

**Arthur Jones (00:06):**

Conventional healthcare design is no longer fit for purpose. The pandemic exposed critical cracks in its foundations, exposing the need for deeper research, connected care and community integration. The question is, how do you build resilient healthcare that benefits patients, health carers and communities? This future hospital blueprint must go beyond concrete steel and material decisions. The social factors and architectural design are as crucial for healing and wellbeing as medicine. This complex challenge requires a new approach, one that introduces evidence-based design, tech-led innovation, cross-sector collaboration and hybrid skillsets.

(00:48):

My name is Arthur Jones and I'm joined by our guests who are pioneers in these fields. Matthew Holmes, Global Director of Health Infrastructure at Jacobs, and Dr. Diana Anderson, dochitect and Healthcare Principal at Jacobs. Diana and Matthew, thank you for joining us on the podcast. Before we get started, could you both please share more about your careers and areas of expertise? I'd like to start with you, Diana, and could you also please explain what a dochitect does?

**Dr. Diana Anderson (01:14):**

Yeah, sure. No, thanks for having me on the podcast, Arthur. Glad to be here. So dochitect, a lot of people ask me that. It's a strange word. It's a combination, as you can tell, of doctor and architect, and it is self-created, but hopefully it's picking up interest along the way. Archidoc sounded not as cool, so we went with dochitect.

(01:33):

So, it's really this intersection and this merging of two fields, architecture and medicine. And people say that's strange. I think along my career path, people said, "Well, that's a weird combination. How did you do that and why?" But especially since the pandemic, there's been a real interest in thinking about how space design actually impacts our health, our bodies, and our brains. And there's actually quite a bit of research coming out now to show that the buildings that we spend time in and the cities that we live in really impact aspects of our bodies and brains over time, and it's a real public health issue. So, I've really spent my career trying to blend those two fields and develop a whole area of research that looks at those questions.

**Arthur (02:16):**

Great. Matthew, could you share a bit about your background?

**Matthew Holmes (02:21):**

Of course. Thank you for having me today. I'm an architect, only just an architect by comparison. I'm from the U.K. originally, I trained in the U.K. I'm currently based in Singapore, leading a very large program I worked here.

(02:36):

But I've had a pretty diverse journey of healthcare experience, starting obviously in the U.K. Ended up in France, working in Paris for a long time, doing a lot of European or Continental Europe healthcare. Ended up in Australia by accident and ended up spending quite a lot of time there, almost 10 years, and more

recently been based in Singapore. I'm also the Jacobs Global Director of Healthcare Infrastructure. And so I work with a very diverse team around the planet leading our health infrastructure line of business.

**Diana (03:11):**

Can I add something, Arthur? I was actually going to say that while Matthew and I work together currently at Jacobs, we actually met and began working with each other in Australia - must have been over a decade ago - when I was in transition. I had been working in an architecture firm and had an opportunity to go over to Australia and work on a big hospital design project prior to beginning my medical residency. So certainly worked together over a long period of time.

**Arthur (03:38):**

So both of you worked together for essentially 10 years then? That's quite interesting.

**Matthew (03:43):**

On and off. I think that first time was ... It was a large PPP project, Sunshine Coast University Hospital, and it was a bid phase with a major contractor in Australia. So at that period, and then obviously other ... I think, Diana, your path went somewhere else, back to North America for a while. I was been doing projects in New Zealand, doing things like Dunedin, Greymouth, so a range of different projects.

(04:06):

So yeah, more recently been collaborating together, particularly on some of our global initiatives and the likes, in how we bring evidence-based or decision making into some of our design efforts and the likes.

**Arthur (04:18):**

Well, you've mentioned some of the topics there in terms of evidence-based design, which I'd love to hear about in some of the later answers. But for now, what I find really interesting is your global expertise, Matthew, and obviously from your side, Diana, bridging between architecture and the medical side of bringing them both to this industry, which is amazing.

(04:39):

Onto the main topic, what are the biggest trends globally when it comes to designing healthcare that creates transformational outcomes for both patients and health providers?

**Diana (04:50):**

Maybe I'll start off, Matthew, on that one?

