

Can ‘Extended Reality’ Technology Bring More Humanity to Health Care?

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Contributor to *Health Progress*

The creators of Radiance, a virtual reality program, initially designed it as a mixed media art piece and displayed it in a Savannah, Georgia, museum.¹ Users put on a headset and joined a digital world that featured an immersive light field that showered them with a swarm of glowing particles, all set to music.

“We had so many people wanting to do it, the museum couldn’t keep enough headsets available. They wore them out,” says Teri Yarbrow, immersive reality professor at the Savannah College of Art and Design and one of Radiance’s creators. But the display proved to be more than a source of entertainment. Using layered patterns, geometric designs and ancient iconography, the work was created to conceptualize the connection of all life, but it had an unanticipated effect on attendees. Many said it calmed their fears around mortality. Users described it as a deeply moving spiritual experience that inspired feelings of awe. “I had a number of people that experienced Radiance say to me, ‘I’m not afraid to die now,’” Yarbrow says.

These intense and unexpected emotional reactions sparked the idea of using the program with palliative care and hospice patients at The Steward Center for Palliative Care, also located in Savannah. Its virtual reality program helps patients manage pain and the emotional and spiritual challenges that come with serious, life-changing diagnoses or end-of-life care.

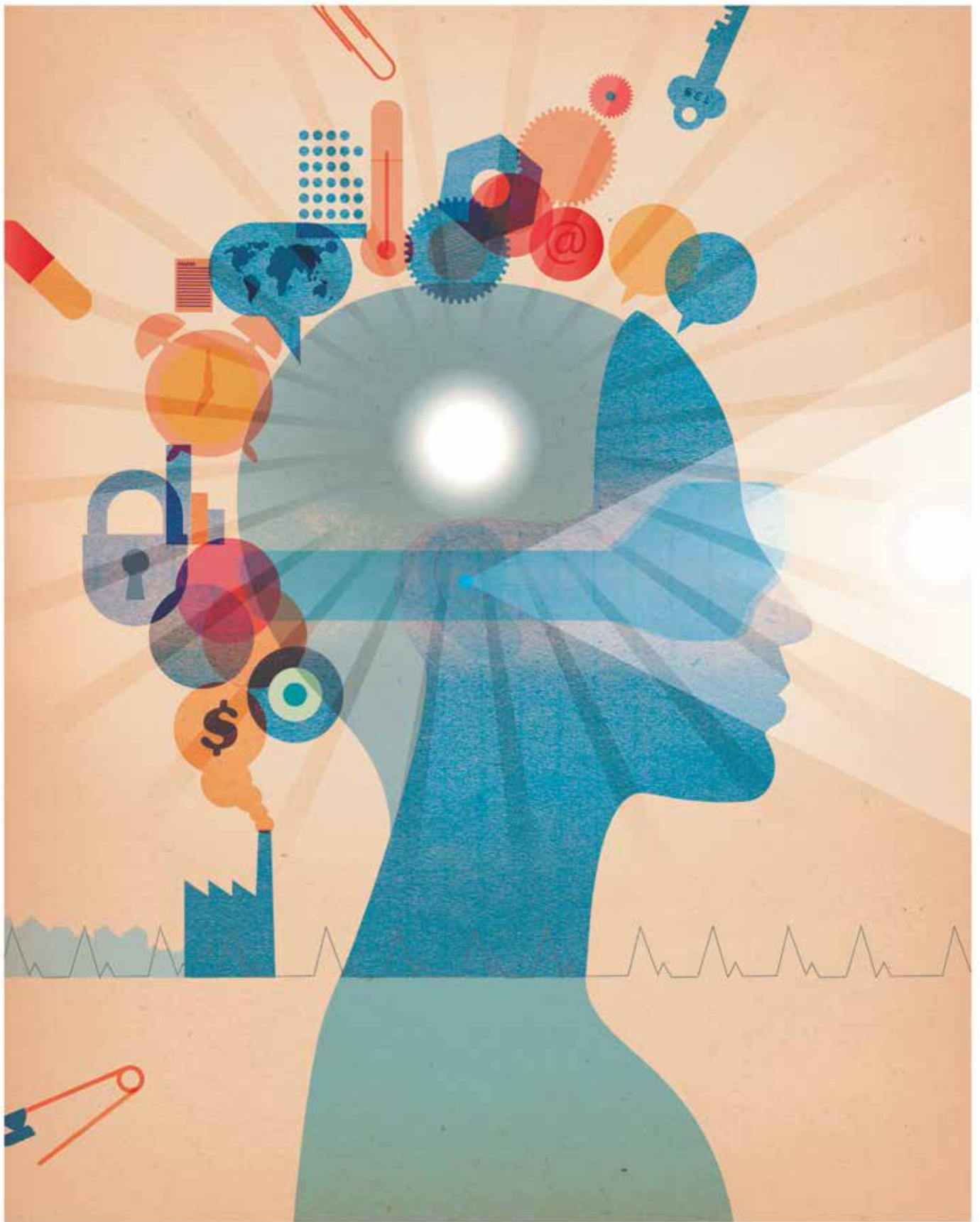
Technology may seem like an unlikely candidate to bring humanity into medicine, but Kathleen Benton, president and CEO of Hospice Savannah, which runs the Steward Center program, says that’s what virtual reality is doing for patients. “We went into VR for pain reduction, and to give our patients a fun experience and something

