Findings from COVID-19 Background Literature Review

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This document provides a brief summary of transmission routes and a full gamut of information about best practices for interventions, followed by appendices of more detailed best practices for each topic. Even more detailed information and references are available as well. Contact Dan.Nathan-Roberts@sjsu.edu

This brief goes hand in hand with the State of California COVID-19 Guidance for Institutions of Higher Education providing best practices for almost every requirement in the guidance.

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Briefing

To determine the primary risks of infection and make recommendations of best practices across interventions in this report Dr. Dan Nathan-Roberts along with heavy support from 3 graduate students performed a detailed literature review identifying over 900 sources including and ultimately fully reviewing 254 scientific journal articles guidelines, expert opinions and news articles combined which were relevant to our needs. Over 400 of the initially identified sources were peer reviewed scientific research papers and over 150 sources from 2020 alone. This brief represents the best knowledge to-date for the COVID-19 virus, but information is constantly changing.

Interventions in this document can be organized into the categories below.

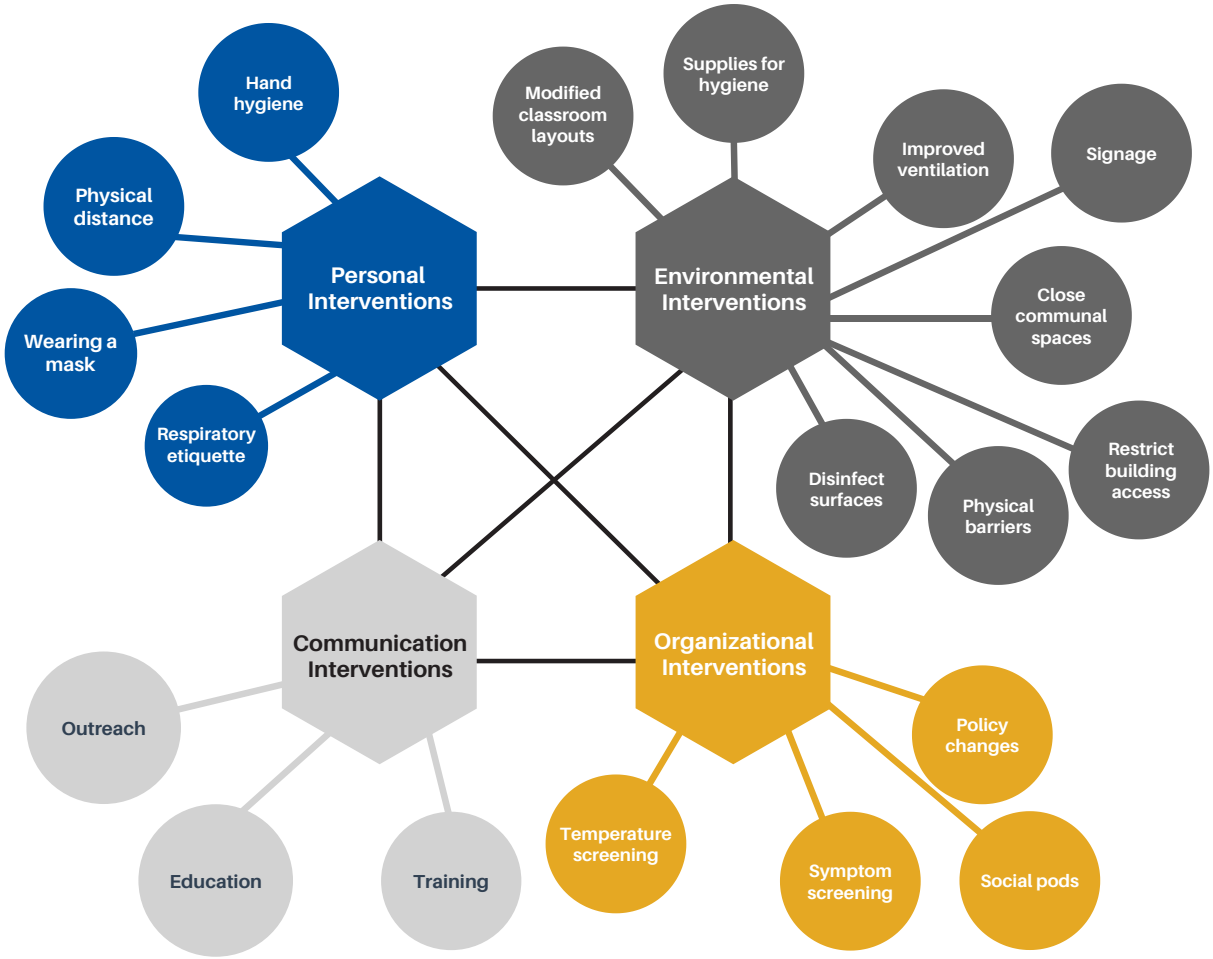

Figure 1. A systems model of Non-Pharmaceutical Interventions to reduce the impact of the Coronavirus Disease in educational institutions developed through a systematic literature review based on over 500 published articles.

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Transmission Routes of the Novel Coronavirus, COVID-19

Currently, there is not a way to predict the percentage of infections that come from one route or another. At this time the scientific consensus appears to be that close-contact, person-to-person respiratory transmission is the primary way the virus is transmitted; however, researchers are clear that they still do not fully understand the ways the virus is transmitted. There is a big risk of transmitting the virus through aerosolized particles since it can stay suspended in the air for up to 30 hours and survive on surfaces ranging hours to days (including pets and lab animals) depending on the temperature and humidity. The scientific community strongly believes that airborne infection far-beyond six feet is possible and likely. This can simply be from the natural air movement from people walking around in buildings. It is also far easier for the virus to be transmitted indoors than outdoors. There is also strong evidence that a new mutation of the COVID-19 virus makes it easier to spread. A well-designed, cohesive set of interventions is critical to reducing infection harm to our university community.

Non-Pharmaceutical Interventions

A systematic review of ways of dealing with the COVID-19 virus identified a large number of Non-Pharmaceutical Interventions (NPIs) that have previously been used to reduce risk during outbreaks like H1N1 in educational settings in other related settings. Many of the listed interventions are from historical records from past pandemics whereas others are from simulations studies.

NPIs can be organized into:

- Personal interventions that can be carried out by individuals, such as wearing masks and practicing proper hand hygiene.
- Environmental interventions that an institution can implement such as modifying classroom layouts, disinfecting surfaces, and putting up physical barriers and signage.
- Organizational interventions such as screening of temperatures and symptoms, enacting policies that promote staying home if experiencing symptoms or suspected infection, and altering work/school schedules.
- Communication interventions such as educating people to increase understanding of the threat of the pandemic and their own susceptibility, increase knowledge of symptoms, training people on proper hygiene, providing up-to-date information on pandemic, notifying people of any exposure or changes in policy, and providing a system to self-report symptoms. A full list is available in the Appendix Non-Pharmaceutical Intervention.