And I suspect we'll both have quite different trends given our different perspectives. But certainly a huge trend, and I alluded to this just before, Arthur, is the impact of space design on our health. And I think the COVID-19 pandemic really highlighted this issue, especially in ... I'm Canadian and in Canada we had a real long-term care nursing home crisis during COVID-19. And if you looked at some of just the raw numbers and data, people who were residing in older facilities just had an increased chance of doing poorly. Your chance of dying from COVID-19 in some of the older buildings was more than doubled. And this is raw data, I should say, it wasn't analyzed through research methodology and statistics, but just what the media obtained. It was quite shocking and it really caused people to step back and say, "Wow, buildings really matter."

(05:39):

And so I think there's this whole trend of thinking about spaces that we live and work in. That's definitely one main trend. And I would say that's pretty global, but Matthew could certainly comment on that as well since he works I think in more countries than I have, at least currently.

(05:55):

But evidence-based design, the whole transition of healthcare architecture ... And I should say for our listeners, healthcare architecture is really a subspecialty of architecture. And to be a certified or a board-certified healthcare architect in North America, it's a whole separate set of work experience, examinations, and understanding of all the building codes and just what goes into hospital design. They're quite specialized buildings. You have to understand flows, you have to understand how care is delivered, and the operations of a complex campus. And you really have to understand what's being done and the disease processes that patients are experiencing that you're designing for.

(06:32):

But it was about the early 1980s that a pivotal research paper came out by an environmental psychologist, Dr. Roger Ulrich, that was a small study. It looked at people who'd had their gallbladders taken out, they had an operation, and they were recovering in hospital. And one group of them had a patient room where they had a window and they looked at a park, so a lot of green and trees. And the other group was on the other side of the unit or the ward and their window looked at a brick wall. And the outcomes were strikingly different.

(07:01):

People who looked at nature went home sooner, and you can certainly assign cost implications to that length of stay as a big cost factor that we think about. It's expensive to be in hospitals and provide care. People who looked at nature took less pain medication, and people who looked at nature and the nurses who took care of them, the nurses had better experience, higher satisfaction. And certainly in the United States, satisfaction is a big metric that we track mostly on the patient side, but just a lot of positive outcomes based on the window and the view.

(07:31):

And so that's what really triggered a whole industry of research to say, "Well, wait, should we be studying what buildings are doing to our health outcomes and the recovery process?" So that's certainly a global trend, no question. There are now journals that have popped up that cover this, a lot of conferences and symposia, a lot of experts who research in this area even. So that's definitely a second big trend.

(07:54):

And the other thing I was thinking about just mentioning, and maybe Matthew will build on it too, I'll call it a performance-based assessment of healthcare buildings, whereby we don't just build a building and walk away, we think about how to measure its performance. And some people will know this as a post-occupancy evaluation or a POE. I prefer to call it a more general performance assessment than a POE. But I think we have a responsibility, if we build a building, and I'm not sure if it's the architect's responsibility, it could be the client side and the health system, but somehow we have to measure the success of the

building or see how it's doing. And these buildings also change over time and healthcare changes over time, how we deliver it. So we really should go back in on a periodic basis and do some sort of assessment. And I think that is also a global trend that we're seeing, we're seeing clients ask for that globally in different countries.

(08:47):

And I think the fourth, I'll just mention this briefly, is staff health and wellness. Clinician and non-clinician burnout rates are certainly a global thing that has come to our awareness, especially since COVID-19. And I think as architects and planners, we're really thinking about what's the impact of space design and flows and wayfinding on staff health and burnout. And so that's been a trend. Not a lot of research to back that up in terms of hard data, but I think we'll see more of that in the coming years.

(09:15):

Those are just some of the things from my clinical and research perspective, but I'm sure Matthew has some different ideas as well to add to this.

**Matthew (09:22):**

I was going to just add to that, Diana. I mean, I was thinking the same and thinking certainly from the clients I work with, some of the biggest considerations is really around staff and the availability of staff as well. We've seen post, or say post-pandemic, the deficit or the shortage of staff, especially staff globally. It's an indication that maybe 10 million doctors shortage across the planet, and how do health system operators respond to that.