extra,” Benton says. Through this powerful tool, the program and other areas of health care are exploring opportunities to channel these broad and rapidly-expanding applications into many specialties, from pain management and mental health to physical therapy and medical training.

A NEW ‘ESSENTIAL UTILITY’ ON THE HORIZON

Virtual reality technology isn’t new. It’s been around since the 1960s, says Dr. Mark Zhang, associate chief medical information officer at Brigham and Women’s Hospital in Boston. “But I think there’s been a big surge of interest over the last couple of years.” Virtual reality is included under the broader term extended reality, or, in health care, as Medical Extended Reality. (See sidebar on page 53 for the multiple terms used for virtual reality technologies.) Globally, Medical Extended Reality could become a more than \$20 billion market by 2028,² and Zhang believes it will one day prove as revolutionary as the internet. In coming years, the field will mature, Zhang says. “Just like with smartphones, when that inflection point happens, suddenly it will become an essential utility,” he says.

Today, health care organizations are testing various uses for Medical Extended Reality and collecting data to see how well it can work. There are now nearly 20,000 published research studies on it, with more than 3,000 from 2022 alone,



according to an article on Cedars-Sinai’s website.³ While not all studies show a benefit, many do, and proponents say that Medical Extended Reality not only helps patients clinically, but can bridge gaps in access by providing an in-home option. Insurance doesn’t cover these treatments, but that could change within a year, which could further expand its access, says Dr. Omer Liran, an assistant professor of psychiatry and behavioral neurosciences at Cedars-Sinai Medical Center in Los Angeles.

The field will also get a boost as the technology continues to improve and become more accessible, Liran says. Recently, some heavy hitters moved into the extended reality market, including Apple, with its soon-to-be-released Vision Pro spatial computing device, and Meta, which rolled out its Meta Quest Pro headset last year and pumped \$10 billion⁴ into the virtual reality and artificial intelligence market in 2022.

FROM PATIENT TREATMENT TO MEDICAL TRAINING

One of Medical Extended Reality’s most well-tested applications in health care is as a side-effect-free treatment for pain. In 2021, the FDA approved the first medical virtual reality device to treat chronic lower back pain at home, a prescription device called RelieVRx (formerly EaseVRx). It uses a virtual reality headset, controller and “breathing amplifier” to guide the user through 56 cognitive behavioral therapy sessions that are each two to 16 minutes long. After an eight-week intervention, 66% of patients reported more than a 30% reduction in pain, compared with 41% of people in the control group who also experienced a reduction in pain and used an alternative 2-D system.⁵

In another study, people recovering from burn injuries who used virtual reality and stan-

dard medication during excruciating wound-care procedures saw a 35–50% reduction in pain, compared with people who took medication alone.⁶ Experts believe that Medical Extended Reality lessens pain by diverting the brain’s attention, diminishing some of the mental resources it uses to process pain signals.⁷ It can make medical procedures easier for both adults and children and lessen or eliminate the need for pain medications, including opioids.

