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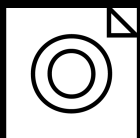
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Device Reprocessing During COVID-19 Pandemic

Know & Reduce Risks



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Device Reprocessing During COVID-19 Pandemic

Know & Reduce Risks

1. Who is most at risk for having severe COVID-19 and why
2. What situations increase staff risk of contamination with the virus in SPD
3. How long does the virus last on different surfaces
4. What can you do to reduce coronavirus spread at work, at home, at the grocery store



Coronavirus-19 is also referred to as SARS-CoV-2

SARS: Severe Acute Respiratory Syndrome

Last 20 years: 3 coronaviruses leapt from animals and caused SARS in humans

- 1st SARS-1: 2002 from civet cats
- 2nd SARS-MERS (Middle East Respiratory Syndrome) 2012 from camels
- 3rd SARS-CoV-2 from bats or pangolins



Pseudomonas

Pseudomonas up to 5000 nanometer length

Standard Microscope:
bacteria, mold, spores

Staphylococcus: 1000 nanometer diameter

Staphylococcus

Electron
Microscope: viruses

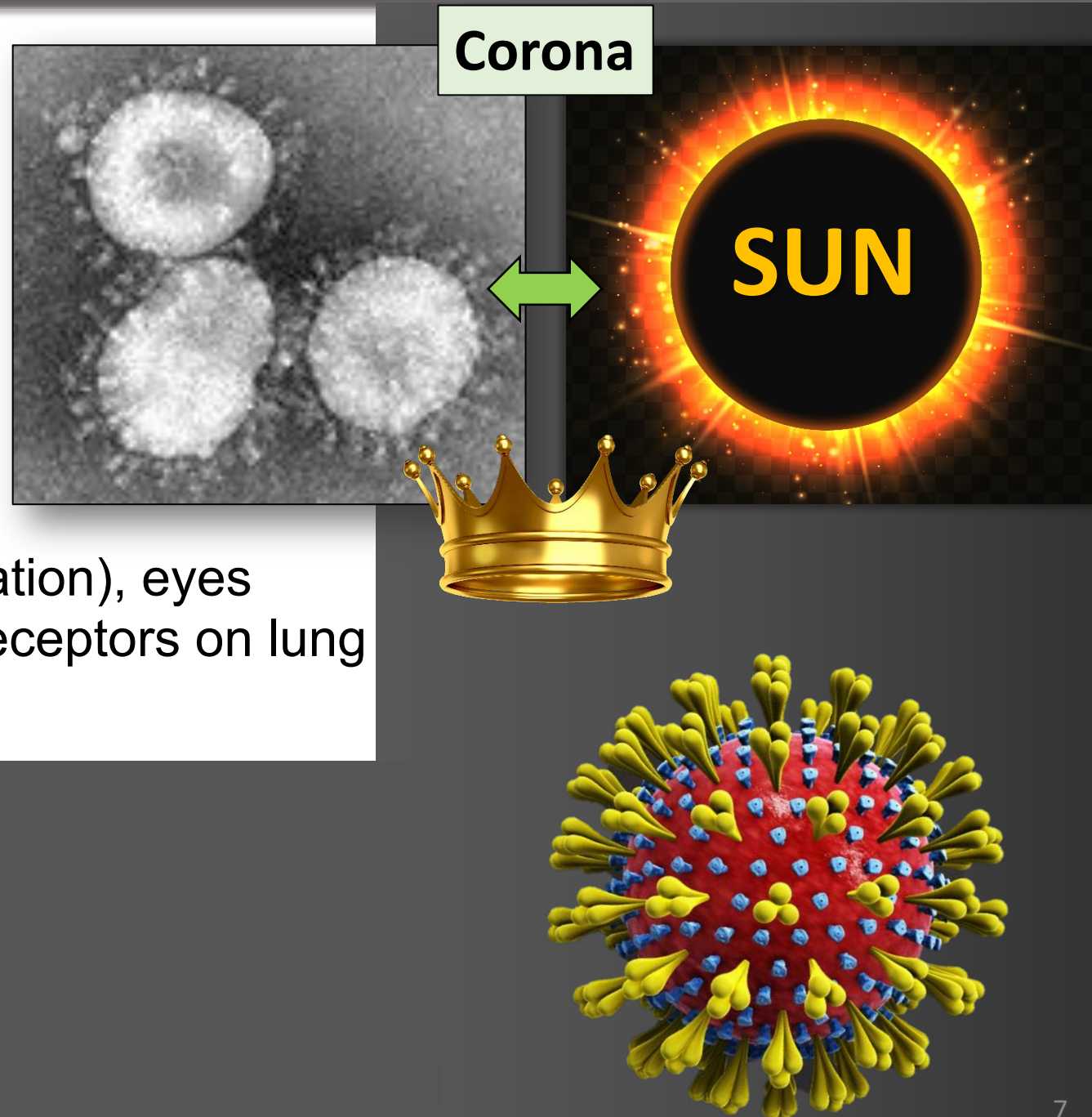
Coronavirus-2: 125 nanometer diameter

Coronavirus



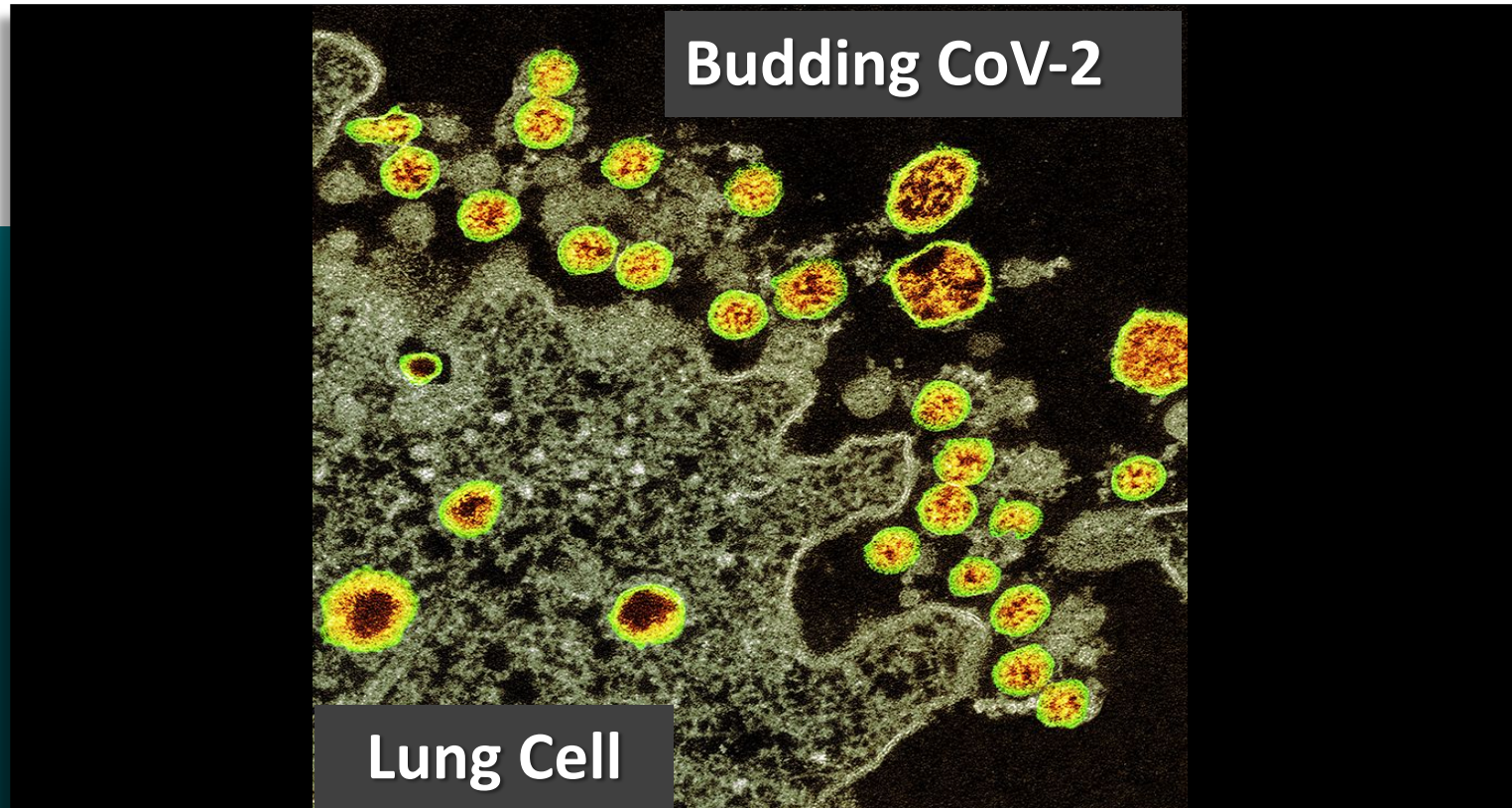
Know Your Enemy

- How Coronavirus got its name
- How CoV-2 enters lung cells
 1. Enters through nose, mouth (inhalation), eyes