Mask Best Practices

Masks play one of the largest roles in reducing transmission of the coronavirus; preventing the wearer from transmitting while simultaneously protecting the wearer from the virus. Masks can be roughly categorized into four different types: medical masks, facepiece respirators, non-medical masks, and face shields. Face shields should be reserved for those with limited compliance to masks due to mental health disorders, developmental disabilities, deaf and hard of hearing community, and children. The general population should use non-medical masks because N95 respirators and medical masks should be reserved for healthcare workers providing direct care to patients. Non-medical masks include disposable face masks and reusable cloth face coverings. These types of non-medical masks can be quite effective if made and used correctly. Furthermore, masks with valves or vents are also not recommended because they act as openings for respiratory droplets to be expelled. To maximize efficacy, non-medical masks should have a minimum of three layers where the outermost layer is made of polyester or polypropylene which can repel water. The middle layer should consist of polypropylene as well if not cotton and the innermost layer should be made of cotton materials. Although better than no masks, porous materials such as gauze, T-shirt materials, or bandanas are strongly not recommended. Masks should also be fitted closely to the face where it is secured over the nose and under the chin as open gaps can allow airborne particles to come through. Having a couple of cloth masks at hand allows the wearer to cycle through them while some are being washed compared to medical masks that can only be worn once. It is important to note that despite mask wear being one of the fundamental NPIs, mask wearing has been associated with a false sense of security, which may result in disregard of other safety measures such as physical distancing or hand hygiene. It will be critical to communicate that mask wearing on its own is insufficient, and the best method is to adopt multiple NPI measures.

Hand Hygiene Best Practices

Proper hand washing is highly effective at preventing illnesses, however studies repeatedly show that prior to COVID-19 about 50% of students (and the public in general) did not practice proper hand hygiene. Implementing education, training, and reminders on proper hand hygiene will be valuable to keep those on campus safe. Regardless of whether someone uses hand sanitizer or soap and water, cleaning hands regularly is by far the most important aspect of hand hygiene, however handwashing with any soap and friction for 20 seconds is more effective than using hand sanitizer. There are aspects of hand sanitizer, such as the ability to use it while walking, or carry it with you that make hand sanitizer a more attractive option in some situations. Hand sanitizer should contain at least 60% alcohol and a sufficient quantity must be used that it is possible to be rubbed on all

surfaces of the hands for at least 20-30 seconds before it dries. The most common issue with hand sanitizer (as with hand washing) is not using it long enough to be effective. Hand sanitizer should be located near entrances, classrooms, and near front-line workers such as cashiers or front-desk staff who can remind people to sanitize. To reduce the cognitive load, locations should be as consistent as possible between buildings. Education and training on how to properly clean hands, such as demonstrations, videos, etc. has been shown to dramatically improve hand hygiene. Similarly, posters and other interventions, such as incentives and gamification can be used to improve hand hygiene.

Best Practices for Behavior Change

Behavior change is at the root of all interventions. Below are specific best practices for several topics but more are included in the appendix of this brief.

Behavior Change for Masks In order to encourage mask wearing through behavior change, people have to be educated about their own susceptibility to COVID-19. Research has shown that if people understand the severity and facts about illness, they are more likely to comply with mask wearing compared to those that do not have such knowledge. Educating people on the effectiveness of mask wearing at preventing transmission is also important. Besides education, using outreach to communicate social responsibility has proven to be indispensable at increasing safety-behavior compliance. Research has also shown that about about 50% of the people forget to wear masks so signage at the entrance of parking lots and other similar locations as well as providing masks to those that forget is important. Also, appealing to social norms by normalizing mask wearing can increase compliance. Some common barriers that can be seen in mask compliance include those that distrust in the coronavirus itself or the infection disease experts. There are also certain age groups (e.g. 18-25) that are least likely to wear masks so solutions that can normalize mask wearing for this group would be important.

Behavior Change for Hand Hygiene Proper hand hygiene requires availability of supplies, knowledge of how to properly wash hands or use hand sanitizer, a desire to have clean hands, and In order for people to utilize hand sanitizer, the dispensers have to be placed in locations where sanitization would be required. Examples would include before dining halls or near classrooms instead of right at the entrances. Seeing dispensers in these locations would allow people to practice proper hand hygiene before eating or after opening the classroom door. Physical prompts such as signage or incorporating flashing lights can also be helpful in increasing compliance.

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Best Practices for Physical Distancing

Physical distancing, also known as social distancing, is one of the key non-pharmaceutical interventions to slow down the spread of COVID-19. To better accommodate physical distancing on campus, the university is recommended to implement the following protocols. First, the university should encourage students to wear masks in elevators, to use the stairs instead of elevators when possible, to leave doors and windows open, to modify classroom layouts (eg. reduce close seating, skip rows in lecture halls), and close communal areas to prevent gatherings. Second, the university is recommended to provide students with information about physical distancing as well as possible repercussions in the event of noncompliance. Third, the implementation of social media campaigns leveraging students leaders or campus influencers may be effective at increasing compliance among students. Lastly, in accordance with some other universities, requiring students, staff, and faculty to sign a pledge or an agreement to carry out physical distancing on campus is recommended for keeping each other safe and accountable. These four protocols will make a big difference on-campus and should be combined with encouragement and support to practice physical distancing off-campus as well.

Best Practices for Room Layouts

To follow the CDC's guidelines of staying 6-feet apart from others, a key consideration for implementation in university classroom settings is whether the tables and seating areas are fixed or not. For fixed lecture halls, tape off 3 empty seats between occupied seats and skip every other row. For fixed lab settings, ensure a minimum of 250-300 square feet per person. For configurable seating, use a 8-foot diameter hexagon or circle shape and include a 2-foot diameter circle in the center that can represent the student, staff, or faculty member. This method can ensure that the distance between people will be spaced a minimum of 6-feet apart. Lastly, incorporate an instructor zone that measures 6-feet from the front of the classroom. A visual diagram is provided in Appendix Room Layouts.

Signage Best Practices

For signage to be effective it needs to be noticed (capture attention), be understood, the desired outcome needs to be possible, desirable, and and as easy to achieve as possible. Signage color, visibility, type of information, placement, pictograms, and formatting of text can increase the likelihood that a sign is clearly communicated and followed.

Education & Training Best Practices

To create an effective educational program, goals, objectives and the specific audience need to be stated. Some possible goals and objectives include increasing knowledge, improving attitudes and beliefs, and encouraging specific behaviors. The program should be geared towards people of different cultures, languages, educational backgrounds as all these factors can change the effectiveness of the program. Specifically, the content should focus on educating people on their susceptibility to SARS-CoV-2, how big of a public health threat it is, what are the different types of symptoms to be aware of, and how interventions can be effective to increase compliance in certain behaviors. In terms of how to deliver this content to people, the safest and most viable method currently due to the pandemic would be online through lectures, however it can be limiting in learning as there isn't any engagement or opportunity for feedback. Another option would be adding quizzes or tests in addition to lecture based training as it provides feedback. The last method is considered to be the most engaging but requires people to apply what they have learned in situations in order to show behavior change. This would also be the most difficult given the current pandemic and physical isolation requirements.

Communication Best Practices

Since information is constantly changing for COVID-19, it is important to let the public know that recommendations today are subject to change or are a work in progress as new findings can occur at any time. Second, being clear and acknowledging that we do not know everything is important because any vague information can cause issues and confusion. Third, demonstrating the ability to make informed decisions with the current information and being honest about how that decision was made can keep people informed. Finally, acknowledge that there can be feelings of anxiety, distress, and depression when it comes to uncertainty in disease. Another point to consider when communicating with people is the type of message that is used whether it be pro-social or threatening. Research shows that both types of messages can lead to behavior change, however, threatening messages are seen to bring about an unpleasant emotional response and may be less beneficial for the university community in most situations. Also, ensuring that there is a method of notifying students, faculty, and staff about closures near buildings and making sure there is a point of contact for people to reach regarding COVID-19 concerns is important.

