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Some experts say 'no' to color

Color is everywhere in our world. Think of all the colors we use for navigating traffic and the unrest it would cause if those signs were taken away. But experts say beware of color in health care; they can cause indelible harm, even death.

Color "works with traffic signals because it ties color and location consistently. But health care can't do that. It's got too many moving parts," says *Debora Simmons*, RN, MSN, CCRN, CCNS, research scientist at Texas A&M Rural and Community Health Institute and associate director at The Patient Safety Education Project. And just as color is used in multiple ways — armbands, IV tubing, medication labels, enteral feeding tubes, infusion pumps — it has been the cause of multiple errors, Simmons says, citing that there is no evidence or literature supporting its use as an indicator or differentiator.

"The sad part about it is that cognitively the driver for us for color is very strongly ingrained in our working memory, so you will hold that in your head and you'll keep that and then you'll make that association without even consciously thinking about it," she says.

In health care now, "people rely on color and just overall appearance. Unless there's something else to differentiate the products — like really *bold* labeling of the name in strategic locations on a container, for example, that helps to differentiate the product — we see the kinds of things that get reported to [our national reporting database]. And that is, they pick up the wrong container thinking they have the right one," says *Michael Cohen*, RPh, MS, ScD, president of The Institute for Safe Medication Practices.

"I think people do develop a picture of what the container is supposed to look like in their mind's eye, and that's what they're looking for, and unless they see any disconfirming evidence that proves to them that what I have in my hand is not what's in my mind it's just very, very easy for us to overlook that," he says.

Anecdotes of errors caused by hospital staff relying on color as a sole identifier are endless, Simmons says. Some, such as the heparin overdose with actor Dennis Quaid's twins, reach the mainstream media. But many don't. Simmons recalls a recent case in a hospital. Typically, she says, red has been used for arterial lines and blue for venous lines. A patient had come into the hospital for dialysis, and one of the ports became clotted and needed to be replaced. "They needed to pull the venous port but after dialysis the last time the techs accidentally recapped with the wrong color. So they put the red cap on the venous and the blue cap on the arterial line. And so they removed the wrong line," Simmons says.

She points to the use of color for feeding tubes. "We've got orange lines, orange oral syringes so you will start to associate orange with oral or GI systems," she says. But one company is coming out with a purple feeding tube, "and now we've got purple PICC lines that are out there... What you're doing is you're making the association with a purple feeding tube to a triple intravenous line. That connection is fatal. That will kill a patient," she says.

Multiple layers of problems with using color as a safety "catch" exist, Simmons says:

- There's no standardization of colors in any setting or use.
- There are no standards regarding color from any regulatory body or the FDA.

She suggests looking at the use of color in other high-risk industries: Color is never used as the sole identifier, she says. With traffic lights, color is tied to position. With stop lights "it's the position of where those lights are that is supposed to cue us forward. If you mixed them up, then people would get all confused. So it's color and location. Well, you can't do that on patients because patients are all over the place and we move them from area to area. So you can't tie location and color."

Also in health care, she says, "You've got all these products that have universal connectors so they can connect to each other, and you've got people that are working fast in risky situations and they're busy and they're interrupted and they're used to doing things and they're making these associations with color, which is the wrong thing to do."



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And using color with IV lines as a sole safety protector, she says, just doesn't work. "If you've got this colored IV line and you stock them and you run out of one, what you're going to do is use the other IV line. That's it. So now if you identified everything as say red is vasoactive and you run out of red lines, well you're not going to stop using that on patients. You've still got to use the drug and so what people will do is substitute those. So now you've got something that was supposed to be in a color and supposed to tee people off to the color but they're out of something so they're using something else," she says.

Simmons says using color seems an easy solution, but looking at it in terms of human factors engineering or cognitive psychology, it doesn't hold up. Good systems use redundancies, multiple layers of preventing errors, and force functions to prompt the correct action.

"If you look at other industries, when they do use color, what they do is they put color with a tactile cue and another visual cue such as shape. So they want something to feel different and be shaped differently and have color," and together those are used to decrease risk of an error. Color alone doesn't do that, she says.