 2. Its protein spikes attach to ACE2 receptors on lung cells like a key fits into a lock



Lung Cell Forced to Assemble the New Viruses

- Viral envelope components are deposited in cell body and its membrane
- Assembled viruses “Bud” through Lung Cell’s membrane becoming wrapped with viral proteins held with in a lipid envelope waiting for them
- Each infected lung cell can produce millions of virus replicates before the cell dies



How is CoV-2 Virus Spread

- Transmitted primarily by droplets that fall rapidly
- Strong uncovered sneeze or cough from infected person can propel CoV-2 approximately 6 feet
- Sneeze/cough intensity, face angle, air humidity, size of droplets containing virus all impact distance & time to drop
- If conditions support it droplet can dry to thin film covering virus
- Extremely small, light weight droplet can float on air currents longer distances (Controversial: Max 10ft/perhaps more) until it falls, or is inhaled. Note: Majority by far are the larger droplets
- Appears more communicable via the larger droplet inhalation, But CoV-2 can also be picked up after droplets fall on surfaces or by touch transfer from contaminated hands, objects, etc.



Sneeze



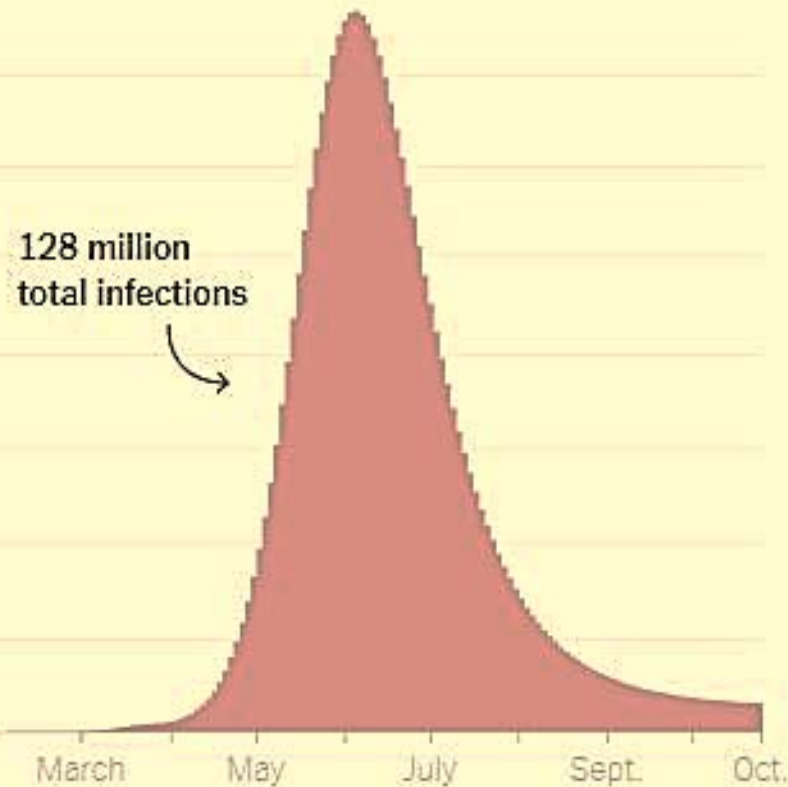
Cough

By **Nicholas Kristof** and **Stuart A. Thompson**

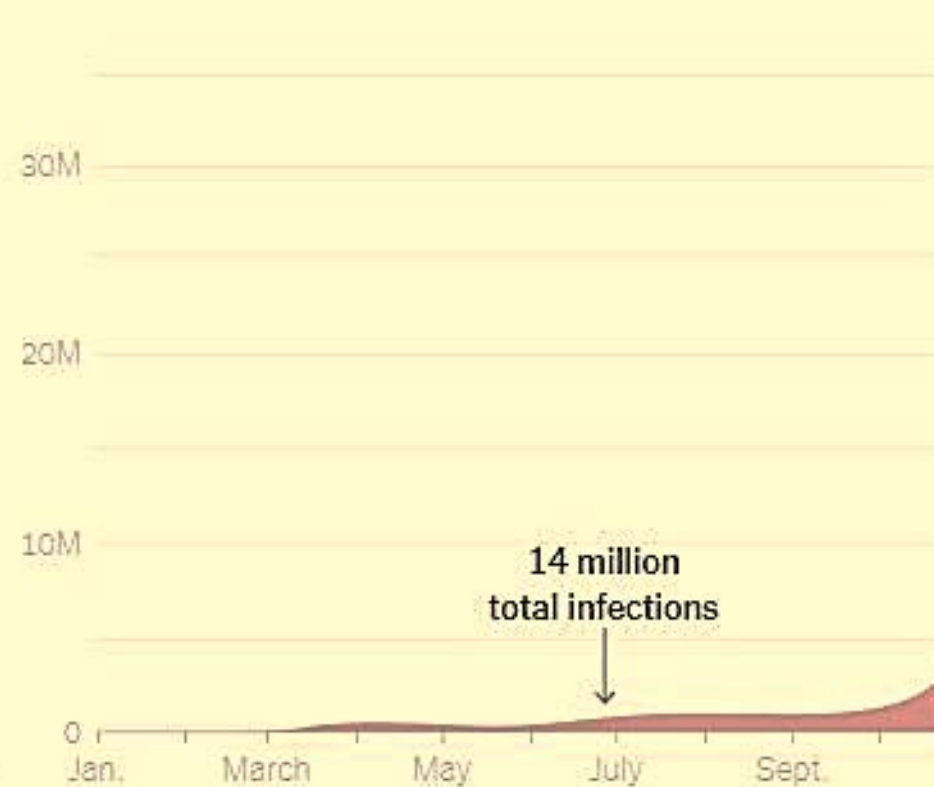
Model created with Gabriel Goh, Steven De Keninck, Ashleigh Tuite and David N. Fisman

