

LITERATURE REVIEW SARS-CoV 2

By: Dr. Rose Ann Huynh, Laureen Gbordzoe, Swetha Maddipudi, Chloe Jensen,
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Peer reviewed by: Dr. Jason Rosenfeld and Dr. Kelly Echevarria

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MASKS

Impact on Health Systems



UT Health
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MASK WEARING IN PUBLIC

- State government mandates for community use of face masks or covers across 15 US states has been associated with a decline in daily COVID-19 growth rates from 0.9 1-5 days after signing orders to 2.0 over 21 days after signing.
- The ideal combination of materials for non-medical masks (e.g. fabric masks) should include 3 layers as follows: 1) hydrophilic material (e.g. cotton or cotton blends) as the innermost layer; 2) a synthetic non-woven material (e.g. polypropylene) as a middle layer; and 3) a hydrophobic material (e.g. polypropylene, polyester, or polyester blend) as the outermost layer. Masks should not have breathing valves or vents*. Mask wearing should be accompanied by proper hand hygiene and physical distancing practices.
- The average jet distance traveled by a cough covered by a two-layer stitched mask made of quilting cotton was 2.5 in as compared to an uncovered cough which traveled approximately 8 ft. The droplets from a cough covered by a single-layer bandana style covering had an average jet distance of 3 ft 7 in.
- Medical masks should have at least a 95% initial droplet filtration and adequate breathability. In times of limited supply, medical masks should be reserved for healthcare workers and at-risk individuals.
- Mask wearing by the general public can provide protection against primary infections from community contacts and protect against household transmission. Masks are especially useful in situations where social distancing is not possible to maintain.
- EXTENDING USABILITY OF N95 RESPIRATORS
- CDC guidelines provide principles for extending usage and reuse of filtering facial respirators, like N95s, in times of limited supply. Decontamination should reduce pathogen burden, retain functionality, and present no residual chemical hazard to mask users.
- Ultraviolet germicidal irradiation (UVGI), vaporous hydrogen peroxide (VHP), and moist heat are the recommended methods for decontaminating N95 masks. Manufacturers should be contacted for guidance on the best mechanism for decontamination.
- The University of Nebraska Medical School has developed a decontamination protocol for N95 respirators that uses UVGI to decontaminate 90 masks/round with a total exposure dose up to 900 mj/cm².
- The Washington University School of Medicine has implemented a VHP protocol that is capable of decontaminating 200 N95 respirators in 24 hours using a minimum dose of 700 parts per minute (PPM) of VHP.



TRANSMISSION

EFFECTIVENESS OF STAY AT HOME ORDERS AND EFFECTS OF RE-OPENINGS

- With continued adherence to stay at home orders, a model has shown that it may be effective in flattening the curve; it showed that the less strict people are in staying at home, the longer the stay at home orders will have to be in place in order to flatten the curve.
- Data from four major cities in the United States has shown that with the implementation of more strict stay at home measures, the average percent change in the number of new cases daily had decreased.
- When comparing data from areas around the United States that put stay-at-home orders in place versus areas that did not, there was a decrease in both the number of weekly cases and fatalities. After three weeks, there was a 48.6% decrease in the number of weekly cases (approximately 390,000) and a 59.8% decrease in the number of weekly fatalities (approximately 41,000). Stay-at-home orders appear to play a role in decreasing the number of cases and fatalities, but other factors also likely contribute (closures of schools and non-essential businesses).
- During an overnight summer camp, one person was discovered positive for COVID-19 despite the requirement of a negative COVID-19 test \leq 12 days prior to camp. Masks were only required for the staff, not the campers. 344 camp attendees test results were made available and 260 were positive.
- In a Dutch nursing home, there was inadequate ventilation in 1 ward, and 81% of the residents and 50% of healthcare workers tested positive; 0% of residents and healthcare workers tested positive who were in the other 6 properly ventilated wards.
- In 3 childcare facilities, there were 101 staff and children and 22/101 tested positive for COVID-19; 12/22 were children. Though the children were asymptomatic or had mild symptoms, 12/46 close contacts of these children tested positive for COVID-19 too.*
- On March 31, the weekly positive test rate in school aged children (5-17) was 10% and on July 5 it was 14%; this correlates with when many states increased their re-openings.*
- *Recommendation:* Social distancing was working to flatten the curve. As businesses begin to open up and people return to work and school, caution should continue to be taken; with adequate ventilation rates, social distancing, low % occupancy of a room, low exposure time, and mask requirements, the benefits of re-opening can outweigh the risk of spread. These should be implemented as much as possible as the need to gather in groups grows in order to minimize the increase in cases. As childcare facilities and schools open too, children should also wear masks as much as possible because there is increased spread between their population especially in the 12-17 age group; even though children tend to have milder symptoms, they are still able to transmit COVID-19*.

