DK, Akl, E.A., Duda, S., Solo, K., Yaacoub, S. Schunemann, H.J. Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis. The Lancet 2020.
18. Ng K, Poon BH, Kiat Puar TH, et al. COVID-19 and the Risk to Health Care Workers: A Case Report. Annals of internal medicine 2020.
19. Howard J, Huang A, Li Z, et al. Face Masks Against COVID-19: An Evidence Review2020.
20. 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;7:413-8.
21. 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:e2618-e.
22. Dato VM, Hostler D, Hahn ME. Simple respiratory mask. Emerg Infect Dis 2006;12:1033-4.

23. Anfinrud P, Bax CE, Stadnytskyi V, Bax A. Could SARS-CoV-2 be transmitted via speech droplets? medRxiv 2020:2020.04.02.20051177.
24. Milton DK, Fabian MP, Cowling BJ, Grantham ML, McDevitt JJ. Influenza virus aerosols in human exhaled breath: particle size, culturability, and effect of surgical masks. PLoS pathogens 2013;9:e1003205.
25. Amid the Coronavirus Crisis, A Regimen for Reentry. The New Yorker, 2020. (Accessed 21 May, 2020, at https://www.newyorker.com/science/medical-dispatch/amid-the-coronavirus-crisis-a-regimen-for-reentry.)
26. Chan JYK, Wong EWY, Lam W. Practical Aspects of Otolaryngologic Clinical Services During the 2019 Novel Coronavirus Epidemic: An Experience in Hong Kong. JAMA Otolaryngology–Head & Neck Surgery 2020.
27. Kowalski LP, Sanabria A, Ridge JA, et al. COVID-19 pandemic: Effects and evidence-based recommendations for otolaryngology and head and neck surgery practice. Head & Neck 2020;n/a.
28. Lerner AM, Folkers GK, Fauci AS. Preventing the Spread of SARS-CoV-2 With Masks and Other "Low-tech" Interventions. Jama 2020.
29. Zuo MZ, Huang YG, Ma WH, et al. Expert Recommendations for Tracheal Intubation in Critically ill Patients with Noval Coronavirus Disease 2019. Chinese medical sciences journal = Chung-kuo i hsueh k'o hsueh tsa chih 2020.
30. Morawska L, Cao J. Airborne transmission of SARS-CoV-2: The world should face the reality. Environment international 2020;139:105730-.
31. van Doremalen N, Bushmaker T, Morris DH, et al. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. New England Journal of Medicine 2020;382:1564-7.
32. How COVID-19 Spreads. 2020. (Accessed 21 May, 2020, at https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-covid-spreads.html.)
33. Riddell S, Goldie S, Hill A, Eagles D, Drew TW. The effect of temperature on persistence of SARS-CoV-2 on common surfaces. Virology Journal 2020;17:145.
34. Hirose R, Ikegaya H, Naito Y, et al. Survival of SARS-CoV-2 and influenza virus on the human skin: Importance of hand hygiene in COVID-19. Clinical infectious diseases : an official publication of the Infectious Diseases Society of America 2020.
35. Ryan MA, Christian RS, Wohlrabe J. Handwashing and respiratory illness among young adults in military training. American journal of preventive medicine 2001;21:79-83.
36. When and How to Wash Your Hands. 2020. (Accessed 02 June, 2020, at https://www.cdc.gov/handwashing/when-how-handwashing.html.)
37. Jensen DA, Danyluk MD, Harris LJ, Schaffner DW. Quantifying the effect of hand wash duration, soap use, ground beef debris, and drying methods on the removal of Enterobacter aerogenes on hands. Journal of food protection 2015;78:685-90.
38. Chamberlain AN, Halablab MA, Gould DJ, Miles RJ. Distribution of Bacteria on Hands and the Effectiveness of Brief and Thorough Decontamination Procedures Using Non-medicated Soap. Zentralblatt für Bakteriologie 1997;285:565-75.
39. Annika K, Daniel T, Philip Vk, et al. Inactivation of Severe Acute Respiratory Syndrome Coronavirus 2 by WHO-Recommended Hand Rub Formulations and Alcohols. Emerging Infectious Disease journal 2020;26.