MARCH 25, 2020

Social distancing for 14 days



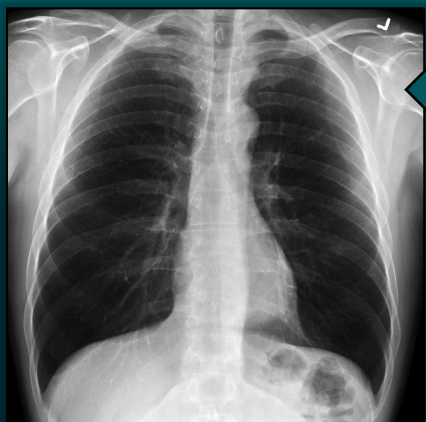
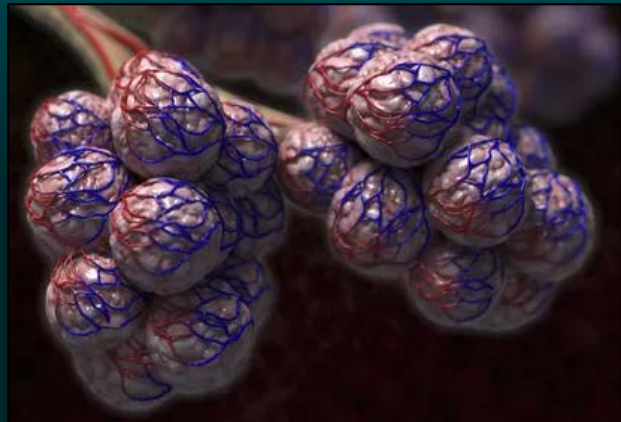
Social distancing for 2 months



Note: "Social distancing" also includes a reduction in large gatherings; some school closures and working from home; and efforts to support hospitals and diagnostic testing. Based on a simulation between January and late October using an epidemic model. See [full methodology](#) for details.

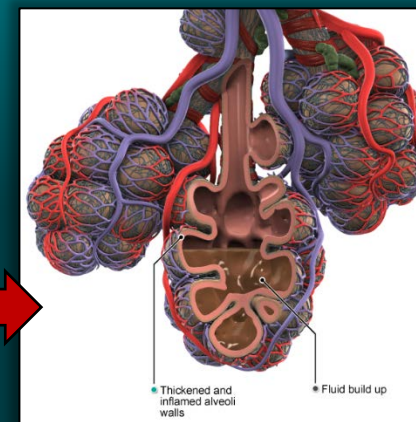
COVID-19 Progression To Severity

- Each lung has about **480 million alveoli**. Every time we inhale, they expand like balloons
- O_2 from inhaled air passes through thin alveolar membrane, enters capillary clinging alveolar surface
- CO_2 from the capillaries goes through the same alveolar membrane and is released into exhaled air
- When Cov-2 attaches to lung alveoli forcing them to make viral replicates, the alveolar membrane swells becoming thicker, reducing lung capacity and O_2 & CO_2 processing = shortness of breath/rapid breathing
- The immune cells try to kill the viral invaders causing severe inflammation from collateral damage to the lung itself resulting in influx of fluid and more immune cells into inflamed alveoli
- Now O_2 cannot pass through the membrane to the capillary & CO_2 is stuck in the bloodstream
- Patient can drown/suffocate lack of O_2 ; have secondary bacterial infection causing traditional pneumonia



Healthy Alveoli
& lung (X-ray)

CoV-2 infected
swollen alveolar
membrane
& lung (X-ray)



Long-Term Consequences Too Early To Totally Know But...

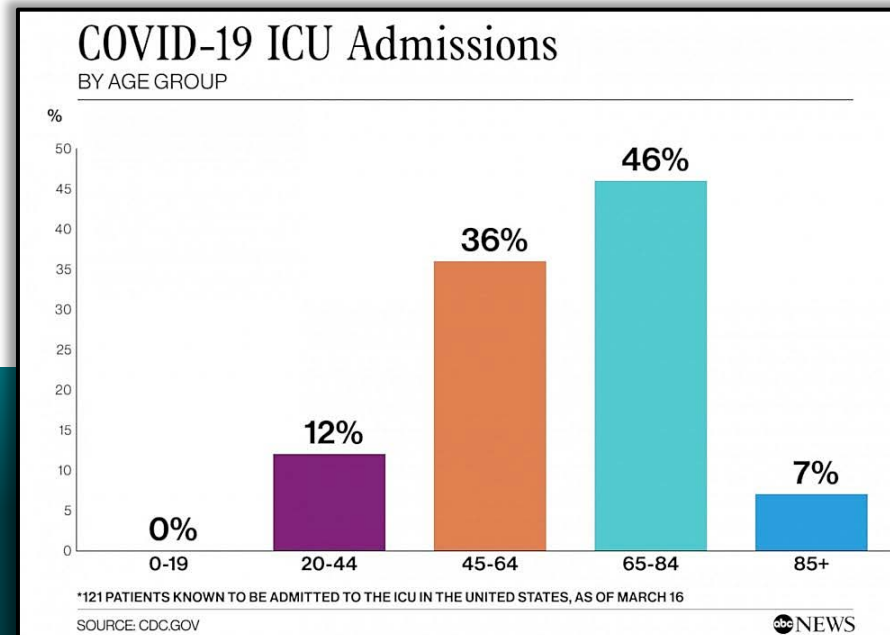
- Note: ~80% of infected have mild symptoms & minimal or no long-term effects
- About 16-20% symptomatic patients who eventually need ventilators likely to have long term consequences that can include:
 - lung fibrosis (scarring: permanently thickened alveoli, adhesions that limit lung expansion)
 - require long term supplemental oxygen
 - develop heart damage (up to 20% of those hospitalized)
 - blood clots (example: pulmonary embolism, stroke)
 - impaired liver function
 - kidney damage
 - neurological malfunction



Primary Variables Determine Who Will Have Most Severe Illness

- Variables determine severity

1. Number of viral particles that cause infection (Dose/inoculum)
2. Genetics (Some viruses have been linked to specific genetics)
3. Route virus enters body
4. Virulence of the virus (Always been virulent or mutations making so)
5. Infection History: Has your immune system fought this virus before?
6. Other illnesses patient may have
7. Age



Elderly: COVID-19 Severity & Death

■ Elderly: protective mechanisms slow down:

- Immune response less effective
- Tracheal cilia to keep things from lungs: slows by 50%
- Malnutrition: protein & calories to fuel fighting infection
- Frailty, weakness
- Organ transplants = anti-rejection drugs

(Mistry PK 2016)