Surface Cleaning Best Practices

The CDC recommends cleaning indoor surfaces with soap and water followed by a disinfectant, however outdoor areas only need to be cleaned with soap and water and targeted disinfecting can be used on outdoor surfaces frequently touched by multiple people. The EPA has a List N of approved disinfectants that should be able to kill the COVID-19 virus as these disinfectants have shown that it can kill a harder-to-kill pathogen or a similar coronavirus. If EPA disinfectants are not accessible, utilizing bleach diluted with water or using 70% alcohol solutions can also be used for disinfecting surfaces. It is important to note that mixing bleach and alcohol or bleach and other cleaners can create deadly gasses such as chloroform. Different types of surfaces require different types of disinfectants, and contact time (eg. porous/non-porous; foot contact areas; food surfaces) to ensure that surfaces are disinfected properly. If someone has had the coronavirus disease, the current recommendation is to close the space and wait 24 hours before thoroughly cleaning, or to close the space for 7 days or more and perform a routine cleaning. There has been research on certain ultraviolet disinfectants to clean surfaces, however portable UV systems are mostly utilized in healthcare industries and there isn't enough research on UV lights to understand the short and long term effects on people yet.

Indoor Air Quality Best Practices

Indoor air quality can be improved by opening windows and doors when possible for natural ventilation to occur. However, if natural ventilation is not possible, utilizing mechanical ventilation through HVAC systems can also improve air quality. Filters should be checked on ventilation systems to ensure that it has the highest possible filtration (MERV) rating to capture airborne particles without jeopardizing the efficiency of the ventilation itself. Research has also shown that installing ultraviolet germicidal irradiation (UVGI) within HVAC systems can serve as a form of disinfection when air passes by the lights in the air ducts. However UVGI is considered harmful to humans, and precautions should be taken to ensure that maintenance, and users are not exposed to these lights. Humidity is also another factor in improving indoor air quality as research has shown that COVID-19 virus can survive longer in low temperatures and low humidity. Keeping the temperature at a comfortable range for people within buildings and adjusting the humidity up to a range of 45-60% can significantly help reduce the inactivity of the COVID-19 virus.

Best Practices for Screening & Symptoms

Temperature checks by themselves miss a large number of coronavirus patients. The best practice is to combine regular screening questionnaires and temperature checks. Screening; asking a series of questions to determine a person's risk of having the coronavirus disease. These questions include symptom reports, travel history, and exposure to someone who has tested positive for the coronavirus disease. The symptoms on the screener will include if the person has had a fever of 100.4 degrees Fahrenheit or higher, sore throat, cough, diarrhea, vomiting, abdominal pain, and/or severe headache. In some cases, it may be suitable to use thermal cameras to conduct mass temperature screening. On campus, the staff and faculty will need to receive training and preparation to monitor students for overt symptoms. Equipment such as thermometers and PPE will need to be adequately supplied for them to be able to carry out the screening process. Screening should be used to determine whether or not the person should be tested for COVID-19.

Testing Frequency Best Practices

As people start to return to campus, it will be crucial to not only screen their symptoms but also conduct testing since screening alone will not detect asymptomatic carriers of the COVID-19 virus. Due to the current limited availability of testing, however, it is important to consider the optimal frequency of testing. The recommended frequency of testing is unique for whether the person is symptomatic or asymptomatic as well as incidence rates in the general population. Regardless of symptoms, people should be required to self-quarantine if there was possible exposure to someone who tested positive for COVID-19 or if they are experiencing any symptoms. In the future when testing and supplies becomes more accessible, there are more generalized recommendations, which are to conduct widespread testing of the entire population (San José State University) until all positive cases are less than 10% or to conduct testing every 3-4 days.

Contact Tracing Best Practices

The exact number of tracers needed for COVID-19 is yet to be determined. Estimates range from 34 to 81 contact tracers per 100,000 people. Contract tracing is most effective when tracers receive training on transmission routes, programs focus on gaining people's trust, encourage physical isolation and quarantine, and keep in touch with cases and contacts.

Appendices

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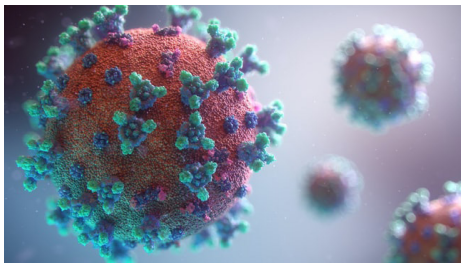
Transmission Routes, Current State of Knowledge



- Currently there is no way to predict the percentages of infections that come from one route or the other*
- Evidence shows a new mutation of the virus is 3-9 times more infectious, but it doesn't make patients sicker
- The scientific community strongly believes that airborne infection far-beyond six feet is possible and likely*

Transmissivity

- Primary transmission is person-to-person*
- Transmission from aerosolized particles, surfaces, and animals also pose a risk
- Surface transmission and airborne transmission appear to be less common than person-to-person transmission*

Person-to Person

- Activities such as breathing, talking, sneezing, coughing create respiratory droplets and aerosols that can be inhaled into the lungs
- Large droplets can travel up to 6 feet in distance*
- Smaller, airborne particles can travel tens of meters*
- Being near an infectious person for 10+ minutes increases risk*

Environmental

- Aerosols can stay in the environment for up to 30 hours*
- Being indoors makes transmission ~18x more likely than open air*
- If someone is in the direction of airflow from a fan or air-conditioner, it can potentially increase risk*
- Particles that land on hard surfaces can survive up to 9 days*

*Predominant scientific belief at this time

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Non-Pharmaceutical Interventions (NPI) in Educational Settings

A list of interventions found through a systematic review of methods to reduce risk that can be applied to COVID-19. Interventions are not listed in a particular order.

Personal Interventions

- Respiratory protection; wearing masks/respirators, proper (re)use, removal, and cleaning
- Regular hand hygiene (hand washing and use of hand sanitizer)
- Proper respiratory etiquette (covering coughs & sneezes with elbows, etc.)
- Physical distancing
- "Podding" reduced inter-group mingling

Environmental Interventions

- Modified classroom layouts
- Hallway restrictions (pre-defined walking areas or directions)
- Disinfecting surfaces
- Physical barriers
- Improved indoor air (increased air external exchanges, filtration, germicidal lights, etc.)
- Closing communal spaces
- Signage; for signage to be effective it needs to be:
- Noticed
- Understood
- Desirable
- As easy to achieve as possible
- Restricted entrance to campus buildings
- Supplies to support good hygiene & environmental restrictions

Organizational Interventions

- Promoting physical distancing through policy changes
- Altering/staggering work/school schedules
- Relaxing attendance policies
- Policies to encourage sick individuals to stay at home without fear of reprisal
- Encourage "podding" reducing inter-group mingling
- Screening of students, staff, and faculty
- Temperature screening
- Symptom screening
- Quickly changing policies and interventions based on new data
- Knowledge of effectiveness of interventions
- Predictive or reactive information about cases
- Restricting mingling with people outside of your class (used in K-12 setting)

Communication Intervention

- Education (specifically the threat, individual susceptibility, symptoms, etc.)
- Training (hand hygiene, proper PPE usage/removal/cleaning, etc.)
- Outreach (communicate clear policies, prosocial messages, self-reporting, health monitoring, notification of exposure/closure, etc.)