40. Show Me the Science – When & How to Use Hand Sanitizer in Community Settings. 2020. (Accessed 02 June, 2020, at https://www.cdc.gov/handwashing/show-me-the-science-hand-sanitizer.html#sixteen.)
41. Sun C-B, Wang Y-Y, Liu G-H, Liu Z. Role of the Eye in Transmitting Human Coronavirus: What We Know and What We Do Not Know. Frontiers in public health 2020;8:155-.
42. Wu P, Duan F, Luo C, et al. Characteristics of Ocular Findings of Patients With Coronavirus Disease 2019 (COVID-19) in Hubei Province, China. JAMA Ophthalmology 2020;138:575-8.
43. Seah IYJ, Anderson DE, Kang AEZ, et al. Assessing Viral Shedding and Infectivity of Tears in Coronavirus Disease 2019 (COVID-19) Patients. Ophthalmology.
44. Zhou L, Xu Z, Castiglione GM, Soiberman US, Eberhart CG, Duh EJ. ACE2 and TMPRSS2 are expressed on the human ocular surface, suggesting susceptibility to SARS-CoV-2 infection. bioRxiv 2020:2020.05.09.086165.
45. Yan Y, Diao B, Liu Y, Zhang W, Wang G, Chen X. Severe Acute Respiratory Syndrome Coronavirus 2 Nucleocapsid Protein in the Ocular Tissues of a Patient Previously Infected With Coronavirus Disease 2019. JAMA Ophthalmology 2020.

46. Belser JA, Rota PA, Tumpey TM. Ocular tropism of respiratory viruses. Microbiology and molecular biology reviews : MMBR 2013;77:144-56.
47. Pedrosa PB, Cardoso TA. Viral infections in workers in hospital and research laboratory settings: a comparative review of infection modes and respective biosafety aspects. International journal of infectious diseases : IJID : official publication of the International Society for Infectious Diseases 2011;15:e366-76.
48. Maragakis LL. Eye Protection and the Risk of Coronavirus Disease 2019: Does Wearing Eye Protection Mitigate Risk in Public, Non–Health Care Settings? JAMA Ophthalmology 2020.
49. Zeng W, Wang X, Li J, et al. Association of Daily Wear of Eyeglasses With Susceptibility to Coronavirus Disease 2019 Infection. JAMA Ophthalmology 2020.
50. Universal face shield use significantly reduces SARS-CoV-2 infections among HCP. Healio, 2020. (Accessed 1 Nov, 2020, at https://www.healio.com/news/primary-care/20201028/universal-face-shield-use-significantly-reduces-sarscov2-infections-among-hcps.)
51. Dai X. Peking University Hospital Wang Guangfa Disclosed Treatment Status on Weibo and Suspected Infection Without Wearing Goggles. Xinjing Newspaper; 2020.
52. Zhou Y, Zeng Y, Tong Y, Chen C. Ophthalmologic evidence against the interpersonal transmission of 2019 novel coronavirus through conjunctiva. medRxiv 2020:2020.02.11.20021956.
53. Different COVID-19 Vaccines. 2020. (Accessed Jan 9, 2021, at https://www.cdc.gov/coronavirus/2019-ncov/vaccines/different-vaccines.html.)
54. Understanding How COVID-19 Vaccines Work. 2020. (Accessed Jan 9, 2021, at https://www.cdc.gov/coronavirus/2019-ncov/vaccines/different-vaccines/how-they-work.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fvaccines%2Fabout-vaccines%2Fhow-they-work.html.)
55. Pfizer-BioNTech COVID-19 Vaccine Questions. 2020. (Accessed Jan 9, 2021, at https://www.cdc.gov/vaccines/covid-19/info-by-product/pfizer/pfizer-bioNTech-faqs.html.)
56. Anaphylaxis cases after COVID-19 vaccine rising but still rare: CDC. 2021. (Accessed Jan 9, 2021, at https://www.mdedge.com/hematology-oncology/article/234309/coronavirus-updates/anaphylaxis-cases-after-covid-19-vaccine?ecd=wnl_evn_210107_mdedge_8pm&utm_source=News_MDedge_eNL_010721_F&utm_medium=email&utm_content=Early+use+of+high-titer+plasma+may+prevent+severe+COVID-19&sso=true.)
