RACHEL DEERR: Hello, I'm Rachel Deerr, host of today's program COVID-19 Critical Care: What Providers Need to Know. This is the May 15th update of DKBmed Radio's coronavirus educational series, COVID-19: Keeping Up with a Moving Target. Thank you for joining us. As a reminder, we are providing twice weekly 15-minute webcasts and podcasts featuring the latest news treatment updates and clinical considerations as well as answering your questions about COVID-19.

These will be available on Wednesday evening and Friday morning. Sign up at COVID-19.dkbmed.com to be sure you get the latest updates.

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Today's learning objectives are:

- **Define PPE**
- **Distinguish between airborne, respirator contact precautions, and droplet and contact precautions**
- **List 3 aerosol generating procedures**

I'm very happy to introduce Sue Hansen, a clinical nurse specialist at Harborview Medical Center in Seattle. This is the first part of Sue's series on PPE in the hospital setting amidst the pandemic. Sue, thanks for joining us.

SUE HANSEN: Thank you for having me. Before we begin, I'd like to thank the generous support of DKBmed, The Postgraduate Institute for Medicine, and the Institute for Johns Hopkins Nursing.

PPE: personal protective equipment, what is it? We're going to talk about what it is, when we use it, where do we use it, we're also going to talk about airborne versus droplet precautions, and also look at aerosol generating procedures that you would need to be mindful of when you choose your PPE.

So, PPE is specialized clothing or equipment worn by an employee for protection against infectious materials. This is the definition from OSHA, the Occupation Safety and Health Administration. OSHA issues guidance on workplace health and safety. They issue the regulations required to use PPE in healthcare settings and they also issue guidance on health and safety issues in any other workplace like construction. This is different than the CDC. The CDC issues recommendations on the type of PPE to wear under what infectious circumstance. They are different agencies, and because of this, you will find variations in practice regarding PPE. The CDC and The World Health Organization issue recommendations, but these are only recommendations. Institutions do not have to follow them. Some institutions follow the CDC religiously, some institutions follow the WHO, and other institutions use a combination of practices that are supported by both the CDC and the WHO. OSHA, on the other hand, those are strict regulations for which an entity can be cited or fined if they do not follow.

Types of PPE used in the healthcare setting: there's many. These are just probably the top six that we use regarding infectious diseases: gowns, respirators, face shields, masks, goggles, gloves, and we're going to go over those a little bit individually so I can show you some examples.

The first is gloves. They come in two main buckets or categories: they can be medical examination gloves or they can be surgical gloves. Medical examination gloves are the typical ones that come in boxes of 50 or 100. They can be vinyl, nitrile, or latex, but primarily they are made of a synthetic material. An example of this is vinyl gloves. They are synthetic, they are less allergenic, and they're very loose fitting. They're not appropriate for aseptic practices, but they are good for routine tasks as well as they are less allergenic than latex gloves.

The next type of gloves that we use very frequently are nitrile gloves. These, too, are synthetic. They can be sterile or non-sterile, but they have excellent strength and they're great for chemical protection. Patients and healthcare staff have less allergenic reactions to these, but they are less elastic and they are less sensitive, and there are certain times, especially during procedures or surgery, where you really do need to maintain the elasticity for dexterity and procedures that require sensitivity.

The third type of glove that is used frequently are latex gloves. These are natural, naturally made from rubber. They fit great and they maintain the dexterity of the individual. They have great sensitivity. These are used primarily in the operating room where you need to maintain your sensitivity, but after using these for a while, many many staff have become allergic to these types of gloves, so they have begun to manufacture synthetic gloves that are sterile that can be used under the sterile conditions, but again, they just do not have the same sensitivity as true latex gloves.

For gowns, again there's all different kinds, there are disposable such as this one. This is plastic, this comes in probably a box of 25-100. These are disposable and this is what we use when we go into certain isolation rooms. They're handy, but they can be expensive as well.