(09:50):

So a big focus on one thing, so attracting and retaining staff. The other one is actually how do we support staff to work more efficiently or effectively within the health facilities. Those considerations around operational performance and the likes, to give staff or give them more time with patients and the likes. I think linking to what Diana said about the post-occupancy evaluation or the performance metrics, a lot more insight or intent to find the insight of are these health facilities delivering what we thought they were going to be delivering? Whether that's throughput, patient outcomes and the like. So looking at that much more rigorously than we have done in the past. I'm definitely seeing that.

(10:36):

The other thing is obviously is what is the future of health, where does digital come into it? Most of our clients are very focused on the digital integration and the delivery of care, and that's whether some sort of pre-hospital admissions, connections to primary and community and the like. So it's a huge amount of movement in that direction and we're just seeing that all over the place.

(11:01):

One of the things I would say is, is that really about how we, as all individuals, live in a digital environment. We all have our iPhones, our mobile devices, we are all very much more digitally aware. So how does healthcare then exist in that environment? So that's a very big trend I see.

(11:20):

Also, maybe some of the lessons of pandemic preparedness and the likes. How do we deal with surge, pandemic planning within the health infrastructure. And certainly my clients, particularly in Asia, they've got multiple experiences of going through different pandemics and they drive a lot of focus on that. I've also learning or learning more about how we can accommodate our infrastructure to respond to those events that we've been experiencing and will experience again in the future. There's no doubt about it, types of events that we've seen will occur again.

**Arthur (11:56):**

It's fascinating to hear all the different trends that are affecting design going forward. And I mean, the actual scope of it is much wider than I thought it was going to be.

(12:05):

But, Diana, I'd like to touch back to one of the points that you brought up because I found it fascinating, the role of the building in healthcare and the access to nature. How does your combination of medicine and architecture help solve some of the design and infrastructure challenges to help deliver better patient care?

**Diana (12:25):**

Yeah, no, I think there's lots of benefits to a hybrid specialty or viewpoint. Certainly I would hope that the dochitect model really facilitates a dialogue with our healthcare clients, given this dual knowledge that I have between clinical and design principles. They're both very complex professions, I think, and they're just getting more and more complex as time goes on. One architect cannot build a complex hospital campus and one clinician cannot take care of a complex patient, these take a group effort. But I think there has to be a shared language and there often exists a gap when you have such diverse specialties. And I see the dochitect model as really closing that gap. And the way I try to do that is through the application of empirical data or evidence-based design, that applying known research.

(13:15):

I can give you an example perhaps that might help some of the listeners. But architects may think about interior design and floor patterns and colors. I'm reminded of a unit for older adult patients in San Francisco when I worked as a clinical fellow. And the floor pattern had been chosen early on in the design process, probably with the best of intentions, to be a striped pattern. But what resulted is difficulty in patients actually walking across that pattern and increasing their mobility. And as many people I hope know, mobility is very important and we want people to get up and out of bed if they're in hospital. And many of the clinicians noticed in this particular unit that patients weren't doing so. For older adults, especially those with cognitive impairment, we see some changes to the brain. And sometimes they can interpret this type of pattern as almost a three-dimensional illusion and it might even be perceived as a staircase. A dark pattern might be perceived as a void or a hole in the floor.

(14:17):

And these things are documented in the literature. And so my role is often to look up the literature, to do a deeper dive, bring these types of empirical data points and papers to the design team and say, "Let's pause before we do this. I know there's the best of intentions, but we have to apply this data that we know to be true." So that closing the gap.

(14:38):

I think also having worked in hospitals and I see patients on a regular basis, who actually give me a lot of the ideas for my research projects and design feedback. It's what patients and their families say, and my fellow clinicians. But a lot of ideas there in terms of how to change what we do in design to make it more user-friendly and to increase the care delivery and the health outcomes.

(15:04):

Some more examples maybe. Call room locations. As a clinician, I've worked in units where the call room can be two floors up in a different building, and they're never used because we can't get to the delivery on time, we can't get to the emergency, the cardiac arrest on time. And so taking these little points to the architects I think is very important.