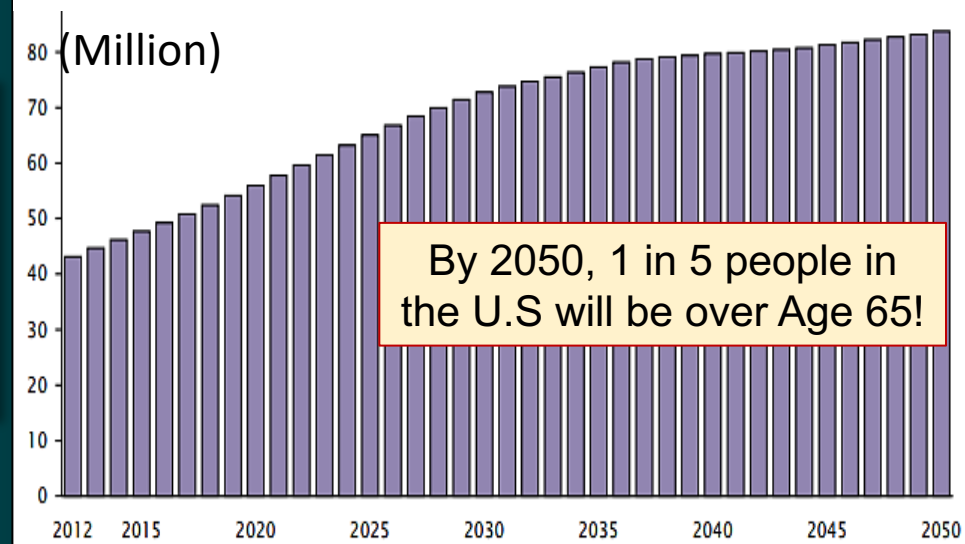
■ Severity increases with underlying diseases:

- Diabetes
- Heart disease
- High blood pressure
- Kidney disease and reduced function
- Chronic lung disease: asthma, smokers lung, COPD
- Cancer under treatment

Each increases risk for severe CoV-2 progress



Population Aged 65 and Over for the United States: 2012 to 2050



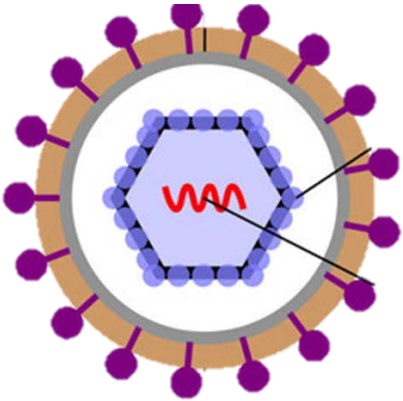


COVID-19 symptoms compared to common conditions

SYMPTOM	COVID-19	COMMON COLD	FLU	ALLERGIES
Fever	Common	Rare	Common	Sometimes
Dry cough	Common	Mild	Common	Sometimes
Shortness of breath	Common	No	No	Common

Some infected individuals have no symptoms and can be unknowing transmitters of the Cov-2 virus

Enveloped



Examples

- Coronavirus
- HIV
- Influenza viruses

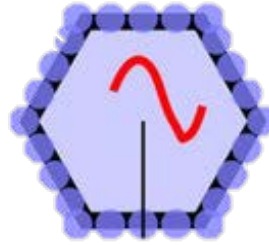
Benefits

- Readily mutates to adapt

Weaknesses

- Easily “killed”- made harmless
- Vulnerable to environment

Non-Enveloped



Examples

- Norovirus
- Poliovirus
- Rotavirus

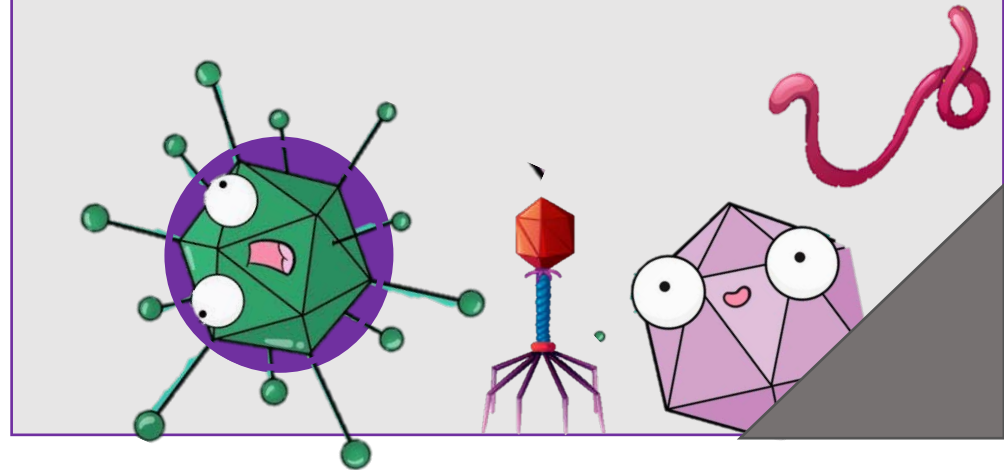
Benefits

- Very hard to “kill” (just below spore difficulty)
- Survives wide range of environmental conditions

Weaknesses

- Cannot easily mutate to adapt

Although there are many different shapes, there are basically two types of Viruses: Enveloped & Non-Enveloped



Hard
to Kill

Always Follow IFU to avoid damaging device, voiding warranty, preventing associated patient injury, liability

Surface Disinfectant Activity

Bacterial spores

Mycobacterium
(tuberculocidal)