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TRANSMISSION CONTINUED

TRANSMISSION FROM SURFACES

- SARS-CoV-2 was shown to be viable on objects made out of plastic and stainless steel for up to 72 hours;
- SARS-CoV-2 was found on copper for up to 4 hours and cardboard for up to 24 hours.
- SARS-CoV-2 was found to persist longer on smooth surfaces compared to other surfaces.
- All samples (from personal items, medical equipment, and floors) from COVID-19 positive patient rooms (from multiple hospitals) were negative after disinfection and sanitation (with a 0.1% hypochlorite solution); consistent disinfection may help reduce transmission.
- Other disinfecting chemicals (e.g. 75% ethanol, 10% bleach, advanced hand sanitizer) can also reduce the infectivity of SARS-CoV-2.
- Increasing temperature and humidity can decrease the half-life of SARS-CoV-2 on stainless steel and plastic surfaces. SARS-CoV2 was also undetectable after 6 days at $\text{pH} \leq 4$ and ≥ 10 .
- In the Emergency department, 10/192 surface samples that were either in direct or indirect contact with patients were positive.
- Recommendation: caution should be taken when handling objects made out of these materials, especially in higher risk settings such as the ICU, as the virus was found on computer mice, trash cans, and door handles in this setting. Disinfecting techniques should be continued. More caution should be taken regarding objects that touch patients directly such as BP cuffs.

TRANSMISSION IN DROPLET VS AEROSOL FORM

- A model showed that droplets less than $60 \mu\text{m}$ can travel about 6 feet - 26 feet. Increased humidity was also shown to decrease the distance that the droplets can travel, but also increase the width that the droplet cloud (as from a sneeze) can extend. The viability of aerosolized SARS-CoV-2 was tested in artificial saliva; it survived longer in 68%-88% relative humidity (RH) compared to 20%-40% RH.
- Aerosols of SARS-CoV-2 were found to travel up to about 13 feet.
- The clothing of personnel who were in rooms with SARS-CoV-2 patients were tested positive for viral RNA despite the absence of cough by the patient when they were in the room.
- Airborne precautions may be needed which is supported by evidence that showed 52/60 people became ill after attending a choir rehearsal with one attendee who had become symptomatic 3 days prior to the rehearsal. 32/52 of these cases were confirmed by positive tests for COVID-19 at a later date; this implies that the forceful exhalation during singing may have aerosolized the virus and allowed airborne transmission.
- Increasing ventilation and decreasing air-recirculation may reduce the transmission of airborne COVID-19. Experimental studies have been done that show there is better positioning for ventilation devices in order to decrease the chance of particles landing on surfaces due to ventilation*.
- There is evidence that supports that COVID-19 can be spread via aerosols (ranked 8/9 on plausibility of aerosol transmission), but also evidence that supports it is not primarily spread by aerosols (measles which is spread by aerosols has a reproductive value of ~ 18 vs COVID-19 has a reproductive value of ~ 2.5). A study was done where air sampling devices were placed 6.6 - 15.7 feet away from a patient's bed and using RT-qPCR, COVID-19 was detected; this is evidence that COVID-19 may spread via aerosols produced from speaking, sneezing, or coughing*.
- During a study at Duke University Hospital where aerosol and fomite samples were collected 20 COVID-19 patients, there were fewer positive samples compared to previous studies; this may be because 10 patients were ≥ 8 days into their illness and it is estimated that viral clearance is ~ 9 days.
- *Recommendation:* Forceful exhalation may be sufficient in aerosolizing SARS-CoV-2 therefore precautions should be taken when doing activities such as shouting and yelling. Opening windows may help reduce the transmission of COVID-19 indoors. Though there is a chance that aerosol transmission is not the primary method of transmission, avoiding large crowds and poorly ventilated areas should still be practiced; evidence is growing for the aerosol spread of COVID-19 as well*. How many and the location of ventilation devices should also be taken into consideration in order to optimize ventilation*.