(15:25):

I mentioned the harms of bedrest. One of my constant battles is to say, "Let's get people out of bed." And as designers, we tend to put the bed in the center and design the room elements around that, both in nursing homes and in hospitals. For older adults and really anybody, even a few hours in bed is extremely harmful for our bodies. We got to get people up. Most of the reason that older people come into hospital and end up in nursing homes or rehab centers is not because of the disease process they came in with. We can treat pneumonias, we can treat urinary tract infections, we can treat wounds, but what we can't treat is the bedrest that happens. It takes on average for a day that an older person is in bed, it takes them maybe a week or more of rehab. So I think as architects, we have a very important role to work with clinicians and say, "How do we not have people stuck in bed? How can the design facilitate mobility?"

(16:20):

And I think another important role of the architect model is to inform guidelines and standards. I think there's great value to publishing a paper here and there with some of the data, like the floor patterns, but how do we enact large-scale change. I think a lot about this, and I think the best way to do it is to really base our minimum standards, our guidelines, our building codes, on credible data, so that we all across the board meet those minimum requirements. If we know that the window view of nature, let's say, has such a dramatic effect, is this in our minimum code so that we could never build something again that has no window or a window without a view. And so I think informing codes and standards is something that is extremely important and where I like to help out when I can.

**Arthur (17:05):**

It's amazing to understand how the smallest design choice can have such a massive impact on the health of patients. And I think it leads well into the next question for you, Matthew. What are some of the lessons that you've learned from past projects around the world, and how do you think these kind of insights can help build the foundations for future healthcare delivery?

**Matthew (17:28):**

I think it's an interesting question and I was reflecting on that. One of the things we see certainly in the type of work that I get involved in when they're big, major health programs, is the timeline of the delivery of that program of works. I think back to my experience, and depending on the locality and stuff, from the pre-planning phase through to delivery, and it could be easily ... I mean, eight years may be fast, it could

often be 12, 14 years from the start of maybe a business case and the likes. And as Diana said, some of those care models could change. So actually, how do we deliver infrastructure that may respond to technology, care models in the future, that we don't actually know what they are or how they will be at the moment.

(18:14):

The reflection I see is actually is how do we speed up that process hugely when we're talking about big infrastructure that might take four, five, six years to deliver, commissioning, pre-planning, design. A big emphasis at the moment on looking at every facet or every stage of that program about how do we streamline it or speed it up. And I see that across multiple client groups around the planet. The timeline is a really big consideration. That's probably one of the big things.

(18:44):

So how do you do that? An element of are we reinventing everything from scratch every single time, or can we actually bring those lessons learned and those examples and just continue to augment and deliver those to the benefit? I would say going back to what's the evidence on that, is it the right answer, the right thing, the right component and the likes. But actually look at some of those standardization elements across the whole paradigm of a project, such that we're not actually starting everything from scratch. And we're doing that already. Many of our colleagues globally around the planet have got that approach, but how do we look at the whole program of work to the delivery of a big hospital, infrastructure project, to speed the process up? And there's obviously many benefits to doing that.

(19:33):

In Singapore, we've been working with the Ministry of Health here for some time. They have a very major program of building, and that element of standardization is really ingrained in the approach to how things are delivered. Whether that's components or the likes, bringing those in and repeating them over multiple projects and programs to speed up is really very apparent across the work we're doing.

**Arthur (19:56):**

And I suppose, aligned to that that you've explained there, and you're learning from these past lessons, can we get any insights from other sectors or other industries or do you use them when applying it to the healthcare sector? Have you learned from other sectors or industries?

**Matthew (20:13):**

I mean, it's interesting. We talk about different sectors and how things work. And healthcare, I mean there's so many different similarities to different parts of the sector. Some people talk to me about aviation. There's different parts of aviation that have become relevant. Safety obviously in aviation is paramount. Safety is obviously paramount in healthcare. So the way that services are delivered. Aviation, again, things like flow management, separation and the likes, we see that in healthcare.

(20:41):

So, while you may have similarities, there's obviously great difference. We're talking about people's families and all those types. Technology is another one in aviation you see. We do learn from aviation, things like the check-in process, how those types of activity [inaudible 00:20:57]. The automation of

baggage handling, how the automation of logistics and delivery is becoming more apparent. But only choose on aviation as one example.

(21:06):

I think one of the challenges a little bit is also about how do we innovate, so what are those industries that got innovation built into them? Healthcare does change. We talked about the future care models, medication and the likes, also the disease profile and the burdens. How do we respond to those changes? So where are those other sectors of industry that demonstrate innovation and the likes? So bringing some of those in also become really apparent. And there is a tension there between standardization and innovation and we're very cognizant of that. How do you continue to innovate but reflect that we don't want to change everything all the time. So that's some of the challenges that we have when looking at these problems.