The others are reusable. The first one here is a surgical gown. This is a sterile gown that comes individually wrapped. You need to take care when you're donning and doffing this and so as to not contaminate yourself or the gown, and this goes right into the laundry system, whether that's your institution or you ship out for your laundry services.

The next one is also a reusable gown. I see this quite frequently used in other types of isolation type situations. This can come in a pack of 10-25. This is also used in situations where you're doing non-sterile bedside procedures or big dressing changes. These work great, you can doff those appropriately and then they to go in your standard laundry services.

Face protection, there are so many products on the market. We're going to do a little side-by-side comparison of cloth, surgical, and respirator masks.

Technically, respirator masks are not masks, they're respirators, but I put them in this category because most people think of them as a mask and they have a lot of questions about the differences between all three.

A cloth mask is just that: it's one that you can make at home. These filter very little. This is what the CDC recommends for the general public. They do not really help you, but they do protect the person next to you in case you have a cold or you're sneezing. These are really good to wear when you go into like a

crowded grocery store or something like that. They do protect against large droplets, but again, those are your large droplets, not somebody else's. It can be loose fitting so it's important to wear it appropriately.

Then you have the surgical masks. This is what we use in hospitals. Mostly these are used in surgery. They, too, have to be donned appropriately. These can protect you from large particles such as blood, large droplets, tissues sometimes. They are disposable and they can be loose fitting, so it's important that these are donned appropriately as well to minimize any risk of exposure.

The third one is respirator masks. This is an n95 mask. This can protect you against very very fine particles. This is what you would wear if you would go into a room with someone who is under airborne respirator precautions. They can also protect against large droplets. This has to be custom fitted. We are fitted every year to make sure that it is appropriately sized and the appropriate type of n95 for us and that it still seals appropriately. You are not to wear this mask if you have a very large beard or a mustache or a lot a lot of facial hair, because you will not get the seal that you need to protect yourself.

Face protection: goggles, shields, eyewear. Again, so many on the market. This is a face shield; it can protect your entire face. It needs to go below your chin. I personally like this because I can wear my glasses at the same time, and then you can wear your mask underneath this as well. You can use this not just in isolation rooms or in droplet isolation rooms, but you can use this when you're doing big dressing changes or wound care where you feel there might be some splatter.

Next is goggles. If you notice, they have the little side panels. These are the ones that you should be wearing. Your own glasses do not substitute for any of these examples of eyewear, you would have to wear your glasses underneath of these.

And then here are goggles that have a little rubber strap on the back just like swimming goggles, and they cover the entire upper entire circumference of your eyes.

Respirators, air purifying systems, these are the two I'm most familiar with, but there are others out there. First is a PAPR which stands for powered air purifying respirator. This comes with a hood or a shroud. A shroud can go down below your shoulders it has a battery pack that you fit around your waist, and it has a hose that connects to that hood. In the second picture, there you'll see a person wearing that. This respirator is battery powered, so it has to be charged. There are batteries that connect onto the bottom of it, and it forces clean air up through a filter and into that hood.

The below example is what we call a CAPR and this is by a company called Max-Air. This is a controlled air purifying system. It's the same principle but it's a little bit less bulky it has a tiny cord coming off the back of the hood, it looks kind of like a bike helmet and it attaches to a little battery pack that that goes around your waist.

This came out on the market probably a couple of years ago, and a couple institutions have really enjoyed this type of system because it is less bulky and the face shield also does not fog up that is connected to the helmet, so I hear a lot of good things about the controlled air purifying system. You would use either of these or the n95 mask if you were going into a patient's room who was under airborne respiratory precautions.