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Effects on Health



Indirect Health Effects & Personal Impact

FOOD SECURITY

- Food insecurity rates in the US have doubled from 18% to 35% during the pandemic. Previous large observational studies suggest that living in food poverty increases the risk of developing childhood asthma, and that parents of children with CF are twice as likely to be living in food insecurity.
- *Recommendation: Clinicians should screen for food insecurity and connect patients with appropriate resources.*

NONCOMMUNICABLE DISEASES & LIFE EXPECTANCY*

- 75% of countries surveyed by the World Health Organization reported a considerable degree of disruption to noncommunicable disease services due to the pandemic.*
- There have been fewer patients admitted for strokes and myocardial infarctions, likely due to public health messages.
- The duration of lockdown is proportional to uncontrolled glycemia and diabetic complications.
- Children may experience unhealthy weight gain related to the pandemic. Unhealthy weight gain may be related to increased food insecurity caused by the pandemic or related to decreased physical activity because of closures.
- The average 2020 US life expectancy is estimated to decrease by 1.41 years. The Black-white life expectancy gap is estimated to increase by 50%, undoing 20 years of progress towards closing the gap.*
- *Recommendation: Practitioners should educate patients with chronic diseases about telemedicine options in order to ensure adequate management. Clinicians should also counsel parents on healthy practices to avoid unhealthy weight gain despite closures. This should include screening for food insecurity and providing appropriate resources.*

MENTAL HEALTH

- Psychiatric symptoms such as depression, stress, and anxiety in the general population may have increased since the pandemic.
 - Healthcare workers are especially at risk. Home Health Care workers reported feeling vulnerable but invisible.
 - In a Canadian cross-sectional study of mothers of kids aged 0-8, the levels of clinically significant depression and anxiety both were dramatically increased compared to pre-COVID levels.
 - A study of LGBTQ+ individuals found higher levels of stress and depression compared to pre-COVID studies, especially among young, transgender, gender diverse, and non-heterosexual individuals who did not identify as gay or lesbian.
 - A UK study of families with children who have special education needs or disabilities found that many families reported increased anxiety and fear.
 - The CDC reported that 40% of adults have been struggling with mental health or substance use, and that young adults, essential workers, unpaid caregivers of adults, and racial/ethnic minorities are experiencing these symptoms at higher rates.
- Since 57% of children who receive mental health services receive it from school, there is reduced access to mental health care for children whose schools closed.
- A cross-sectional study of people with alcohol use disorders in the UK found that lockdown was a risk factor for increased alcohol consumption, including harmful levels. However, some participants actually decreased their alcohol consumption.
- *Recommendation: Practitioners should screen for psychiatric symptoms and connect patients with mental health resources, including affordable and telemedicine options where possible. Public health efforts should include efforts to prevent psychiatric symptoms, like financial support and promoting social connectedness. Clinicians should screen for increased alcohol use and connect patients at risk of harmful alcohol use with alcohol liaison services.*

DOMESTIC VIOLENCE, CHILD ABUSE & NEGLECT

- There may be increased risk of domestic violence compared to pre-COVID-19 levels due to increased stress and financial insecurity as well as decreased social support.
- Child abuse reporting in several states have decreased by up to 70% percent compared to pre-COVID-19 levels. In the United States, 67% of substantiated reports come from victim-serving professionals like educators, so reduced reporting likely indicates that child abuse and neglect are continuing unreported due to school closures.
- Domestic violence reports have increased dramatically around the world, by as much as three-fold during lockdown in China. Some reports also include the use of COVID-19 as a weapon for emotional abuse.
- *Recommendations: As clinicians are some of the few remaining reporters, they should screen for signs of domestic violence, child abuse or neglect.*

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Effects on Health



Indirect Health Effects & Personal Impact Continued

CHILDHOOD VACCINATIONS

- Routine childhood immunization orders have decreased significantly since COVID-19 was declared a national emergency. This may reflect parental concern of exposing children to the disease.
- A World Health Organization poll found that in 85% of 61 countries that responded, childhood immunization rates had decreased since January.
- *Recommendations:* Clinicians should continue outreach efforts for bringing children up to date with routine vaccinations, including educating parents on the importance of preventing serious illness with vaccines even during the pandemic. Making vaccine administration available with limited contact (for example, via a drive-thru vaccine clinic) could also ease parental concerns.

STIGMA & RACISM

- In one survey, a quarter of respondents felt that healthcare workers should have restrictions placed on their freedoms to avoid infecting people with COVID-19. Nearly a third would avoid healthcare workers to avoid infection. These indicate increased stigma.
- In a survey of Chinese American families, nearly half of parents and youth reported being directly targeted by COVID-19 racial discrimination online. Higher levels of parental and youth perceived racism and racial discrimination were associated with poorer mental health in parents and youth.
- *Recommendation:* Clinicians should be sensitive to the challenges Asian American families may face due to racism during the pandemic.