**Arthur (21:49):**

I just want to maybe delve into one of those challenges a little bit more, just to understand. If you're bringing in digital as a layer earlier on in the process and it's part of healthcare, obviously going forward, it's a very important part, how do you make sure that a project that is say five, six years long, like you've mentioned, how do you keep that technology iterating and that it doesn't become outdated? And then like you say, ensure that it's more of a standard across all the healthcare. Because it must be quite tricky to make sure that you're staying on the edge of innovation and technology.

**Matthew (22:19):**

I mean, digital is a really interesting one in healthcare because it's got so many facets, whether it's from the way that clinicians record and maintain data, the clinical environment, whether it's how projects are delivered, whether it's understanding what's occurred and the likes or seeing the visibility of what's happening.

(22:40):

I guess from what I've seen is having a platform that supports a level, so if you've got a framework that allows you to add to it. And I wouldn't profess to be an expert in all things digital. I work with very many smart digital people and I certainly look towards their expertise about how you can add that on. But I suppose what I do see is it's not one thing, it's a multitude of approaches across different areas. I suppose the area that I'm probably more connected with is probably around digital delivery, so how do we utilize digital to assist the rapid delivery of projects and the likes. I don't know, Diana, from your experience within delivering care and those trends, how do we add to the digital framework or the likes, I don't know if you want to ... Thoughts about that.

**Diana (23:33):**

Yeah. And I think there's just a lot of global disparity when it comes to the application of the digital environment into the built environment, Matthew. I just think of my home country of Canada where we're still writing everything on paper and we're still faxing, versus the United States that has an integrated electronic health system in many places. So I think there's a lot of discrepancies, but I appreciate Arthur's question of how do you keep us up to date. I think a big building, a big bed tower, takes many, many years



to get from the initial idea, schematic design, all the way to ribbon cutting and inhabiting the building. It can be up to towards a decade and medicine changes so quickly, so does technology.

(24:13):

So I think it's a real challenge. I like to think about spaces and architecture that flexes and is able to adapt over time, even though we don't exactly know what's coming down the pipeline. Maybe doctors will be robots in 50 years, I don't know, and can the building accommodate that? Certainly there's going to have to be changes. And that's why it's so important to do these performance evaluations and critically look at how the building's performing on a regular basis to understand how we might adapt it with current technologies.

(24:44):

I was thinking a little about your question, Arthur, about parallels to other fields, and I really appreciate that Matthew mentioned aviation. That's a very common one that's mentioned in clinical practice. It seems to be very efficient. I think my own opinion is that medicine is a field that changes quite slowly. And certainly, when I go into high-tech office buildings, I'm surprised, and then I walk next door to the hospital and it seems like you're stepping back in time by 50 to 75 years. I'm sure others have had that sort of experience. But I certainly take a lot of lessons from clinical medicine and the research fields into my design practice.

(25:21):

I think architecture and healthcare architecture specifically is also a very slow-changing field. I say that again to harp on this emphasis on evidence-based design and data. This shift towards empiricism, many fields have done it. In medicine, evidence-based medicine is standard practice. You couldn't be a clinician that looks at a patient and their disease process and says, "I'm going to treat it this way," without looking at what the data says. We have to do that. That's part of our code of ethics, that's part of how we professionally deliver care.

(25:52):

Nursing has shifted towards empiricism law, bioethics, maybe public health. I think architecture's a little bit slower to take on that trend. We could probably have a whole other podcast debating why, I'm not exactly sure, but we're trying to push some of that. But certainly when I look to other fields to thinking about empiricism is very important. We have to now pull that into our practice.

(26:16):

Also, how does design respond to the care delivery models? Matthew alluded to this in his prior answer, but something that we do in clinical medicine that has really shifted over time that I think we need to try to emulate in architecture, and we do sometimes but it's not really common practice, I don't think, is this idea of shared decision making. In medicine now, and I think listeners will agree, patients I hope are not sitting in a clinic, let's say, with a big desk in front of them and a physician behind the computer and the physician is telling them what to do. That really isn't our role as clinicians anymore.