So, what to wear and when? The PPE selection can be quite confusing, but it basically comes down to your level of risk. What are you going into the room to do? If you're going to have a procedure or you're going into a room where there's a potential to be splashed or sprayed in any way, you need to take that into consideration before donning your PPE or choosing your PPE. In addition, you need to think about the durability and the appropriateness for the task. When I think of this item, I think of gloves or sterile gowns, and so if you're going to have a procedure and you're going to be at the table, you're going to need to choose the sterile gown versus the disposable non-sterile. You're going to probably want to choose the best sterile gloves that maintain your dexterity and the sensitivity, and then next you need to think about fit. When I think about fit, I think about that n95 mask that you need to be fit tested every year. When you are in a situation where you have to grab respirator equipment quickly, you need to make sure that you have the one that's appropriate for you, so if you have not been fit tested in the past year or you have been fit tested and you failed, those n95s are not for you, if for whatever reason it doesn't maintain a good seal or your facial shape is not conducive to the n95, then you need to ensure that there's enough PAPR hoods, batteries, and belts for you in case you need to go into that room quickly.

The situation I think about here is the code situation. You need to make sure that you have the proper equipment on your units so that anybody who needs to go into the room quickly has the proper equipment to do so. Lastly, you need to consider the type of isolation precautions. Are they contact precautions? Are they droplet or are they airborne, or respirator? Are they a combination of all three? Those are some of the things you need to take into consideration before you don your gear.

When thinking about respiratory illnesses that can be transmittable to others, you need to think in terms of droplet, airborne, and contact. I'm talking in general terms not just for COVID-19, but transmission can be direct or indirect. It can come in the form of contact, droplet, or airborne. From the limited time that we've had to study COVID-19, what is coming out is that it’s primarily transmitted through large droplets and contact transmission, but in addition is also transmitted in fine particles in the air.

Contact transmission this occurs when someone coughs or maybe a vent circuit comes apart and those large particles disperse into the air and then they fall on a surface. This can be a gown, this can be a bed rail, or another example is if somebody should cough and then cover their mouth with their hands and then touch a doorknob, or touch the phone receiver, or their cell phone, that is a contact surface. If somebody goes up and touches that contact surface then maybe rubs their eyes, that's the way that that virus can be transmitted.

Another form is droplet transmission. These are heavier particles. These are generally anywhere greater than five to ten microns and they can travel about three to six feet and then they begin to fall, but this is also a way to contract a virus. If it's by droplet transmission, it's probably generally direct transmission, so maybe you're standing close to somebody who coughs or sneezes and they're not wearing a mask. This could be a mode of transmission.

Thirdly is airborne transmission. These are finer particles, it's more like a mist. These are generally less than five microns. They can travel farther and they can last a little bit longer in the air because they're not as heavy unlike larger droplets are.

I thought this was a great picture showing how COVID-19 can be transmitted in all three forms, either contact, droplet, or airborne. This is just a diagram of someone coughing and sneezing, and if you look at the coughing, it shows that those droplets can travel about 10 meters per second. Those are heavy droplets, and then they'll begin to fall. If you sneeze, those droplets travel farther and faster, right up to about six meters, some studies have shown. When you look at the exhalation curve and how it drops off there, this is how contact transmission comes into play. Those heavier droplets fall to whatever surface is around you and then the next person will touch that surface and maybe rub their eyes or rub their nose and then they could be exposed to COVID-19. Lastly is airborne transmission. You can see in the beginning when this person coughs or sneezes, those smaller particles kind of hover around in like a cloud formation. They can go farther, and they kind of linger. These are the ones that would require someone to wear airborne respirator precautions to protect themselves from these.

So when thinking about airborne precautions and choosing the right precautions, before you go into the patient's room, again, you need to think about the level of risk, and the level of risk always has to include these aerosol generating procedures we do a lot of these at the bedside. Your patient may not always have these going on at any given time, but these are some of the things that could happen that would make you change what you're going to wear. Some of them could be intubation, extubation, bronchoscopy, if your patient is on CPAP or BiPAP which is forms of non-invasive ventilation, or you need to induce some sputum, or you're proning your patient, where your ventilated patient needs to go on their belly. This a high-risk procedure. Unfortunately, sometimes the circuits become disconnected and so that person at the head of the bed can get splashed or sprayed with that positive pressure ventilation, and those aerosolized particles could contaminate them. In these situations, this is really when you need to choose your n95 respirator or your PAPR or your CAPR before you go into the room.