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Masks Best Practices

Purpose of masks

- Masks can act as a source control by preventing infected wearers from transmitting the virus to others or as a prevention tool by offering protection to healthy wearers against infection.
- Mask wearing in general has been associated with a false sense of security, which may lead wearers to disregard other safety precautions and not modify their behaviors

Types of masks

- Medical/Surgical Masks: These are certified according to standards and should be reserved for healthcare workers.
- N95 Filtering Facepiece Respirator: These filter 0.075 micrometre solid particles and should be reserved for healthcare workers.
- Non-Medical Masks: These include disposable masks and homemade or store-bought cloth face coverings. Cloth face covering is recommended for the general population in public settings. These masks should be made out of different combinations of fabrics, layering sequences, and shapes.
- Face Shields: These are inferior to masks and should only be worn by individuals with limited compliance with masks due to mental health disorders, developmental disabilities, deaf and hard of hearing community, and children.

More on cloth face coverings

- Porous materials such as gauze, T-shirt materials, or bandanas are not recommended because wearers and others around them may have a false sense of security though even the least effective type of mask is better than no mask in emergency situations.
- A minimum of three layers is recommended for cloth coverings. The ideal material will have a hydrophilic material (e.g. cotton or cotton blends) as its innermost layer, a hydrophobic layer of synthetic non-woven material as its middle layer, and a hydrophobic layer (e.g. polypropylene, polyester, or their blends) as its outermost layer.

Wear

- Mask should fit closely to the shape, as internal/external air can penetrate through the edges of the mask if there are gap
- Masks should be put over the nose and mouth and secured under the chin.
- Wet or soiled masks should not be worn
- Masks should not be shared with others
- Handle masks only by the ear loops or ties
- Wash hands before putting on face masks and before and after

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- Some non-mask wearers reported mask are uncomfortable on their ears, if this is an issue, a cardboard cutout or other device can be used to take the pressure off of the ears and increase comfort ears
- Masks with vents or valves should not be used because they expel respiratory droplets and could potentially spread the virus

Care

- Reusable masks can be washed using a washing machine or by hand. Similarly, masks can be dried using a dryer machine or be air dried
- Non-medical masks should be washed frequently or after each use
- Wash masks in the highest permitted washing temperature, depending on the fabric used

Campus

- Masks should be worn on campus in classrooms, bathrooms, enclosed spaces, outdoor spaces, especially when physical distancing is difficult.
- The types of masks worn on campus may vary, but they should all be fitted closely to the face. Face coverings made out of thin materials and/or do not closely fit the face, such as bandanas, are strongly not recommended

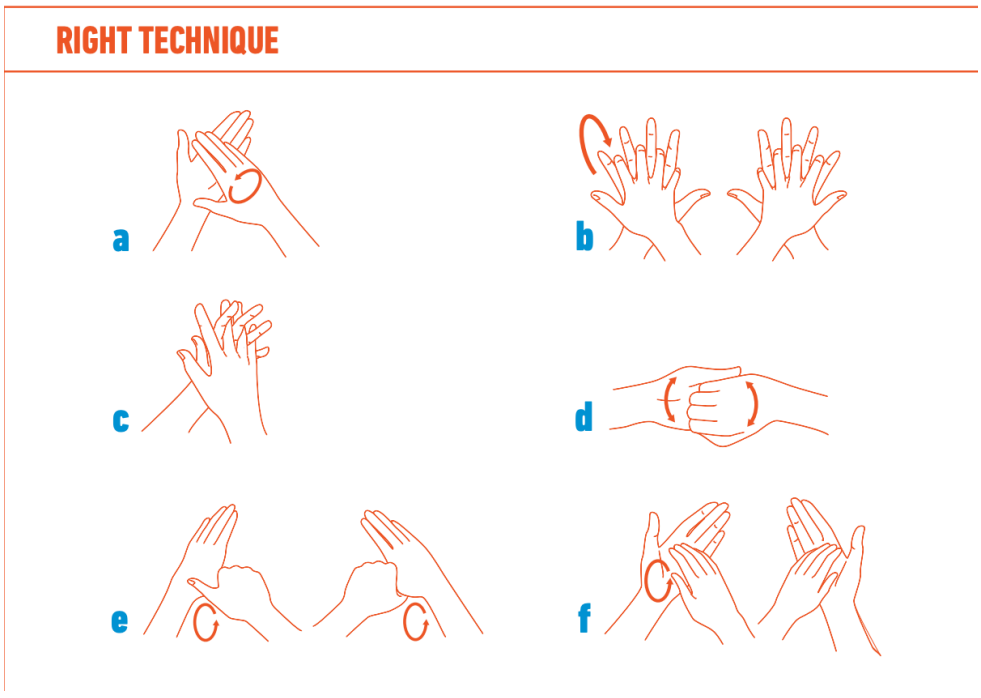
Other Considerations

- Although non-medical masks have proven to be quite effective when made and worn properly, they are inferior to N95 or medical masks, as non-medical masks do not adequately filter out smaller airborne particles. Hence it is important to practice physical distancing, hand hygiene, and other interventions while wearing non-medical masks.

Hand Hygiene Best Practices

Hand washing standards

- Sanitizing twice daily has been shown to reduce the risk of infection
- Frequent hand washing with soap for at least 20 seconds
- Wash your hands:
  - ◊ After coughing and sneezing
  - ◊ When caring for the sick
  - ◊ Before, during, and after you prepare food
  - ◊ Before eating
  - ◊ After toilet use
  - ◊ When hands are visibly dirty
  - ◊ After handling animals or animal waste
- Steps to consider for handwashing:
  - ◊ Any temperature of water (warm or cold) removes germs. Warmer water might cause more skin irritation and be more environmentally costly
  - ◊ Turning off the faucet is okay and won't transfer a large amount of germs between the hands and the faucet.
  - ◊ There is no added benefit of using antibacterial soap compared to plain soap.
  - ◊ Lathering and scrubbing your hands lifts germs and dirt from the skin. Germs are on all surfaces of the hand, especially under the nails.
  - ◊ Hand washing with soap and friction for 20 seconds has been shown to be more effective than hand sanitizer. Sing the "Happy Birthday" song twice as a rule of thumb.
  - ◊ No studies show turning a faucet off with a paper towel improves health and doing so may increase use of water and paper towels.
  - ◊ Dry hands with a clean towel or air drying.
- "Right time and right technique" (WHO, 2020)



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- Without a threat of a pandemic, most students who practiced good hand hygiene favoring soap and water over hand sanitizer in bathrooms.
- Hand hygiene frequency was higher in academic buildings/ student centers than in the student recreation center
- Using paper towels was most common for drying hands.
- Student said barriers to hand hygiene were:
  - ◊ Tools (i.e lack of soap, paper towels, hand sanitizer)
  - ◊ Hand irritation and dryness
  - ◊ Laziness
  - ◊ Forgetfulness
  - ◊ Lack of knowledge
  - ◊ Females may be better at hand hygiene than males

