CONVERSATIONS

# THE BUILT ENVIRONMENT'S ROLE

## in Infection Control Is Multi-Faceted

An Interview on Infection Control With Megan Denham, MAEd, EDAC

### INSIDE YOU WILL LEARN ABOUT:

Strategies that disrupt pathogen transmission.

The numerous reasons that sink location is important.

Why post-occupancy evaluations by the design/architecture community are necessary.

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Megan Denham, MAEd, EDAC

Megan Denham is part of the Research Faculty at SimTigrate Design Lab within the College of Architecture at the Georgia Institute of Technology. Her research focuses on evidence-based design to improve healthcare facilities, reduce the risk of healthcare-associated infections, improve clinical processes, and promote patient- and family-centered care. She recently completed a systematic literature review on the built environment's role in the acquisition and prevention of HAIs in collaboration with Emory University and funded by AHRQ and RTI International. In response to the Ebola virus disease outbreak, she has begun collaborating with colleagues from the Emory SCDU and Johns Hopkins to understand factors in the environment that can support safer care in biomedical patient units. Megan has authored multiple peer-reviewed journal articles and given many presentations focused on infection control and promoting patient-centered care.

# The Built Environment's Role in Infection Control Is Multi-Faceted

## Tell me a bit about your background and how you came to be working on issues in the healthcare environment.

I am just celebrating my 3-year anniversary at Georgia Tech. Prior to coming here, I was Manager of Clinical Operations at Emory Healthcare, where I had both clinical and administrative responsibilities. Our research at Georgia Tech focusing on the use of evidence-based design to improve healthcare allows me to have a continuing impact on healthcare and improving the patient experience by developing, creating, and fostering the healing environment—which is what a hospital environment should be.

## Can you describe your research on the link between the healthcare environment and healthcare-acquired infections at the SimTigrate Design Lab?

We completed the project in collaboration with Emory University School of Medicine, the Agency for Healthcare Research and Quality, and the Research Triangle Institute. We conducted a systematic literature review of over 3800 articles looking at the link between infections, transmissions, and the built environment. We developed a conceptual model to understand how pathogens move through the hospital system, which was a critical communication tool for our multidisciplinary team. This conceptual framework for the transmission of pathogens through the environment allowed the team to begin to look for opportunities to interrupt that process.

We looked at three mechanisms for transmission: contact, airborne, and waterborne. The strategies for interrupting each of them vary. Some of them have to do with technologies for terminal cleaning, like Ultraviolet Germicidal Irradiation (UVGI), but there are limits to every technology. For example, UVGI only kills where the light reaches—so if there are places under tables or equipment where the light can't get to, it won't kill the pathogens. Alternatives are hydrogen peroxide vapor (HPV), which can clean everything in the room, leaving behind only water residue. The trade-off for HPV is that the rooms have to be sealed off during cleaning. With both technologies, rooms have to be vacated while the systems are in use. Conventional cleaning products are also

very effective in reducing and killing pathogens, but low compliance to cleaning protocols often means that many high-touch areas are missed when cleaning.

Our review showed that there are definitely additional opportunities to change behaviors. Take hand hygiene, for example. In study after study, we've seen that hand hygiene is abysmally low. We have to try to figure out how and why that happens, since everybody knows it's important to wash your hands. There are many experiments with different strategies, such as the placement of hand hygiene dispensers. If you put it in a place where people see it when they walk by, are they more likely to use it? If they don't clean their hands on their own, we need some way to signal that to a provider or patient. New sensors can tell if somebody enters a patient room and doesn't wash up, in which case users are reminded to perform hand hygiene. So there's work being done in these areas.

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**There is, of course, broad awareness of the importance of reducing infections in healthcare facilities. But is there universal agreement on the best way to do that?**

There may not be a consensus about the best way to reduce infections because there is very limited data on the link between the strategy or technology and reduction in infection. For example, we know that UVGI, HPV, and copper reduce the presence of a pathogen. And we also know that if there is a reduction in the presence of a pathogen, there is a lower infection rate. But it's making that link—to say, "This intervention reduces pathogens, and therefore infections"—that's the missing data. So there is limited agreement on a single intervention or strategy.