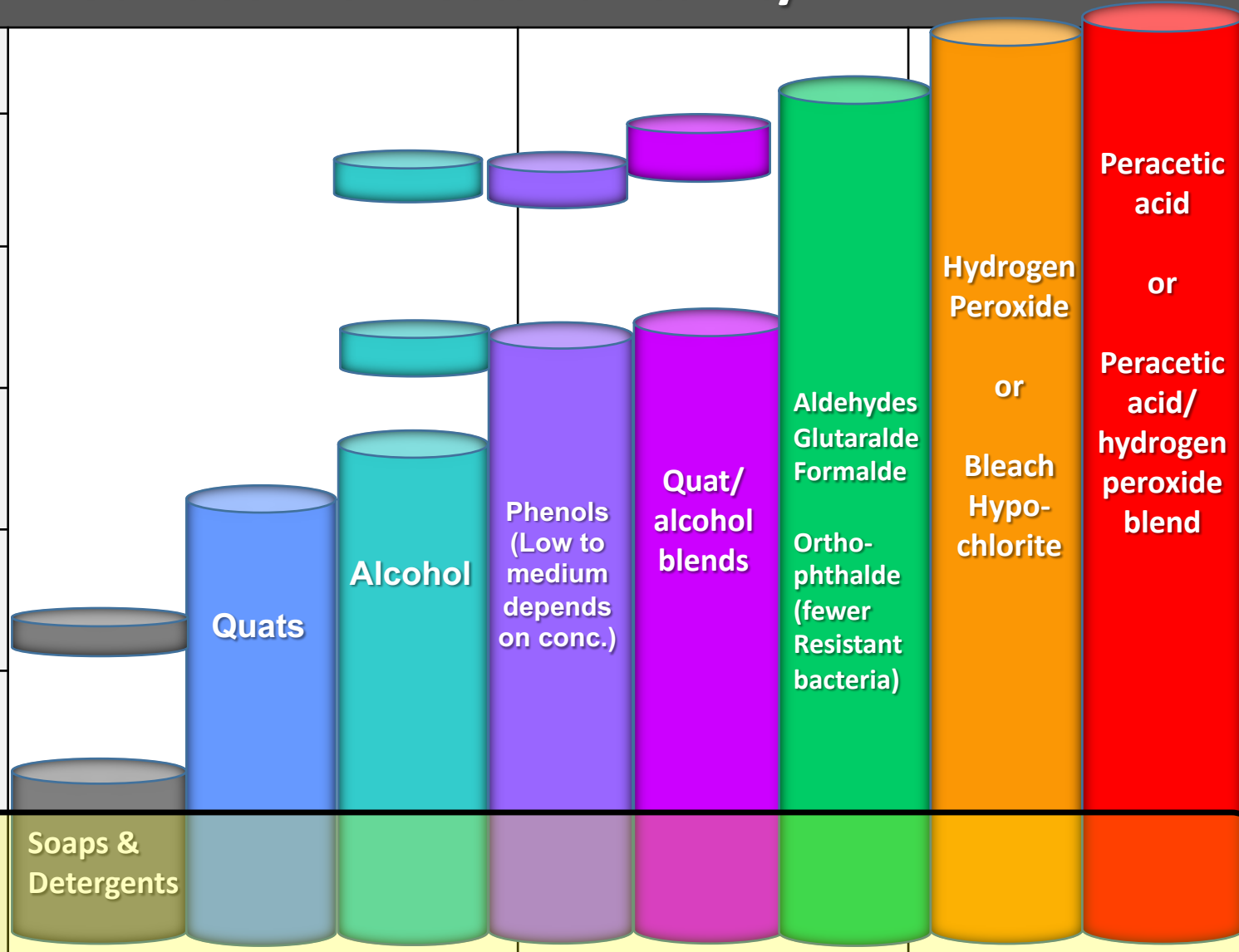
Viruses without
envelopes

Fungi & fungal
spores

Gram negative
bacteria

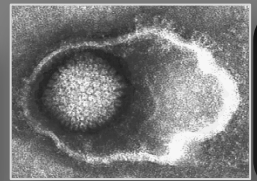
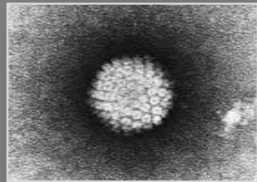
Gram positive
bacteria

Enveloped
viruses



Harder to Kill

Easy
to Kill



Soaps & Detergent Destroys Enveloped Viruses

1. Red Protein “keys” needed to fit the “lock” to enter the human lung cell

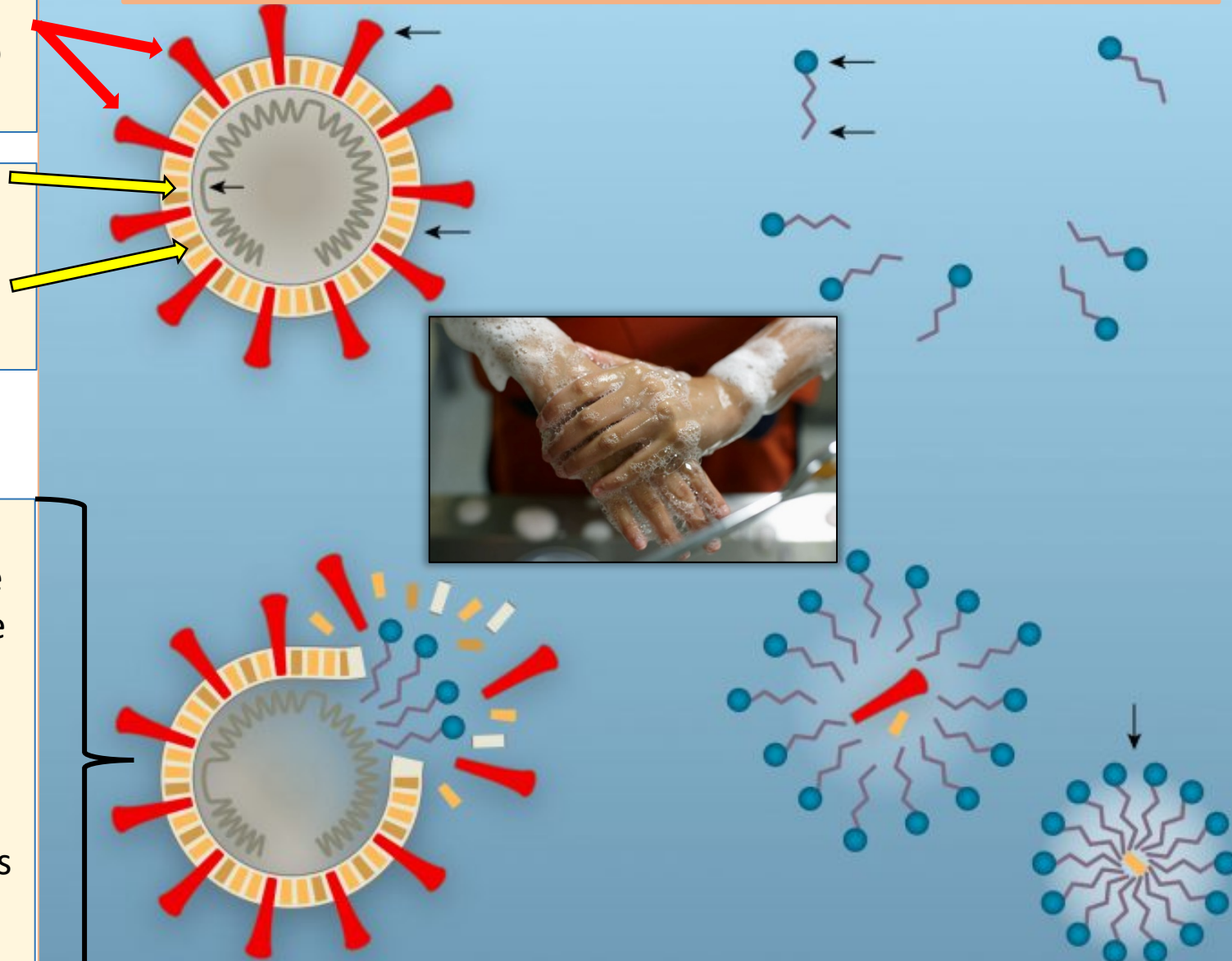
2. Lipids make up the Envelope in which the Protein “keys” are embedded

4. Hand soap molecules rupture the viral envelope and the protein “keys” are no longer held in place and the envelope that merges into the lung cell membrane is destroyed. The remainder of the virus can no longer enter any cells = rendered harmless

3. Soap or detergent molecules

5. Hand soap molecules gather around the proteins & lipids

6. Hand soap molecules bind themselves to the lipid molecules



By Victor -March 13, 2020

Material	Stays Infective	Testing on coronaviruses. Results vary with variation in humidity & temperature; type & relative smoothness of surface; porous & non-porous. Examples:
Metals generally	3-7dy	Door knobs, clipboards, clips, brush stock, cabinets, mop hardware, equipment, sinks, pots, buckets, handles, toilets, faucet assemblies, jewelry, silverware, buckles, carts, table legs, back splash, storage racks, hand rails, aluminum foil, instrument trays
Stainless Steel	3-7dy	Counters, table surfaces, some equipment, surgical instruments
Copper	≤4hr	Door knobs, hand rails, pennies, cookware
Aluminum	2-8hr	Food cans, Soda cans, tinfoil, water bottles

Destroying Ability of SARS Cov-2 to Attach To Cells and Replicate?