Hand Sanitizing Standards

- Hand sanitizer gels containing 60- 95% ethyl alcohol are more effective at both bacteria and viral killing activity. If the alcohol level is less than 60%, it may only reduce the growth of germs rather than kill them.
- Rub all surfaces of your hands for 20- 30 seconds
- People may not use a large enough amount or wipe it off before it has dried
- Hand sanitizer cannot remove or inactivate many types of harmful chemicals and certain germs, such as Cryptosporidium, norovirus, and Clostridium difficile

Hand Sanitizer Set-up

- Place stations:
  - ◊ Near environments or actions that would require hand sanitization. For example, stations would be ideal before entering dining halls or classrooms rather than building entrances.
  - ◊ With a change agent, such as a social assist (i.e. a cashier at a market reminding customers to use hand sanitizer) poster to encourage use.
- Don't place stations only:
  - ◊ Outside buildings.
  - ◊ Inside bathrooms.
- University students have said a barrier was not enough hand sanitizer in stations, so make sure stations are continually checked.
- Set the height of dispensers at a height that works for most people.
- Have the same placements in all buildings
- If the dispensers are touchless, make sure they react quickly
- Flashing lights on dispensers have shown to increase usage
- Most students notice when temporary hand sanitizing stations

Hand Hygiene: Education & Training

- After a training session, more students thought college students have bad hand washing habits, reevaluated their own hand washing habits, said they would increase their habits during an outbreak, and thought hand washing was important in preventing illness. The training session had the following elements:
- Entertainment feature: video
- Informative feature: powerpoint presentation
- Increasing awareness component: demonstration of how glitter traveled from shaking hands
- Assessment of information: quiz
- Incentives: Prizes of hand sanitizers, stickers, and hand washing timers
- Reinforcement: posters in the bathrooms, kitchen, tv rooms, and hallways
- Students being taught the way to wash hands recommended by the CDC significantly improved hand hygiene
- Students said they adhered to hand hygiene but less said their peers did the same
- A small number of students believed their hand hygiene had an effect on their peers and said the hand hygiene of their peers had an effect on their own
- During a gastrointestinal outbreak, more than half of students said the outbreak had an effect on their hand hygiene (i.e. increased practice) and more than a quarter said they were motivated to improve their adherence level

Hand Hygiene Reminders

- Posting an informational poster, strategically placing a hand sanitizer station inside the door entry, and having a person recommend hand hygiene can be the most effective to encourage hand hygiene
- Most students notice when public notices are posted in common areas
- A poster had a limited effect on improving hand washing in a bathroom with thermal camera observation. Posters might be more effective when paired with educational campaigns
- Student said barriers to hand hygiene were lack of soap, paper towels, or hand sanitizer (90.6%), hand irritation and dryness (28.1%), laziness (24%), forgetfulness (22.9%), and lack of knowledge (6.3%)

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Best Practices for Behavior Change

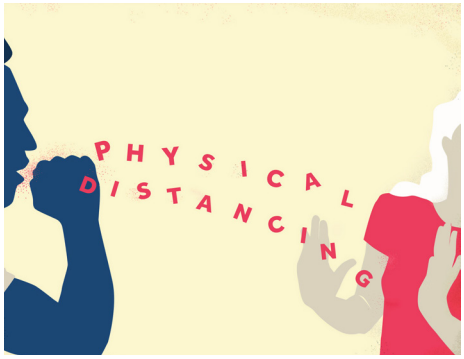
Increasing Mask Compliance

- Educate people of their own susceptibility, severity of the illness, and general facts about the illness. Past studies have shown that those with greater knowledge of these concepts had greater compliance with mask wearing.
- Educate people on the effectiveness of masks in preventing the illness. Studies have shown that the mask wearing group had higher perception of the effectiveness of the mask. Increasing self-efficacy has also been proven to increase behavior compliance.
- Communicate the social responsibility of mask wearing. Past studies have shown that mask wearing groups felt a greater responsibility to prevent illnesses than non-mask groups. Studies have also shown that people engage in behaviors that they believe are something larger than themselves.
- Send out regular reminders to wear masks. Studies have shown that over half of non-mask wearers did not think about wearing masks or forgot, and after CDC recommendations to wear masks has been distributed for at least 1 day, there was a large increase in reported mask wearing.
- Appeal to social aspects by normalizing mask wearing. Studies have shown that non-mask wearers reported reduced feelings of embarrassment after exposure to photographs of people wearing masks.
- Increase trust in leadership. Mask wearing compliance has been significantly larger for people with more trust in infectious disease experts. (See Education, Training, & Communication for more details on health communication)

Increasing Hand Hygiene Compliance

- Availability of Supplies. Ensure that students on campus will have access to masks if they forgot to wear one that day. Make sure that there is enough soap and hand sanitizer in dispensers so that students have the ability to practice proper hand hygiene. (Applicable to mask compliance)
- Convenience. Ensure there are enough hand sanitizer dispenser locations as hand washing can be considered an inconvenience if required to wash for a certain time frame (30 seconds) in addition to drying hands. However, hand sanitizer can be utilized while on the move.
- Visual Prompts. Research has shown that placing visual lights near hand sanitizer dispensers increases the usage on them. Similarly, placing signage near soap dispensers that have framing messages to encourage washing hands can remind students to wash their hands. Something else that can be considered is placing eyes on signage as research shows that people are more likely to perform or avoid a certain behavior depending on the message of the sign.
- Appeal to the emotions of people. Research has shown that students were not as worried about getting sick. Instead they were more worried about having ‘gross things’ on their hands. Utilizing educational methods to teach students about germs or bacteria that exist on the hands without proper hand hygiene can potentially change behavior.
- Physical Signal Prompts. Incorporating some sort of signal or display near sinks or soap dispensers to allow students to know how long they have been washing their hands can solve the convenience problems of not knowing how long they have been washing their hands.

Best Practices for Physical Distancing



- Protocols
  - ◊ Common spaces
    - * Wear face covering in elevators
    - * Use stairs with four floors or less
    - * Leave doors open
    - * Reduce seating to prevent gathering
    - * With fixed seating, skip rows and seats
  - ◊ Students in residence halls may not be required to physically distance
- Give safety kits to students with face masks, hand sanitizers, thermometers, and educational information about social distancing. Another item could be a contactless door opener and button presser.
- If students don't comply with social distancing protocols, other universities are considering:
  - ◊ limiting use of facilities
  - ◊ removal from housing
  - ◊ disenrollment in one or more courses
  - ◊ transition to remote-only instruction, banning from campus for two weeks, additional education and coaching.
- Consider social media campaigns leveraging student leaders or campus influencers.
- Universities are planning on asking students to sign a pledge or agreement to maintain physical distancing when they arrive on campus.
- On-Campus Housing
  - ◊ State what the allowed occupancy of rooms are and develop a method to monitor and enforce it.
  - ◊ Prioritize single occupancy rooms if possible unless it is family housing. If two beds need to be in one room, ensure proper physical distancing guidelines are in place between tables and beds. Also if two people are sharing a room, suggest students sleep in opposite directions (head to foot).