(26:50):

We are really here to practice shared decision making, whereby what we essentially do is think about the range of options that we have, and this is in parallel with what we do as architects, what we should be thinking about the range of options with this particular individual. Then we should look at the evidence and we should use that to narrow down that range of options. But that's not enough, we have to go one step further to value preferences by multiple stakeholders. We have to think about who's in front of us, what are their values, what are their goals of care? How do they want to live with this disease process? What's important to them, what's important to their families? And then you essentially end up with your choice.

(27:28):

And I like to see design in that way. There are infinite possibilities. Certainly codes and guidelines and minimum standards will whittle that down initially. We can do a deeper dive into the data and get a few options, but then we have a real responsibility to think about stakeholder involvement and to make that very inclusive. I think we're doing a better job of that in clinical care to involve patients, understand who they are, understand who their caregivers are, and how they live.

(27:56):

But I think in architecture, it's still challenging for us to involve stakeholders in an inclusive way. We tend to hold user group sessions during design processes where we involve key clinicians and non-clinicians and hospital leadership. But I think we still have some work to do in terms of how we capture that information and apply that to our designs, and how we make sure we capture an inclusive set of opinions, how do we make sure we have a good patient representation.

(28:30):

And, Matthew, maybe in your projects you've had more experience with this, but I would like to see a framework or methodology for gathering feedback as we design buildings and make sure we have patients there. We often have clinicians there. I'm not sure we often represent patient opinions as well as we could.

**Matthew (28:47):**

You remind me there, Diana, of, I may have mentioned in the past, a project we did in Roma in West Queensland, which was a relatively small project and it really covered almost all services. It's a rural health facility with a limited site. We spent a lot of time looking at what we would call the block and stack or the arrangement and distribution of services. And we engaged with the local community, obviously significant Indigenous community there. And I was probably being a bit naive thinking it'd be great to have the inpatients on the upper level, views over the landscape and the likes. And I remember them engaging and saying, "But Matthew, we don't really want that. We want to be connected to country, connected to ground."

(29:34):

And I suppose having that level of engagement at that point in time we did. We actually changed the block and stack on the project. It was early enough. Bring the inpatient accommodation to the ground floor. Every single bedroom had a direct access to the gardens or the exterior, and that was really successful. I think I was really proud actually how, because of that level of engagement at that moment in time. It wasn't too late, it was early enough that we were able to accommodate it. And it was really good outcome I

think for the community there in Roma, or in Marano. So I think Diana's comment there that there is a place for that engagement and you can't underestimate how meaningful it can be.

**Diana (30:11):**

Well, I think that's a great example. And I like the cultural sensitivity to that, involving users early on. I have a similar example. You just reminded me of a famous hospice building in the United States whereby they needed to build a new building. They had two different sites, and they actually went to the patients who would be living their final days in this building and said, "Which would you prefer?" And it was on the ocean. One of the sites was on a beach, overlooking the sea, and the other site was in a canyon, overlooking many of the highways around this area.

(30:43):

And intuitively, I just assumed the beach would be what patients would choose. And actually they all really preferred to be in this canyon where they could see cars whizzing by and have more of a connection to daily life versus looking at the ocean. So really interesting. And I think it just speaks to the importance of who is using the building and get them involved early on. Very important.

**Arthur (31:05):**

It's amazing to hear the role of engagement and how important that patient experience is and through those stories. But I think moving away from that, there's obviously we also need to think about sustainability and return of investment when we talk about healthcare infrastructure and it's two of the key focuses. And at times they seem they can be directly opposed.

(31:28):

What would be your advice when you're trying to reconcile the two? I mean, there's so much that we trying to achieve in healthcare architecture, but obviously sustainability and return on investment are two key points that have to be kept in mind.

**Matthew (31:41):**

I think it's a good question, and I suppose part of me would question, are they opposed or are they not actually aligned? We have a moral responsibility to respond to the challenges of climate change, global heating and the likes, and healthcare have been a significant contributor to climate change. If you look at the numbers or percentages of how healthcare delivery has been, it could have partly accelerated climate change.