57. Zambrano LD, Ellington, S., Strid, P., Galang, R.R., Oduyebo, T., Tong, V.T., Woodworth, K.R., Nahabedian, J.F., Azziz-Baumgartner, E., Gilboa, S.M., Meaney-Delman, D. Update: Characteristics of Symptomatic Women of Reproductive Age with Laboratory-Confirmed SARS-CoV-2 Infection by Pregnancy Status — United States, January 22–October 3, 2020. 2020;69:1641-7.
58. Polack FP, Thomas SJ, Kitchin N, et al. Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine. The New England journal of medicine 2020;383:2603-15.
59. Baden LR, El Sahly HM, Essink B, et al. Efficacy and Safety of the mRNA-1273 SARS-CoV-2 Vaccine. The New England journal of medicine 2020.
60. Moderna COVID-19 Vaccine Questions. 2020. (Accessed Jan 9, 2021, at https://www.cdc.gov/vaccines/covid-19/info-by-product/moderna/moderna-faqs.html.)
61. Avram M, Bertucci, V., Cox, S.E., Jones, D., Mariwalla, K. Guidance Regarding SARS-CoV-2 mRNA Vaccine Side Effects in Dermal Filler Patients. American Society for Dermatologic Surgery; 2020.
62. Bhojani-Lynch T. Late-Onset Inflammatory Response to Hyaluronic Acid Dermal Fillers. Plastic and Reconstructive Surgery – Global Open 2017;5.
63. Turkmani MG, De Boulle K, Philipp-Dormston WG. Delayed hypersensitivity reaction to hyaluronic acid dermal filler following influenza-like illness. Clinical, cosmetic and investigational dermatology 2019;12:277-83.
64. Bourouiba L. Turbulent Gas Clouds and Respiratory Pathogen Emissions: Potential Implications for Reducing Transmission of COVID-19. Jama 2020;323:1837-8.
65. Social Distancing. 2020. (Accessed 21 May, 2020, at https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/social-distancing.html.)
66. Feigin RD, Baker CJ, Herwaldt LA, Lampe RM, Mason EO, Whitney SE. Epidemic meningococcal disease in an elementary-school classroom. The New England journal of medicine 1982;307:1255-7.

67. Olsen SJ, Chang HL, Cheung TY, et al. Transmission of the severe acute respiratory syndrome on aircraft. The New England journal of medicine 2003;349:2416-22.
68. Jones NR, Qureshi ZU, Temple RJ, Larwood JPJ, Greenhalgh T, Bourouiba L. Two metres or one: what is the evidence for physical distancing in covid-19? BMJ 2020;370:m3223.
69. Burke RM MC, Dratch A, et al. Active Monitoring of Persons Exposed to Patients with Confirmed COVID-19 — United States, January–February 2020. MMWR Morb Mortal Wkly Rep 2020:245-6.
70. Coronavirus Disease 2019 (COVID-19) Appendices. 2020. (Accessed Nov 1, 2020, at https://www.cdc.gov/coronavirus/2019-ncov/php/contact-tracing/contact-tracing-plan/appendix.html.)
71. Zhen-Dong G, Zhong-Yi W, Shou-Feng Z, et al. Aerosol and Surface Distribution of Severe Acute Respiratory Syndrome Coronavirus 2 in Hospital Wards, Wuhan, China, 2020. Emerging Infectious Disease journal 2020;26.
72. Howard BE. High-Risk Aerosol-Generating Procedures in COVID-19: Respiratory Protective Equipment Considerations. Otolaryngology–Head and Neck Surgery 2020:0194599820927335.
73. Somsen GA, van Rijn, C., Kooij, S., Bem, R.A., Bonn, D. Small droplet aerosols in poorly ventilated spaces and SARS-CoV-2 transmission. The Lancet 2020.
74. Shen Y, Li C, Dong H, et al. Community Outbreak Investigation of SARS-CoV-2 Transmission Among Bus Riders in Eastern China. JAMA Internal Medicine 2020.