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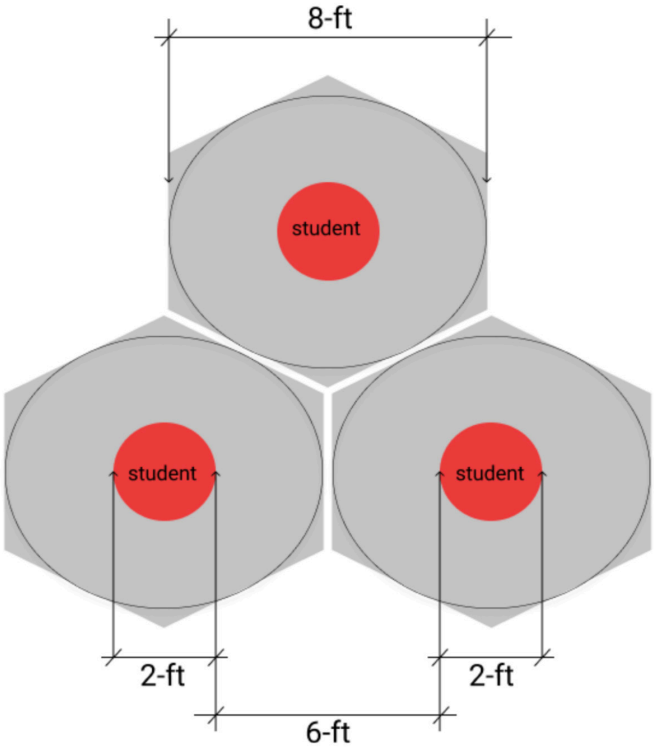
Best Practices for Room Layouts

CDC recommends:

- Seating and desks spaced at least 6 feet apart when feasible
- For lecture halls consider taping off seats and rows to ensure six-foot distance between seats
- Provide physical guides (eg. tape of floor) so that people understand the layouts of rooms to ensure physical distancing.
- Conduct smaller classrooms in larger rooms
- Adequate distance between individuals in experiential learning opportunities (eg. labs)
  - ◊ Minimum of 250 - 300 square feet per person in a lab setting

General Guidelines

- Ensure study spaces are available for individual study where students can maintain a 6-feet distance. These spaces will require a limited occupancy to 25% of the room capacity OR 100 people in the room, whichever comes first.
- Utilize a 8'-0" diameter hexagon/circle measuring from edge to edge to ensure physical distancing guidelines between individuals
- Use a 2'-0 diameter circle in the middle of the hexagon that represents students
- For fixed lecture halls
  - ◊ Have 3 empty seats between occupied seats
  - ◊ Skip every other row or more if necessary to maintain a 6-ft distance
- Make an 'instructor zone' that provides 6'-0" distance from the front of the classroom specifically for instructors.



Signage Best Practices

Signs need to be able to capture attention while being short and straightforward with the message. It should also be easy to understand, the outcome of the behavior needs to be desirable and easy to achieve.

What colors & shapes are recommended?

- Consistency is key, for example, OSHA standard colors that alerts people include red (danger), blue (notice), yellow (caution/warning), green (safety)
- Shape should be used to denote importance as well; circles (mandatory actions), triangles (warnings), circle with a red bar through it (prohibition)

What type of information to include

- Listing information at the top of the sign or changing the size of the text to a bigger font can signify importance. Signs should also include:
- Signal word (eg. danger, warning, caution, notice)
- Statement on the health hazard (eg. Bright light!)
- Consequences (eg. eye damage)
- Specific instructions or suggestions (eg. have eye protection)

Where should the sign be placed?

- Signs should be close to where people need to do the requested action.
  - Ex. Masks required on-campus signs should be in parking lot, not just in classrooms.
  - Ex. Hand hygiene signs right next to hand sanitizer stations
- The distance from the point of action should allow for reading & processing (see page 14)
- Text in a sign should be at least 40 inches above the floor

Visibility

- Signs should avoid finishes that have a glare as it affects legibility and visibility.
- Size should be legible from the distance necessary to read, understand, and modify behavior (see Table 703.5.5)
- Have stark contrasts, where dark text is on a light background or vice versa
- Avoid placing signs in locations with the same background as the sign (eg. sign with a white background on a white wall.)

How to incorporate pictograms into signs

- Pictograms that incorporate the human body (side view), with specific 'to-do' actions, are easier to understand for many people and more likely to get action
- Pictograms need to be at least 6 inches in height and placed above any text.

Text formatting to consider

- Text should have a combination of upper and lower case letters.
- Bold or underlining can help differentiate important information.
  - Ex. Keep a **6-feet distance** from those around you.
- Avoid italics, obliques, scripts or decorative fonts.

Additional considerations

- Adding an image of eyes increases good behavior
- Adding flashing lights near signs can increase following of the sign

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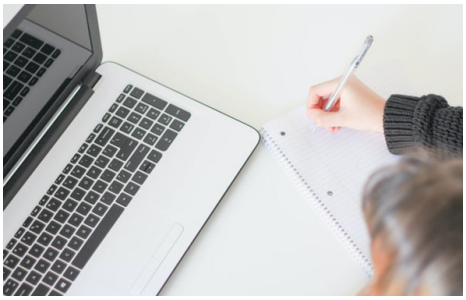
Education & Training Best Practices



What are the intended goals and objectives of the educational program?

- Goals include: Increasing knowledge, improving attitudes and beliefs, and encouraging behaviors

Who is the target audience?

- Important to consider characteristics of learners such as literacy, native language, cultures, and educational background, as these may affect the outcomes

Content

- It is crucial to educate the population of their own susceptibility to the virus, its public health threat, symptoms of the illness, and efficacy of the safety behaviors in order to increase compliance in non-pharmaceutical intervention behaviors.
- Inform staff at SJSU about the resources that are available if they are not able to attend work (e.g. government programs supporting sick leave and workers compensation for COVID-19; families first coronavirus response act) as this can relieve financial stress.

Delivery Method

- Online method is the safest method during COVID.
- Educational and training programs can be categorized by the level of engagement: low, medium, and high
  - ◊ Low engagement methods are lecture-based training. It is recommended to demonstrate and provide alternative behaviors to replace the prohibited behaviors. For example, rather than simply prohibiting hand shaking, provide an alternative such as a bow or a nod of the head. This will increase the learner's sense of self-efficacy. Lecture-based training on its own is not sufficient and has been shown to be the most limiting in growth of knowledge.
  - ◊ Medium engagement methods allow learners to demonstrate their knowledge via a feedback mechanism such as quizzes and tests. Implementation of feedback is recommended because learners can correct their own mistakes.
  - ◊ High engagement methods involve modification of behavior. It has been shown that an intervention program that directly addresses barriers to performing target behavior will increase behavioral compliance.

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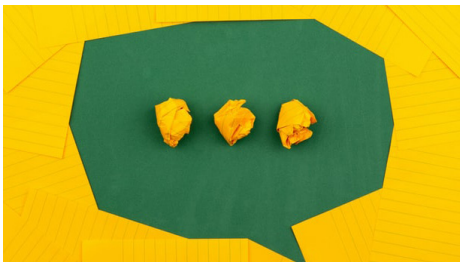
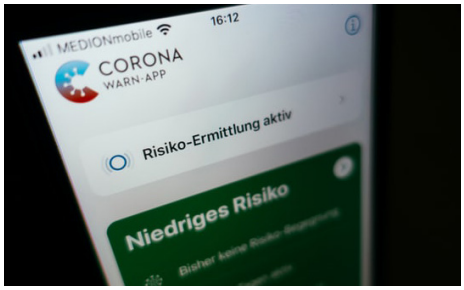
Communication Best Practices