(32:13):

Our response as planners, designers, and the likes, is to adjust or reconcile some of those challenges. I certainly believe and see in most of my clients, that response now becomes the forefront of thinking. Whether that's regarding materiality and the likes in its health facilities, what is in the low-carbon materials. But that has to go further than just the building. I mean, I think we've been talking about low-carbon buildings for some time, but actually then how do we run a health system and the likes which has got decarbonization or the likes, within its full remit.

(32:54):

And so some of those things about what is the role of the hospital where services are delivered and the likes, again, seeing much more emphasis on where care is delivered. Can we deliver care at the home, is that going to be a lower carbon outcome? What is the decision around all those consumables and the likes within a hospital setting? How do we reduce the waste and the likes? So most of my clients are absolutely engaged on this and I don't really see them thinking it's a conflict. The two have to go together.

(33:30):

And I think that change is accelerating even further and faster at the moment. And if we don't do it, I don't think we have any choice, we have to get on and do it. And most of my clients are wanting to do it, I find. I don't know about you, Diane, if your thoughts to that?

**Diana (33:44):**

Yeah, I mean, I have more of an emotional response to this question I think than the others, perhaps, Arthur. But I think it's patient care, bottom line, period, stop. Sustainability, return on investment, that's definitely of a lesser value in my mind. I think it's important to think about, but it's about humanity and people, and the other elements will follow if we do it right and we care for people first. I've seen such a pendulum shift to not thinking about staff health and thinking about return on investment over patient outcomes. And I think it just has to come down to helping people heal or helping them live the best possible life in the healthiest way they can.

(34:28):

I should make it clear though that what I've been talking about applying data and evidence, I think there's a popular idea that that's more expensive and will cost more. And I really want to debunk that myth. And there's actually evidence and good data that's been published out there. The Business Case for Better Hospital Design is a famous paper, but if you utilize good quality research in your design processes, this is cost saving. Even if, and not always, but even if there's a slightly higher upfront cost, the return on investment is strikingly short. And I'm definitely not a business major, I'm not very good at that, but I certainly think it was, I think, two years in the data. That's pretty good.

(35:10):

And you can apply a cost to pretty much everything in medicine. We have quality-adjusted life years. We put a cost to every fall, every physician that burns out, there's a cost to that, so we can actually cost it out. There's a great paper recently that I talk about a lot because it's just such a striking result. It was a nursing home. This is a researcher out of Boston. And what they did is they just changed out all the light bulbs, simple. And actually it's more sustainable this way, but there's an upfront cost to doing that, couple thousand per bulb, couple hundred, whatever it was.

(35:42):

But the result, they measured falls, and falls are what we call a never-event. They really should never happen in a hospital or nursing home, but they're very common and they're very expensive, and they also have pretty severe affects to people who sustain a fall. Often it's quite a serious injury, there needs to be a hospital trip. They were actually able to reduce falls with just changing out these light bulbs. To think about the spectrum of light, the level of blue light during the day and at night to really understand our circadian rhythms, like let's utilize the science, they actually decreased falls by up to 43%.

(36:16):

And I should say that that's a very striking fall reduction rate, even higher than some of the AI-assisted robotic fall prevention programs. And this is not high-tech, and they're more sustainable. So you almost get the benefits of patient care, you get the sustainability, and you get the return on investment, all in one simple example that is research-based.

(36:37):

I think that's a good example for this question, but it always has to come back to people. I worry sometimes that we go down a rabbit hole around cost savings and sustainability, but really in my mind as a practicing clinician, it's about the patient in front of me and the next one who's coming in the room. But research, it's all about the data and the research.

**Arthur (37:01):**

Some of these numbers are incredible and the actual effects of the decisions are amazing, from the light bulbs and the impact of it. Incredible. As the last question, what would you say are the future trends in technology you're most excited about in this sector? I think, Matthew, if you can go first?

**Matthew (37:19):**

That's a good question. I mean, technology, we spoke a little bit around digital and how digital is going to interface with healthcare. I suppose one of the things I reflect on a little bit is we talk a lot about the growing, you could say, demand of healthcare and the cost burden of healthcare. And I think that whilst we're in the paradigm of healthcare being a treatment-based service that we're treating things, with the technology, with digital, whether it's my watch on my wrist and the likes, moving healthcare into a prevention or preemptive type model, I think that will be the paradigm shift that we will see over probably in my own lifetime.