75. Baka A, Cenciarelli, O., Kinross, P., Penttinen, P., Plachouras, D., Semenza, J., Suetens, C., Weist, K. . Heating, ventilation, and air-conditioning systems in the context of COVID-19. In: Control ECfDPa, ed.2020.
76. COVID-19 Employer Information for Office Buildings. 2020. (Accessed June 4, 2020, at https://www.cdc.gov/coronavirus/2019-ncov/community/office-buildings.html.)
77. ASHRAE. ASHRAE Position Document on Infectious Aerosols2020.
78. Nardell EA, Nathavitharana RR. Airborne Spread of SARS-CoV-2 and a Potential Role for Air Disinfection. Jama 2020.
79. ASHRAE. ASHRAE Position Document on Airborne Infectious Diseases2020 Reaffirmed by Technology Council 5 February 2020.
80. Committee IESP. IES Committee Report: Germicidal Ultraviolet (GUV)- Frequently Asked Questions: Illuminating Engineering Society; 2020.
81. Nardell EA, Bucher SJ, Brickner PW, et al. Safety of upper-room ultraviolet germicidal air disinfection for room occupants: results from the Tuberculosis Ultraviolet Shelter Study. Public Health Rep 2008;123:52-60.
82. Miller SL, Linnes J, Luongo J. Ultraviolet Germicidal Irradiation: Future Directions for Air Disinfection and Building Applications. Photochemistry and Photobiology 2013;89:777-81.
83. Memarzadeh F, Olmsted RN, Bartley JM. Applications of ultraviolet germicidal irradiation disinfection in health care facilities: effective adjunct, but not stand-alone technology. American journal of infection control 2010;38:S13-24.
84. Lu J, Gu J, Li K, et al. COVID-19 Outbreak Associated with Air Conditioning in Restaurant, Guangzhou, China, 2020. Emerg Infect Dis 2020;26.
85. Xue X, Mi Z, Wang Z, Pang Z, Liu H, Zhang F. High expression of ACE2 on the keratinocytes reveals skin as a potential target for SARS-CoV-2. The Journal of investigative dermatology 2020:S0022-202X(20)31602-X.
86. Sanchez A, Sohier P, Benghanem S, et al. Digitate Papulosquamous Eruption Associated With Severe Acute Respiratory Syndrome Coronavirus 2 Infection. JAMA Dermatology 2020.
87. Ahouach B, Harant S, Ullmer A, et al. Cutaneous lesions in a patient with COVID-19: are they related? British Journal of Dermatology 2020;n/a.
88. Colmenero I, Santonja C, Alonso-Riaño M, et al. SARS-CoV-2 endothelial infection causes COVID-19 chilblains: histopathological, immunohistochemical and ultrastructural study of seven paediatric cases. The British journal of dermatology 2020:10.1111/bjd.19327.
89. Magro C, Mulvey JJ, Laurence J, et al. The differing pathophysiologies that underlie COVID-19 associated perniosis and thrombotic retiform purpura: a case series. The British journal of dermatology 2020:10.1111/bjd.19415.
90. Ravishankar A, Turetsky Y, Novotny S, Allen T, Farah RS. Implementing Laser Safety Standards in the Outpatient Academic Dermatology Clinic: A Quality Improvement Based Study. Lasers in surgery and medicine 2019;n/a.
91. Emadi S-N, Abtahi-Naeini B. Coronavirus Disease 2019 (COVID-19) and dermatologists: Potential biological hazards of laser surgery in epidemic area. Ecotoxicol Environ Saf 2020;198:110598-.

92. Clinical Questions about COVID-19: Questions and Answers. 2020. (Accessed May 21, 2021, at https://www.cdc.gov/coronavirus/2019-ncov/hcp/faq.html.)
93. Corman VM, Rabenau HF, Adams O, et al. SARS-CoV-2 asymptomatic and symptomatic patients and risk for transfusion transmission. Transfusion 2020.
94. Kruglikov IL, Scherer PE. The role of adipocytes and adipocyte-like cells in the severity of COVID-19 infections. Obesity (Silver Spring, Md) 2020.