Considerations for Communication

- In health communication, it is important to clearly communicate what is known and what is unknown by acknowledging the temporality of facts. With that said, it is important to be clear as possible to avoid ambiguity and confusion. It is also important to demonstrate ability to make decisions in a situation by uncertainty with confidence and honesty. Lastly, it is important to acknowledge emotions. Uncertainty in illness has been shown to be associated with anxiety, depression, and distress, which can result in panic and passivity.
- Use of prosocial messages for communication is recommended over threatening messages.
  - ◊ Example of a prosocial message: *"Help save our most vulnerable. Together, we can stop the coronavirus. Everyone's actions count, every single person can help to slow the crisis. We have the tools to solve this problem. Together, by self-isolating we can save millions of lives."*
  - ◊ Example of a threatening message: *"The coronavirus is coming for you. When it does, your healthcare system will be overwhelmed. Your fellow citizens will be turned away at the hospital doors. Exhausted healthcare workers will break down. Millions will die. The only way to prevent this crisis is social distancing today."*
  - ◊ Both prosocial and threatening messages increased willingness to self-isolate; however, threat intervention evoked unpleasant and highly arousing emotional response while prosocial was fairly pleasant and moderately arousing.
- Maintain communication systems that give students, faculty, and staff the opportunity to report if they have symptoms of if they were exposed to someone that was positive for COVID-19. Also, it is important to have an open line of communication system that allows people to receive notifications about closures or areas they should avoid until disinfection has occurred.
- Ensure that there is a designated point of contact (eg. one person or a team of people) that is responsible for addressing any COVID-19 related concerns. All staff, faculty, and students should know who this group is and how to contact them should they need to.

Surface Cleaning Best Practices

1. Clean surfaces with soap and water first to reduce germs and dirt. Besides soap and water, the EPA Safer choice program has a list of certified all-purpose, asthma-safer cleaning agent products available.
2. Follow up with an EPA approved disinfectant (LIST N). If EPA disinfectant is not available, you can utilize bleach/alcohol solutions. Refer to Chemical Disinfectants below.
   . Outdoor areas do not need to be followed up with a disinfectant.

Cleaning Frequency

- Develop a schedule for increased routine cleaning and disinfection to avoid under cleaning an area and to avoid over use of cleaning products.
- Public spaces utilized by many different people (eg. computer labs) should be cleaned and disinfected before each use.
- If an area has been unoccupied for 7+ days or more, it requires normal routine cleaning.
- Non high touch areas need to be gleaned but do not require disinfection.
- Discourage sharing any items that would be difficult to clean or disinfect

Cleaning Electronics

- Consider a wipeable cover on computer screens
- Follow manufacturer's recommendations for cleaning first. If no instructions are available, use an alcohol based spray of 70% alcohol and dry the surface thoroughly.

Cleaning an Area if a Person was Sick with COVID

- Close off the area if it was used by the person that was sick, if this is not possible you want to close off the affected areas.
- Open doors and windows for natural ventilation.
- Wait 24 hours to clean and disinfect, if this is not possible, wait as long as possible.
- If more then 7 days have passed since the infected person has used the facility, just routine cleaning and disinfecting.
- Area can be reopened once it has been cleaned and disinfected.

Cleaning Considerations for Athletes

- Thorough cleaning and disinfection should take place in high traffic areas such as locker rooms, dugouts, benches, stairwell handrails, chairs, doors/door handles, etc.
- Avoid any shared objects or equipment such as balls, bats. Balls should be rotated If not possible, and cleaning in between usage is recommended. If there is not enough supplies, try to limit equipment to groups of players or teams.
- Avoid having shared towels, clothing or items that will touch faces or hands.

High Touch Areas

- Some high touch areas include: Tables, doorknobs, light switches, countertops, handles, desks, phones, keyboards, toilets, faucets and sinks, gas pump handles, touch screens, and ATM machines.

Chemical Disinfectants

- Note. Please read instructions as different disinfectants vary for surface type (porous/hard non-porous) as well as precautionary statements. Instructions for using disinfectants can be found at California Department of Pesticide Regulation. Also consider contact time for the disinfectant to be effective.
- List N: EPA approved disinfectants by surface types:
  - ◊ Hard/non-porous (eg. High touch areas)
  - ◊ Porous (eg. carpet, linen, cloth seating areas)
  - ◊ Food Contact No rinse
  - ◊ Food contact Rinse required
- If EPA approved disinfectants is not available, please utilize:
  - ◊ Bleach: ⅓ cup of bleach + 1 gallon of water (do not mix bleach with other solutions)
    - * Bleach should have sodium hypochlorite concentration of 5-6% and should not be expired
    - * Solutions should stay on surface for at least 1 minute
    - * The World Health Organization (2014) recommends leaving the solution on for 10 mins or more.
    - * Products that have the ingredients (peroxyacetic (paeractic) acid, sodium hypochlorite (bleach) or quaternary ammonium compounds can cause asthma.
  - ◊ 70% alcohol solutions

UV Disinfectants to Consider

- Far UVC lights are shown to inactivate viruses, without harming human skin, however there is not enough research done to show the long term and short term effects of continuous exposure to far UVC lights.
- There is also ultraviolet germicidal irradiation in the form of portable room decontamination systems but is commonly used in healthcare settings to kill bacteria and also inactivate viruses. This type of UV light can only be used in unoccupied areas as it is not safe for human exposure.

Indoor Air Quality Best Practices

Natural Ventilation

- When possible utilize natural ventilation through opening windows and doors as much as possible. This type of ventilation is useful in buildings that have open floor plans and those with no mechanical ventilation as natural airflow can help better control the spread of particles that exist in the air.

Mechanical Ventilation

- Demand controlled ventilation should be turned off as mechanical ventilation systems should be running 24/7 or for as long as possible especially when a building is occupied.
- Open outdoor air dampers to at least 100% to eliminate air recirculation within the building if possible.
- Vent toilet rooms separately as flushing could potentially create airborne particles
- Consider the filter upgrades if possible and Ultraviolet Germicidal Irradiation (UVGI) as mentioned below.

Filters

- Filter efficiency is about how well particles are removed from the air after passing through a filter. This is measured in MERV ratings.
  - ◊ MERV ratings range from MERV 1-16. Higher the MERV rating, the more efficient the filter.
  - ◊ MERV 13 can capture airborne particles.
- Make sure that the HVAC system can handle filter upgrades because increased filter efficiency can increase the pressure, thus reducing airflow which becomes more harmful in the long run.
- If natural ventilation is not possible due to outdoor particles, consider utilizing portable air cleaners with HEPA filters.

Ultraviolet Germicidal Irradiation (UVGI) in HVAC systems

- UVGI is a form of disinfection by installing UV lights within HVAC systems in order to disinfect the air passing through the air ducts. These types of lights emit UV radiation at an average 254 nm which is considered germicidal and can be harmful to humans that are physically exposed to the lights.

Humidity

- Low temperatures and low humidity allow viruses to survive for longer periods of time on surfaces and in the air.
- High temperatures (>86 °F) and high humidity is able to inactive (kill) viruses more rapidly.
- Temperature ranges from 68-75°F allows the virus to survive in the air and on surfaces for a longer period of time, however you want to keep the humidity at a higher level to prevent dry air.
- Based on research, the recommended general humidity level ranges from 45-60%. The higher the relative humidity level, the faster the virus loses its ability to infect.

Important Note: Methods of installing higher MERV rated filters or UVGI lights into HVAC systems, and adjusting the humidity levels are only **additional considerations** to combat SARS CoV-2. Proper physical distancing, hand hygiene, mask wearing, and disinfection is still required and more important to implement when looking at opening up buildings (e.g. schools, businesses) again.