(38:00):

We will be able to anticipate before the event occurs. We will be able to do interventions before they happen. Whether that's with diagnostics or medication. I think that paradigm shift is coming and that will change a significant amount of our approach to the delivery of healthcare. So actually a preemptive approach to healthcare. I can't ascertain exactly how all those pieces will come together, but with technology, I think healthcare will be different in 20 years' time.

**Diana (38:36):**

Yeah, I certainly agree about that. Trends I was thinking about. Arthur, really are I think for me around interdisciplinary teams coming together to solve some of these very complex health challenges that are here already and also coming down the pipeline. I think the dochtect idea of combining architecture and medicine, but like I said before, healthcare spaces, healthcare issues, even one patient's complex chronic care, people come in, they're living longer, older, lots of disease processes or entities that last many years, diabetes, heart disease, dementia. It takes a team of individuals, it takes a lot of expertise.

(39:14):

If you look at any clinical publication and big research study, there's not just one or two people on it, it's an entire group. And I think we're just going to see that increase, both in architectural health design and in

clinical practice. We're going to need lots of different kinds of experts at the table to figure out how we're going to deal with some of the problems and solutions.

(39:35):

And then this isn't really a trend. I hope it becomes one, and I wish it was one right now, but getting architects involved in policy decisions and some of the public health issues. Architecture is a public health issue. I say that because in a hospital building, a nursing home, it's not just one or two people that are coming through there. We are treating generations of people. And how we design these spaces, where we put them, really impacts health. And so it's so many numbers of people that it's definitely a public health issue.

(40:07):

I would really like to see architects involved at the political level, involved in things like nursing home reform. And it's been very hard to get that message out there, but that's a trend that I hope changes. We do have a good level of expertise, problem solving skills, and we see things in a different way when we put our design hat on. And so I really hope that we become part of the discussions at that level, beyond what I think we're doing now.

(40:33):

Technology question is an interesting one, and yeah, maybe my thoughts on that might be different to Matthews, but I see certain trends coming down the pipeline for technology and I think we will increase in terms of high-tech design process. I've heard some ideas or I think about things like apps to potentially read our floor plans early on and spit out health metrics. For example, if we design a particular critical care unit or post-op recovery space, maybe this room has poorer metrics, infections are going to be higher in this room. So can technology help us almost predetermine the outcomes based on our space designs before we build something.

(41:16):

And then can we actually, instead of building a building and then coming in a year or two later to do these post-occupancy or performance evaluations, can we use technology on our side. Can we build virtual models and go through the space and utilize it virtually and then measure outcomes before we actually do the bricks and mortar, that's another idea that's been talked about in the literature.

(41:37):

But then I might conclude on a point that may be controversial, but I'd say technology is great, but let's not forget about the basics. If you think about the tuberculosis sanatorium model, they worked really well. People were outside a lot of the time, that was part of the treatment utilizing nature. There's a great example I'll maybe end on, Arthur, but there's a big hospital in the United States for children. And if you go into the large multistory atrium lobby, they've installed a huge digital screen, many meters high, and on the screen, you often see fish tank footage and fish swimming around. I had the opportunity to go visit, and when I went inside, there's maybe a couple of kids staring up at the screen, but everyone's huddled in the corner. And when you go to that corner, you see a real small life-size fish tank with real fish swimming around, and that's what the kids are looking at.

(42:30):

So let's not forget that high-tech is great, but we also just really need to not forget that we need to connect back to non-high-tech and to nature and bring that in, because it's just part of our humanity and what we really are drawn to and what helps us from a health perspective. So that was my thought on the technology question.

**Arthur (42:51):**

Matthew and Diana, you have provided so many insights that it's made my job really difficult at providing one takeaway lesson from either of you. But I think that, Matthew, the impact of your cross-sector global experience and asking the right questions and the role of stakeholder engagement was really insightful.

(43:13):

And from you, Diana, I think that you've explained just how powerful design and architecture choices are and why it should be part of medicine going forward to be. They're very complimentary. But thank you both for the discussion.

**Diana (43:26):**

Thanks. Thanks, Arthur.

**Arthur (43:27):**

Thanks very much.