Agent	Comments
Most materials: Heat to 56°C; 133°F	15 min kills approx. 10,000 coronaviruses
Soap or detergent	for hands
Alcohol	Ethanol (best) or Isopropyl: 70-90%
Detergents	for cleaning devices, clothes, dishes (Same action as soap but leaves no film)
Bleach	1:10 (5 minute contact time) or 1:100 dilution (10 minute contact time) of 5% sodium hypochlorite (household bleach concentration) Note: Once diluted hypochlorite only good for 24hr. Place date/time on label. Note: Hot water decomposes hypochlorite; renders it ineffective
EPA Hospital listed disinfectants Use against Cov-2	Check EPA List for disinfectants cleared for use against coronavirus It also lists compatible surfaces

Always Follow IFU to avoid damaging device, voiding warranty, preventing associated patient injury, liability

As always, must be cleaned to remove organic soil before disinfectant is applied, or alternatively, commercial cleaner-disinfectant products may be used

Disinfectants for Destroying Coronavirus in Healthcare Settings

<https://www.epa.gov/coronavirus>

<https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2>

Search:

List N: Products with Emerging Viral Pathogens AND Human Coronavirus claims for use against SARS-CoV-2

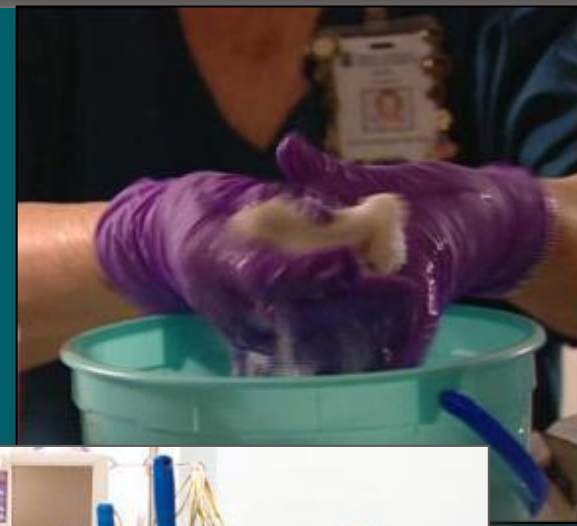
EPA Registration Number	Active Ingredients	Product Name	Company	Follow the disinfection directions and preparation for the following virus	Contact Time (in minutes)	Formulation Type	Surface Types for Use	Use Site	Emerging Viral Pathogen Claim?	Date Added to List N
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EPA Reg. No.: xxx-xx

Wipes/Rags Bind Active Biocide Molecules?

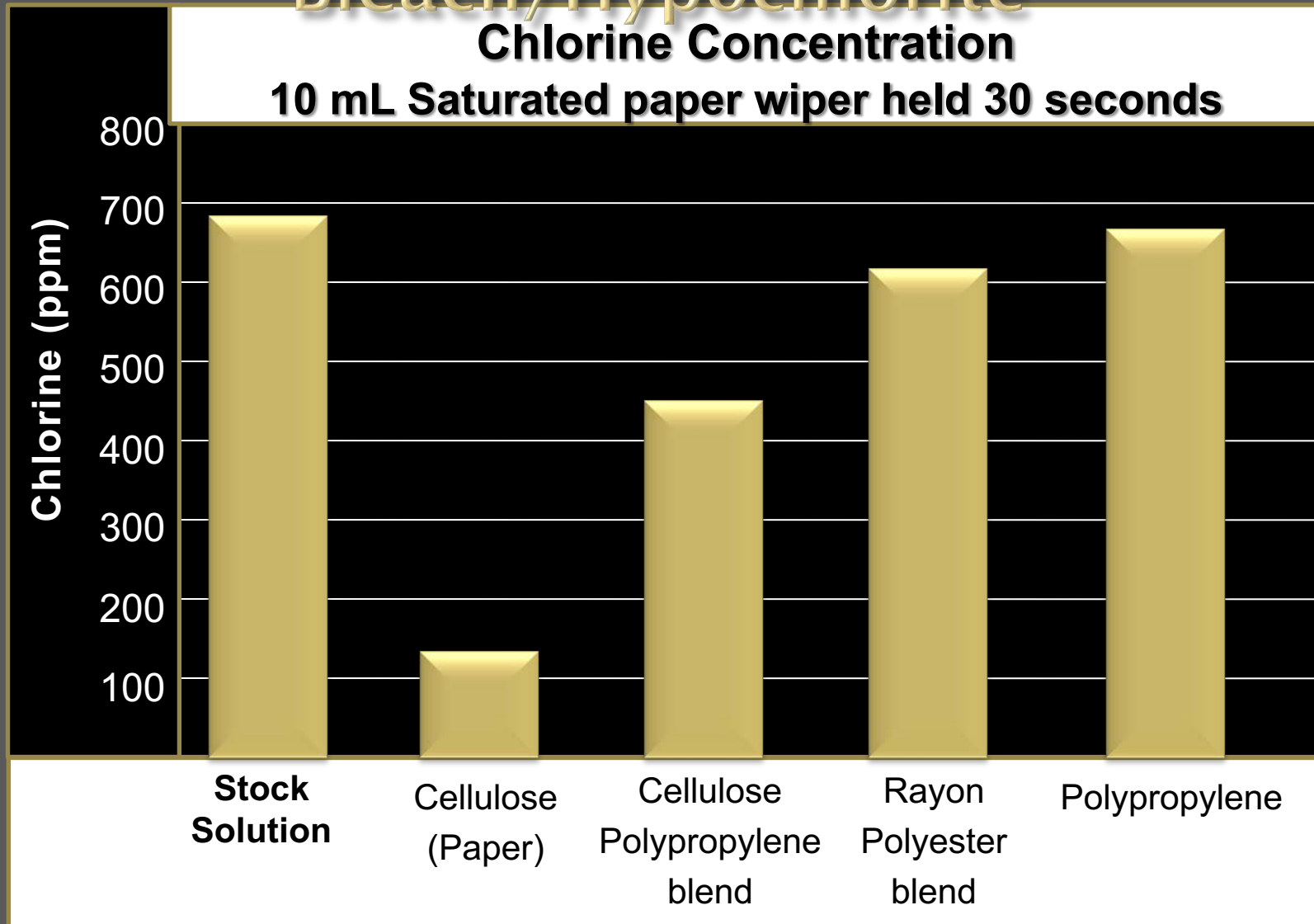
- Wipes and rags that contain cellulose (paper, cotton) bind/absorb active disinfecting molecules of:
 - sodium hypochlorite (NaOCl)
 - Quats (QAC)
 - hydrogen peroxide
- Decreases active concentrations
- Example:
 - NaOCl 500ppm chlorine >100,000 *Staphylococcus aureus* killed
 - cotton rag in bucket 1 hour
 - only about 100 *S. aureus* killed



Impact of Wiper On Bleach/Hypochlorite

Chlorine Concentration

10 mL Saturated paper wiper held 30 seconds



Cellulose (Paper) Wiper Caused 75% Reduction in Disinfection Efficacy

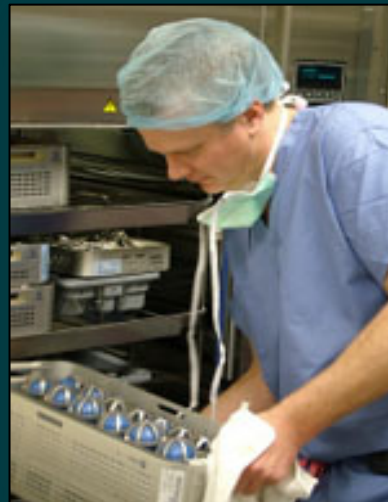
The Decontamination Unit Is A Biohazard Area

- Every instrument or device that enters the decontamination area must be treated as if it is potentially hazardous
- So is every surface that any of these items touch, or the gloves touch after handling these items
- Floors that have been splashed upon and soles of shoes/shoe covers spread contamination



Remove Jewelry

- Jewelry must be removed. Coronavirus can remain infective on metal for 2-7 days
 - Rings
 - Studs
 - Earrings (pierced or clipped)
- And never wear masks like necklaces!! Cov-2 still infective on outer mask surface after 5-7days!