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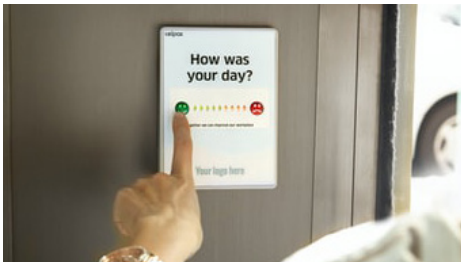
Best Practices for Screening & Symptoms

Temperature measurement combined with questionnaires far outperform either method by itself. Questionnaires have been updated as more has been learned about COVID-19. Currently the questions include symptoms (chills or fever with a recent temperature of 100.4 degrees Fahrenheit or higher, sore throat, cough, diarrhea, nausea or vomiting, abdominal pain, severe headache, shortness of breath or difficulty breathing, fatigue, muscle or body aches, congestion or runny nose, new loss of taste or smell), recent travel history, and exposure to someone who has been confirmed to have COVID-19.



Questionnaires

- A chatbot can be used to help with the high volume of screening. Users respond better to screening hotlines (human or chatbot) when they understand the human or chatbot's ability. When ability is the same, users view chatbots no different than human agents. Perception of ability is mainly the user's trust in the hotline provider, with a slight negative bias against chatbots' ability.
- If questionnaires will happen at home, determine how results will be reported and verified
  - ◊ It is recommended to report answers on two topics: Symptoms and Close contact/potential exposure (i.e. close contact with a person, traveled or lived in an area with a large number of cases).

Temperature measurement

- Have sufficient quantities of equipment (i.e. thermometers, PPE)
- Properly clean the screening area and equipment
- Maintain a safe distance
- Set protections for staff and students who are more susceptible to COVID-19
- Set a process of how the results of the screening will be verified (i.e. incorrectly taken temperatures can lead to a false interpretation that the person has a fever)
- Make sure enough staff are trained in screening procedures and putting on and taking off PPE
- Thermal cameras are in development for mass screening

Symptom observation

- Ask staff and faculty to visually and safely monitor students for overt symptoms
- The CDC does not recommend universal symptom screening at school
- Strategize for scenarios such as false identification of symptoms

After screening

- After screening and consulting with CDC guidelines and directives, clinicians or doctors can make a decision on whether or not testing is warranted.
- A COVID-19 viral test is needed to confirm if someone has a current infection

Other considerations

- Reduce stigma for students who are identified as having symptoms of COVID-19
- Consider the emotional impact of daily screenings and find ways to reduce fear of new mitigation protocols.
- Allow ill students to make up for any missed classwork without penalty and reduce mental or physical anxieties
- Reinforce students, staff, and faculty to stay home when sick and at least 24 hours after they no longer have a fever

Testing Frequency Best Practices

Current Testing Frequency

- Testing for Symptomatic Individuals
- If individuals have had possible exposure to COVID-19 while showing symptoms, they should quarantine first and then set up an appointment with a health professional because the testing frequency is dependent on clinician/doctor recommendations.
- 3 days after symptoms occur is the best time for testing to minimize false negative tests.
- Testing for Asymptomatic Individuals
- If individuals have had possible exposure to COVID-19, quarantine is necessary. Testing is recommended if an individual was in close contact for 15 minutes or more with someone that had COVID-19.

Testing for Returning to Work/School

- Individuals that tested positive for COVID-19 who had symptoms should
  - ◊ Wait until 10 days have passed since symptoms originally started AND
  - ◊ At least 24 hours have passed since fever has gone away without any fever reducing medication AND
  - ◊ Other symptoms have improved
- Individuals that tested positive for COVID-19 but don't show symptoms can return after 10 days have passed after they take a positive RT-PCR test.

Possible Testing for the Future

- If there was easy access to testing locations with more access to supplies and materials for testing (eg. testing kits), below are some different recommendations to do so.
- Widespread Testing: You want to do as much testing where the percentage of people that test positive within the San José State University population comes back to be 10%, which is a measure that was recommended by the world health organization.
- The second option is to test every 3-4 days because on average people start showing symptoms on the 5th day. Testing before symptoms occur can lower the chances of it being spread since it will have been 1-2 days since being infected.
- Systematic testing of staff and students for current COVID-19

Contact Tracing Best Practices

What is the cost?

- Overall cost would range depending on the amount of workers that are hired to be trained. According to the National Coalition of STD directors, cost of contact tracer workers would be around $720 million for 30,000 workers ($2,400/worker). John Hopkins University and the Association of State and Territorial Health Officials both say the cost would be $3.6 billion for 100,000 workers ($3,600/worker).

How many tracers do we need?

- Number of contact tracers varies per resident depending on location, survey data, and health care system capacity. The main goal and reason for contact tracing is avoid hospitals from reaching their patient capacities. If half of the symptomatic cases can be identified and 40% of contacts traced, reopening the economy will be manageable for the healthcare system. Some numbers are listed below for reference:
  - Wuhan: 81 contact tracers per 100,000 people
  - 44 states and District of Columbia: 17 contact tracers per 100,000 people
  - California (stated): 50 contact tracers per 100,000 people

How can you do it well?

- Training
  - Learn and understand transmission routes
  - Gain peoples' trust and support as people will need to share information about where they have been recently and who they have been interacting with.
  - Know the principles behind case isolation and quarantine
  - Keep in touch with both cases and contacts
- Collaborate with global medical organizations, public health universities, students of public health schools, temp agencies and job placement programs

Literature Review Reference Counts

Source Metrics

A total of 942 articles were identified by three graduate students and reviewed for relevance in the 14 topics previously mentioned. 254 articles were read and summarized in the appendices below. Out of 474 sources, the year of publication ranges from 1972 to 2020 with a majority of sources from 2020. Out of 529 sources, 407 were peer-reviewed journal articles. The year of publication and source type were automatically populated through the reference management software, Zotero, so some sources were excluded from the total count.

Below are three tables that show the type of articles, count of source by publication year, and total number of articles identified and ultimately reviewed. These articles were coded using NVivo. Full set of references is available upon request.

Count and percentage of source type for sources that were categorized automatically

Source Type	Count	Percentage
Blog Post	7	1%
Book	8	2%
Book Section	3	1%
Conference Paper	1	0%
Document	3	1%
Journal Article	407	77%
Magazine Article	7	1%
Newspaper	3	1%
Report	9	2%
Webpage	81	15%
Grand Total	**529**	**100%**

Count of source publication year

Year Range	Count
1972-1999	11
2000-2009	70
2010	29
2011	22
2012	21
2013	25
2014	28
2015	21
2016	17
2017	28
2018	25
2019	21
2020	156
Grand Total	**474**

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Total number of articles identified and reviewed by topic

Topic	# of Articles Identified	# of Articles Reviewed
Transmission Routes	53	35
NPI	502	27
Masks	9	9
Hand Hygiene	67	13
Behavior Change	37	24
Physical Distancing	15	6
Room Layouts	6	5
Signage	94	25
Education, Training, & Communication	20	18
Cleaning	10	10
Indoor Air Quality	96	54
Screening & Symptoms	6	5
Testing Frequency	18	14
Contact Tracing	9	9
Total	**942**	**254**

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