Medical Extended Reality also has an established track record in mental health, treating anxiety, post-traumatic stress disorder and phobias, says Dr. Jose Ferrer Costa, a clinical team leader in Barcelona, Spain, of the XR Medical and Health Care team for Educators in VR. The technology is also becoming a cornerstone of medical training, allowing doctors and other clinicians to practice complex procedures safely in a virtual world. Medical Extended Reality, paired with artificial intelligence (AI) algorithms, can create experiences that are both realistic and interactive.

For example, AI can enable conversations with virtual avatars or enhance training by creating true-to-life patient scenarios. “The technology is being used to plan major surgeries collaboratively,” Zhang says. It can also guide procedures. Augmented reality layers medical images onto the patient’s body, for example, overlaying the image of a tumor on the surgical field, to make sure the surgeon doesn’t leave remnants behind, he says.

Medical Extended Reality is also finding utility as a diagnostic tool — for example, a headset to perform specialized vision tests — and makes it possible for people to work together, remotely. “There’s a company that’s essentially building a virtual radiology reading room. So, instead of spending money on an immovable high-fidelity reading room, you can actually do most reads in a

UNDERSTANDING VIRTUAL REALITY TERMINOLOGY

When people talk about virtual reality technologies, you might hear them referred to by various names. Below is a guide to explain the differences:

- **Virtual reality (VR)** immerses the user in a simulated digital world.
- **Augmented reality (AR)** puts a digital overlay on top of a real-world view. The smartphone game Pokémon GO is an example of AR. Digital characters are added to a real-world camera view.
- **Mixed reality (MR)** blends the real and digital worlds and allows the two to interact.
- **Extended Reality (XR)** is the umbrella term that covers all of these different technologies.
- **Medical Extended Reality (MXR)** refers to all these applications as they are used in health care.

Awe-inspiring virtual reality trips help people feel like they are part of something much larger and can make them less fearful of death. “These are people who are held hostage by their bed and their disease, and we’re able to achieve awe for them,” Kathleen Benton says.

virtual space using a portable headset,” Zhang says.

But the technology’s benefits aren’t only clinical. Sometimes described as an “empathy machine,” Medical Extended Reality enables clinicians to feel what their patients feel, including what it’s like to have certain medical conditions or impairments or to receive bad news, Zhang says. This can help doctors improve communication. Ferrer Costa is also testing virtual reality as a means of preventing burnout in stressed-out health care workers using a system that teaches emotional management strategies, such as mindfulness techniques.

Medical Extended Reality also has immense potential in geriatric, palliative and end-of-life care. The Steward Center for Palliative Care invites often-bedridden patients to take bucket list trips or adventures — such as dipping into the sea with a pod of dolphins or skydiving — says Yarbrow. One Alzheimer’s patient, a music lover, got a front-row seat alongside the orchestra at a Beethoven concert. After one session, the woman, who sometimes struggled to remember her own name, spontaneously played songs she once knew on the piano, Yarbrow says. These interventions can improve quality of life and reduce loneliness and anxiety.

Medical Extended Reality programs like Radiance also help people tap into the complex emotion of awe. “Awe is the feeling you get when you take a walk out in nature and see that you’re just a small piece of this universe,” Benton says. Scientists studying this emotion say people who experience awe reap a host of benefits, including a sense of connectedness, mood improvements and even physical changes, such as a decrease in markers of chronic inflammation.⁸ Awe-inspiring virtual reality trips help people feel like they are part of something much larger and can make them less fearful of death. “These are people who are held

hostage by their bed and their disease, and we’re able to achieve awe for them,” Benton says.

BRIDGING ACCESS GAPS

Medical Extended Reality could also be a valuable tool to compensate for the staffing shortages plaguing health care. The technology can be used at home, giving it a unique power to reach those who might otherwise go without treatment. “VR has the opportunity to touch patients that do not have ready access to the health care system,” says Dr. Lindsey Ross, an assistant professor of neurosurgery and spine specialist at Cedars-Sinai Medical Center. “We currently have a study that tests the use of VR in rural communities. VR has the ability to not only bridge gaps in health care where location is a barrier, but also may be the key to addressing health care issues where there may be a shortage of providers, such as mental health care, obesity medicine or physical and occupational therapies.”