There are many initiatives under way to try to stop companies from using colors in their marketing, and Simmons says in California there is legislation that prevents the use of universal colors on feeding tubes after 2013. "I'd be willing to forego the attractiveness of the label for safety reasons, and that's what I would like to see knowing that it will never happen," says Cohen.

Simmons suggests looking at your purchasing and join with others to stop companies from using color on their labeling. Beyond that, with the system as it is, and companies using marketing and colors and different fonts to distinguish themselves and compete with others, she admits there are not many great interventions to overcome errors.

One safety check she suggests is using independent double-checking by staff, for instance, when a nurse moves or reconnects a line. However, this not only disrupts workflow, but it can be burdensome for staff. For now, though, it can be helpful. She acknowledges the fact that now hospitals have to try to create others layers of safety and workarounds around things that were created with safety in mind but just don't work.

Another suggestion she makes is to "stop beating people up for errors so they'll tell you about them. The second thing is, you can make people aware that if something looks alike or sounds alike, that should be a huge red flag to your staff that an error might happen. And they should recognize that. The only way to do that is to put emphasis on it and make them aware of their environment. Say, 'If you see something like this, we need to move it. If you see something that looks alike, sounds alike next to each other, we need to move it.' So we've got to start teaching people to do that."

Both Cohen and Simmons favor hospitals using internal labeling — black and white labeling. "I would avoid things like asking nurses to use color tags to add to the IV line to differentiate them. I understand why people want to put a tag on it, but I would just use a black-and-white label. If you start putting colors on it, it could mean different things to different people. You could increase the rate of an infusion pump on the wrong line unintentionally," Cohen says. He would like to see labels that emphasize the drug name and strength rather than an attractive, marketable, and colorful label.

Peggi Guenter, PhD, RN, CNSN, director of clinical practice, advocacy, and research affairs for the American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) also notes the flaws with using color as an indicator. She says A.S.P.E.N. has joined an international task force to redesign enteral connectors.

"What's happening is that some companies are claiming that purple is the standard when a standard color has actually not been set by a standards organization. The whole premise is that color in and of itself does not prevent a misconnection and our safe practices for enteral nutrition actually say that it should serve as a trigger for the nurse to think maybe this shouldn't be connected to something else. Color does not actually prevent the misconnection. Only a connector redesign will prevent the misconnections," she says.

"So what's happening is that some enteral equipment manufacturers are claiming that purple is the color and they're all fighting with each other about what color is the standard color even though a color has not been set. But they only work in their little realm. And they're not realizing that there actually are purple IV lines, PICC lines, on the market," she says.

She relates a conversation with a nurse at an Iowa hospital who works with the purchasing agents. This nurse "has had a terrible time trying to educate the nurses about color, and she's in this dilemma because they have a contract with the purple IV people and a contract with the purple enteral people and she's really having to go through a tremendous educational endeavor in order to prevent these from being hooked up with each other. So the problem with color is that all of these systems are being developed in silos and there's no overseeing body that looks at the color," Guenter says.

She says for the most part, there are no enteral systems on the market that don't use color "at least in their administration sets." She also promotes looking at your purchasing options. Her suggestions. "It's checking the bags. It's working down the tubing system so that before you take the end of an administration set, you need to make sure that what you're hooking it to is not an IV. There are some intravenous lines that are white and made of silicone and look very much like what an enteral feeding tube might look like. So tracing that feeding tube back to its origin to make sure that that's not an IV line and is indeed a feeding tube is really probably the most primary thing to do," she says.

She also suggests looking at your supply room and creating force functions to help nurses locate the correct tubes. She recommends packaging the tubing with the enteral feeding bag in a central supply room. "There's a way the correct tubing can be packaged with the bag using a rubber band. The correct tubing can be packaged with the bag coming up versus the nurse just running into a local supply room and pulling tubing out and pulling indeed the wrong tubing and priming the bag and then hooking into an IV."

She also favors internal labeling systems. "For instance, on a patient's abdomen, who is a surgical patient, we might

have three or four different tubes on their abdomen. Some are drainage tubes, some are feeding tubes. And to make sure that you label those so that when you go to hook the feeding in, you're putting it in the right kind of tube."

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