Scrubs in SPD

- Scrubs should be provided by and donned at the facility
- Change daily; more often if: wet or blood/body fluids
- Visibly contaminated scrubs must be laundered in facility's laundry (primarily applies to decontamination staff)
- Clean shoes to be worn only at work (non-skid); wear shoe covers
- CoV-2 on floors around patient, HCW carried out of room on shoe soles



Personal Protective Equipment (PPE) for Decontamination

PPE required at all times

- Separate PPE area for storage and changing
- Scrubs laundered by facility; wet/soiled change
- Head cover required in CS
- Fluid-resistant barrier (jumpsuit, apron with sleeves, gown)
- Fluid resistant shoe covers
- Heavy-duty gloves (inner can be thinner glove): change if punctured, torn
- Face mask or respirator
- Face shield or goggles
- Remove PPE if leaving Decon; Reusable gloves, wash; inside out to dry
- Wash hands in hand wash sink



An Important Reminder

- Exterior surfaces of mask/respirator can become contaminated when inhaling air contaminated by CoV-2 stays infective ≥ 7 dy
- CoV-2 on mask/respirator surfaces can be transferred to wearer when:
 - performing seal checks (respirators)
 - adjusting fit
 - removing
- There are several effective ways to disinfect masks & respirators, but each has some limitations

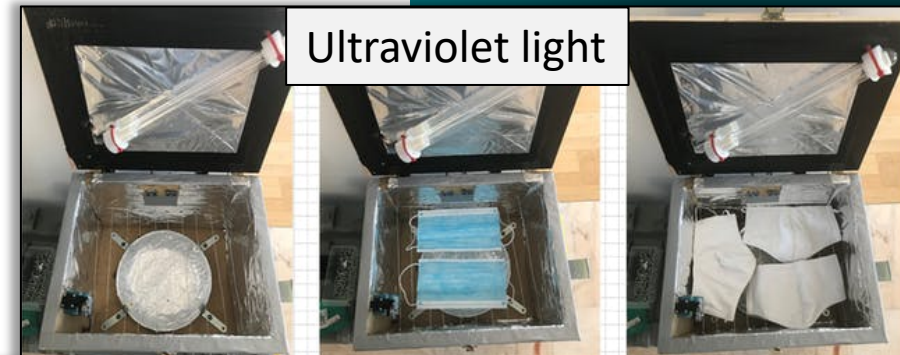
Hydrogen Peroxide Vapor
decontaminates in 2.5hr/ 80,000/dy



Dilute bleach or H₂O₂ spray or wipe



Ultraviolet light



Important Practices To Emphasize

- Brushing instruments should be done under water to prevent excessive splatter/spray
- Decontamination soak, wash, & rinse sinks must be before refilling
- When changing detergent or rinse water, clean/disinfect sink well before refilling*

*alcohol wipe after disinfection
removes ant residual disinfectant



SPD Decontamination Watch-Outs: Inadvertent Aerosolization Infective CoV-2

- Water spray of pre-washed/pre-detergent soaked devices could aerosolize CoV-2: Make certain in deep sink and after pre-wash or soak in detergent water
- Do not drop dirty items into sink creating a splash
- Close lid on ultrasonic cleaner every second it's running!
It does create tiny aerosolized droplets. Fix it or improvise if lid is broken or missing!
- When pulling brush in & out of endoscope, direct away from your mask/respirator & face-shield as added pre-caution (especially Bronchoscopes & Sigmoidoscopes)
- Do not dry with forced-air unless absolutely necessary. Then use only after cleaning/disinfecting CoV-2 rendering it harmless
- Remove contaminated PPE properly to prevent aerosolization of virus



Contaminated Cell Phones: Why Should They Be Immune to Contamination?

- Cell Phones can easily become contaminated in Decon
- Then you put it to your face, touch your mouth, close to your eyes
- After handling, you contaminate clothes and surfaces
- Take it home, kids pretend talking on it, or playing angry birds
- Decontaminate cell phones with disinfectant wipes or alcohol, but be sure to check phone Manufacturer for compatibility



Instructions for Disinfection: One Manufacturer

1. Use only a soft, lint-free cloth
2. Avoid excessive wiping
3. Unplug all power sources, devices, cables
4. Keep free liquids away from your device, don't soak
5. Don't allow moisture into any openings
6. Avoid spraying cleaners/disinfectants directly onto device
7. Avoid strong bleach, abrasives
8. One manufacturer recommends use of 70% isopropyl alcohol wipes or Disinfecting Wipes



To Start, With Environmental Cleaning (EVC)

- Dedicated storage area (no other area should “borrow”)
- Keep storage “closet” interior & contents dry
- Use disposable items for cleaning/disinfection wherever possible
- General Rule - Clean from:
 - top to bottom
 - cleaner to dirtier
 - can use clockwise or counter-clockwise motion along with above



PPE When Cleaning/Disinfecting Environmental Surfaces

Guidelines less stringent than for devices where much greater opportunities for splash, spray, aerosols

- Remove Jewelry

Your facility may require increased precautions

- Wear:

- water-proof shoe covers
- gown
- mask/respirator advised (during covid-19)
- eye protection
- examination gloves or heavier

- Change PPE (at least gloves & gown) to prevent contamination between Clean & Dirty



Daily Frequent Housekeeping - at Least Twice

- Recommend pass-through window into sterilization disinfected frequently ($\geq 2X/day$) during the day
- Frequently touched surfaces-clean frequently: countertops, washing equipment surfaces
- Buttons, dials, handles in SPD
- Handwashing sinks, faucets
- Utility sinks before and after each used for medical devices along with implements handled during device cleaning:
 - brushes
 - faucets
- Frequent removal intervals of Biohazardous wastes
- Each bag: must hand tie by gathering and twisting neck of bag and using a tie or hand knot to secure bag



Some Are Environmental Services' But if Not, Those Items You May Touch Near SPD

- Confirm EVS is disinfecting elevator buttons at least hourly (study showed elevator buttons 40X higher bacterial counts than toilets!!)
- Hand rails for stairs SPD may use
- Hand rails near SPD doors
- Door handles, auto-open pads, push bar doors, all frequently
- Data Touch screens
- Lights switches
- Transport carts for dirty and sterile delivery (don't forget wheels!)
-and whatever you realize may have become contaminated – the cleaner/disinfection canisters with disposable wipes are the easiest & quickest to use. Don't forget to wipe the canister itself!