So to give you an example here, primarily, our COVID-19 patients are in droplet contact precautions, meaning we are mindful of those large droplets that are in the air as well as contact surfaces, or they can be an airborne respirator contact precautions. When it becomes confusing is when your patient is in droplet contact precautions, but then you see someone walking in having donned an airborne respirator. So what's the difference when you go into your patient's room if they're not going to have any of those aerosolizing procedures is that it lowers your risk of contamination by aerosols dramatically, and so you would only need to wear droplet contact precautions, which includes various forms of eyewear that you see here. You can choose a mask, gloves, disposable gown, again your own glasses do not serve as protective eyewear, but if you're going into that patient's room who is under a droplet contact precautions and let's say you're going to give a nebulized treatment, in that instance you're going to want to don for airborne respirator precautions. You would not just wear a simple mask or a surgical mask, you will want to don an n95, you will want to have proper eye wear. You can wear a disposable gown, or if you do not fit into an n95 you'll want to wear one of the purified air systems such as a PAPR or CAPR. Once that aerosolizing generating procedure is completed, you wait the allotted time for those particles disperse. The next time you go into the room, then you can go back to droplet contact if you're not going to be exposed to any aerosolizing procedures.

That being said, generally most patients who are in the ICU are under airborne risk for contact precautions, simply because that they are intubated. When a patient is intubated on the ventilator, even though they're not having any of those procedures that are listed on the previous slide, the risk of that circuit coming apart and having an exposure to staff is much higher. At our institution, all of our patients who are in the ICU who are intubated are on airborne respirator contact precautions.

RACHEL DEERR: Sue, thanks for those updates. We will now continue to the listener Q&A.

First question: can we use gowns and surgical masks that have exceeded the manufacturer's expiration date? Do they offer the protection needed?

SUE HANSEN: That's a really good question. In times of where we need to really be conservative with our PPE, this has come up a lot, and the answer is yes and no. You have to really look at the product. The reason expiration dates are placed on products is that it is regulatory requirement. It doesn't mean that they don't work anymore, and so in our institution we have used some products that have gone past their expiration date. One of the examples that I can give you is n95 masks. We have reused and we have repurposed them. We have re-sterilized them through UV methods, and now we're just starting the vaporized hydrogen peroxide method. That being said, you have to examine your gear as well, and so you need to ensure that it's going to stand up and protect you for when you walk into the room. Anytime you don any type of gear, you need to make sure your mask seals appropriately. If it's been cleaned by either the UV method or hydrogen peroxide method, you've got to make sure that it fits appropriately, and it maintains a seal. You have to check your gown and make sure there's no holes or tears in it. So you kind of have to look at it both ways, it's not a yes or a no, but certainly some products you can use past their expiration date as long as you ensure that they still fit you appropriately and protect you.

RACHEL DEERR: Sue, here's our other question: what PPE would you recommend to someone as a minimum for taking care of a COVID-19 patient at home?

SUE HANSEN: As a minimum, I would wear a mask on the patient and a mask on yourself and gloves. Just think about those three things and how the virus travels and is transmitted. It'll be by droplet, aerosol, and contact transmission, so just do your best to clean all those surfaces regularly on a daily basis, sometimes several times a day. If your loved one at home is coughing a lot or gets treatments at home, make sure that you have the appropriate mask on for that as well. Make sure you have the appropriate face shields on if they're undergoing treatments at home. A lot of patients are, but if they're not, a mask and gloves should just be all that you need. Just make sure that you clean those surfaces like we've all been told to do. You should be just fine.

RACHEL DEERR: Sue thanks again for your contribution to the program.

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Any questions or issues, feel free to email us at the address listed. Don't forget to access our resource center at covid19.dkbmed.com. There you'll find information on the latest COVID-19 data and statistics medical society guidelines and resources in Spanish.

Thanks again for joining us and thank you for your dedication to your patients with COVID-19.