An example is electronic faucets. There have been several studies linking electronic faucets to infections. There are several reasons for that, one of which is human error. People get tired of waiting for the faucet to come on and touch the sensor. Some of the problem may also be with the actual design of the faucet, which is complex and has a lower dynamic water flow. But there is no consensus about whether they should be replaced with something else like a foot pump, a manual faucet, or another device.

## You've mentioned several strategies to help reduce infections, including where to place hand sanitizers. What are some other ways the built environment can help reduce healthcare-associated infections?

One important consideration is the sink location. That's important for several reasons. First of all, it should be located as close to the door as possible to promote hand washing. Its location is important from a patient satisfaction level as well. Studies are starting to show that if healthcare providers can wash their hands facing the patient, it increases patient satisfaction. The faucet also shouldn't spray the water straight into the sink trap, because that can cause splashing; the sink should be separated from working surfaces where, for example, medication is prepared. The sink should also be separated from the bed so the patient is not exposed to splashing.

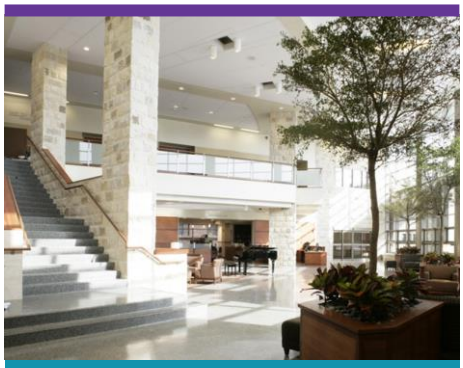
There are a number of products coming out to help reduce infections.

There are a number of products coming out to help reduce infections. Copper is something you hear a lot about. It's a registered pesticide with the EPA, so we know it will kill pathogens. Reports vary on how long that takes—but for that specifically, and any surface that claims it is antimicrobial, there is a risk factor in that environmental services staff may not feel it needs to be cleaned as thoroughly. In no way should the surface properties substitute for proper cleaning.

We are also exploring new ways to make existing technologies more effective. With UVGI, there are some reflective coatings and paints that help to increase the reach of the light. And there are people who are trying out products that are woven with copper.

## What do you think are some of the key issues and/or challenges to incorporating these design strategies in healthcare settings?

Lack of evidence that makes the link between an intervention or strategy and reduction in infection is the biggest issue. It's difficult to set up studies to look at the impact of a single intervention. You'd have to figure out how to control every other possible factor before you could link it to one specific intervention. Another thing, and this is something that's really important for the design/architecture community, is that they have to do post-occupancy evaluations (POEs). If they are working with clients on innovative strategies that



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they think will impact a certain patient outcome, the part that's missing is going back in and looking to see if this design did what we intended it to do. What are the outcomes? We need to write that up so we can learn from it. That's true also of the questions around these new technologies, like UVGI. Is repeated exposure to UVGI going to break down surfaces? We don't know how well antimicrobial surfaces hold up to repeated cleaning with abrasives.

## If there were one thing that healthcare owners could do to reduce the spread of infection, what would you recommend?

That's a tough question, because there are so many layers. Generally, promoting hand washing compliance is the most important thing people can do—but the human factor is really important. It doesn't matter how many technologies you have in a facility. If people don't use it right, it will fail. It's important to figure out how to continually train and educate people on cleaning methods and what happens if they don't do a good job. It's also important to have a maintenance plan in place. That's something a lot of people miss. If UVGI light bulbs are not changed regularly, they cease omitting the ultraviolet light and are not effective anymore. So, there has to be someone responsible for monitoring and checking these things. Short of that, we have to come up with new compensatory strategies to remind people that these things need to be done.

## Do you have plans for future areas of research into healthcare-associated infection control?

We are greatly in need of studies set up to control as many factors as possible so we can look at the impact of specific strategies on infection outcomes. With this knowledge, we can move the field along and leverage the built environment as an effective tool for infection control.