SPD Terminal Cleaning (end of each shift)

- Clean & Disinfect all work and high-touch surfaces
 - clean, low-linting non-cotton, non-paper based rag, or single-use wipes (EPA approved canister wipers are compatible w/disinfectant)
 - horizontal surfaces should be cleaned/disinfected at end of each shift (minimum for COVID-19 Pandemic)
- Do Not Dry Sweep Floors
- Mop floors (clean and disinfect)
 - single use mop head or use wet vacuum
- No Terminal cleaning while Devices being reprocessed



Association for the Health Care Environment

COVID-19 Resources for EVS Professionals 2020

Waste Management

- CDC has determined medical waste generated in treatment of COVID-19 positive patients and patients under investigation (PUIs) be managed in accordance with routine procedures
- No additional packaging or transportation requirements from Department of Transportation (DOT) for regulated medical waste or sharps
- Facilities are responsible for packaging waste for transport to treatment facilities



CDC Proper PPE Removal

■ CDC Proper PPE removal (Free)

[CDC Removal Ex. 2](https://www.cdc.gov/hai/pdfs/ppe/ppe-sequence.pdf) (I think best for SPD):

<https://www.cdc.gov/hai/pdfs/ppe/ppe-sequence.pdf>

■ Assume Cov-2 viruses on outer surfaces of PPE

- PPE including
- face shields
- goggles
- masks/respirators
- aprons
- gowns
- shoe covers

■ Wash: soap & water or use alcohol hand sanitizer

HOW TO SAFELY REMOVE PERSONAL PROTECTIVE EQUIPMENT (PPE) EXAMPLE 2

Here is another way to safely remove PPE without contaminating your clothing, skin, or mucous membranes with potentially infectious materials. Remove all PPE before exiting the patient room except a respirator, if worn. Remove the respirator after leaving the patient room and closing the door. Remove PPE in the following sequence:

1. GOWN AND GLOVES

- Gown front and sleeves and the outside of gloves are contaminated!
- If your hands get contaminated during gown or glove removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Grasp the gown in the front and pull away from your body so that the ties break, touching outside of gown only with gloved hands
- While removing the gown, fold or roll the gown inside-out into a bundle
- As you are removing the gown, peel off your gloves at the same time, only touching the inside of the gloves and gown with your bare hands. Place the gown and gloves into a waste container



2. GOGGLES OR FACE SHIELD

- Outside of goggles or face shield are contaminated!
- If your hands get contaminated during goggle or face shield removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Remove goggles or face shield from the back by lifting head band and without touching the front of the goggles or face shield
- If the item is reusable, place in designated receptacle for reprocessing. Otherwise, discard in a waste container

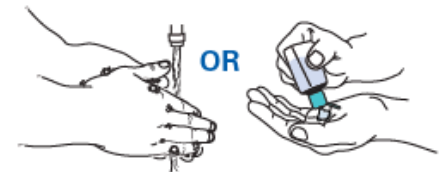


3. MASK OR RESPIRATOR

- Front of mask/respirator is contaminated — DO NOT TOUCH!
- If your hands get contaminated during mask/respirator removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Grasp bottom ties or elastics of the mask/respirator, then the ones at the top, and remove without touching the front
- Discard in a waste container



4. WASH HANDS OR USE AN ALCOHOL-BASED HAND SANITIZER IMMEDIATELY AFTER REMOVING ALL PPE



PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE



Everywhere Think: What Could Be Contaminated?

- Remove work shoes and leave at hospital
- Wipe down your car seat and steering wheel
- If subway or train, wipe down areas you touch or sit on before touching & when leaving
- Cover face as required by your state/city
- Arrive at home, shower or bath may be wise
- Cough or sneeze into a tissue, place in trash or plastic bag to toss later
- Avoid sneezing onto clothes if possible as they will then be contaminated and cannot be immediately thrown in trash or washed



Groceries: Decrease Frequency Shopping, But When You Must Go:

- Wear a mask or material to cover mouth and nose
- Wear disposable gloves if you have them
- Wipe down cart/basket handles with disinfectant wipes
- Stay at least 6ft away from other people at all times
- Assume items have been handled by others with contaminated hands or contaminated gloves
 - produce, packaged foods, cans, shelves, freezer and refrigerator door handles, credit card machines
- Touch just items you intend to buy
- Wash hands or use hand sanitizer when you're done



Groceries: When You Get Home

- Two ways to significantly reduce risk of CoV-2 contamination:
 1. Leave Non perishable bagged groceries in garage/porch 72hr to deactivate virus
 - Wash hands, sanitize surfaces you touched in car and home
 2. Setup a cleaning station sink or basin
 - Wipe down or dispose of plastic grocery bags or throw them out
 - If not left out for the 72hr, wipe cans with disinfectant wipes, or detergent water, remove, let dry (can rinse lid later if soda can, etc.)
 - Vegetables: soak/lightly 20sec, in water+mild dish detergent in basin (**not hand soap**, leaves a film) mild rub as remove & rinse
 - Wash/disinfect surfaces touched by hands, groceries, unwashed bags, counter-tops, light switches door handles, keys, steering wheel, anything touched bringing in groceries
 - Wash/sanitize your hands



Laundry

- Wash/sanitize hands (Don disposable gloves if available)
- DO NOT shake laundry before placing in washer
- Wash potentially contaminated together with non-contaminated laundry
- Use normal detergent and warmest water temperature allowed for items (fabric softener can be used as normally would)
- Wash/disinfect hands
- Dry at highest temperature recommended by items being dried
- If at laundromat, take clothes home to fold)
- Wash/sanitize hands
- Disinfect surfaces dirty clothing, linens placed prior to washing
 - detergent & softener containers, washer/dryer surfaces & controls, room light switch, door handles
 - after disinfecting hamper, place disposable bag liner for dirty laundry
- Wash/sanitize hands



End of Grocery, Laundry, Surface Disinfection Adventure (Ordeal)

- Such precautions can help you lower your chance of being exposed to the virus and in turn your family, colleagues
- Please take these inconveniences seriously - health and lives depend on being aware of our actions and the actions of others

Note: Don't forget to disinfect the bottles, push ports, caps, dispenser heads, of your hand sanitizers and spray disinfectants! 😊



The Perfect Storm, Be Prepared: Very Probable Will Face A Worse Pandemic

Address What Can Be Addressed, For Patient Safety & Optimal Outcomes

1. Failing means of treating infections: antibiotic & drug resistance
2. Mutating, new emerging, & returning microbial pathogens
3. Decreasing vaccination acceptance
4. Declining efficacy of pathogen diagnostics
5. An aging, more vulnerable patient population
6. Expanding percentage of patients with drug addictions, weakened defenses
7. Increasingly more complex surgeries
8. More intricate & delicate medical devices to clean & sterilize
9. Climate change, permafrost thaw, deforestation
10. Increasing natural disasters disrupting services
11. Demands for saving healthcare & companies' money
12. Increasing human population density, rodents, obesity, diabetes
13. Aging utilities: water pipes, electrical grids
14. Moving back to untreated foods, non-disposables
15. Homeless populations with lack of: sanitation, medical care, good nutrition



We Will Make It Through This
We Must Learn & Be Better Prepared For the Next One



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