The need is particularly acute, and likely to worsen, in mental health care. “Right now, there is a huge shortage of mental health workers, especially in the United States, but really everywhere. And this is one solution to deliver that care not in clinics, but in people’s homes,” Liran says. While virtual reality isn’t yet on par with a visit to the therapist, Liran says they are working to improve the experience. Once the technology matures, some people might still prefer to work one-on-one with a professional, he says. “But right now, half of Americans don’t have that choice,” he says. If they don’t have access to a therapist, they have few other resources. Virtual reality will give them an option.

PUTTING GUARDRAILS IN PLACE

Overall, Medical Extended Reality use in health care is still spotty and driven mainly by early



A patient at Cedars-Sinai Medical Center in Los Angeles uses a virtual reality headset as part of their care.

adopters — those who were impressed by the technology and found ways to put it into practice. Zhang says that as the leader of the Brigham Digital Innovation Hub, which is part of the Mass General Brigham health system, he looked to see how the technology was being used at the organization and discovered 30-plus independent research projects. Zhang’s team has since worked to build a collaborative Medical Extended Reality community at Mass General Brigham, which led him to a larger mission. “I realized that the same kind of issues we were seeing within our system were replicated across the entire nation and the industry as a whole,” he says. This pushed him to establish a professional society for the technology, the American Medical Extended Reality Association (AMXRA). He now serves as its president and founder. The interprofessional, nonprofit medical society aims to create a central hub for information and education on Medical Extended Reality and to set professional standards around it. Zhang says a medical journal for this technology is also in the works to provide a central source for research.

While he’s a big advocate for Extended Reality technology, Zhang says it’s also important to proceed into this new field with a touch of skepticism.

“Part of the reason why we’re creating AMXRA is to have an independent, nonindustry-sponsored group that’s able to advocate and to help create some of these guidelines, and to have an impartial perspective on the field as a whole,” he says. “People need to consider the implications of using the technology.” This means understanding how it’s best used and potential drawbacks. With technology also comes concerns about privacy and security. “That’s going to be another piece that’s going to be interesting to navigate,” Zhang says. “This is at the early stages, and we’re building the foundations to hopefully try to address this. I don’t think there’s going to be a magic bullet. I think it’s going to take many years. But I don’t think that’s a reason not to start, because we have to start.”

Ultimately, he sees the shift into the virtual world as an inevitable change that needs to be managed well to fulfill its potential. It’s critical to ensure equitable access across different groups, some of whom will need help to make that leap into the digital world, Ross says. “Older patients or patients with less access to technology may feel like VR is not for them,” she says. Establishing an education program, building trustworthy referral networks and using culturally-inclusive materials can help to open the technology to more people.

By ensuring everyone has access to the digital world, health care and patients will be better positioned to reap its future benefits.

KELLY BILODEAU is a freelance writer who specializes in health care and the pharmaceutical industry. She is the former executive editor of *Harvard Women's Health Watch*. Her work has also appeared in *The Washington Post*, *Boston* magazine and numerous health care publications.

NOTES

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3. "vMed23: How Virtual Reality is Transforming Medicine," Cedars-Sinai, April 10, 2023, <https://www.cedars-sinai.org/newsroom/vmed23-how-virtual-reality-is-transforming-medicine/>.
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QUESTIONS FOR DISCUSSION

Hearing about the different technologies involved in Medical Extended Reality raises a lot of interest and questions about how it is currently being used in medicine and what the future holds. Author Kelly Bilodeau describes some of the approaches and programs being used around the country.

1. While some of these approaches, like the ability to communicate and share information in virtual environments may provide for more specificity than a phone call or a communication over a laptop, do you have concerns about what these practices mean for the healing strength of presence and touch? How can such technology better serve human interactions?
2. Did reading this article make you think of therapies or interventions in your work that could be delivered through virtual or augmented reality? Is there any mechanism in your health care environment to share ideas or to voice interest for further training in these areas?
3. This article discusses the feeling of awe, and how some sick people or those with limited mobility report experiencing awe when immersed in a visual and sound experience that transports them. Are you able to take time or have experiences that bring you a feeling of awe? How can opportunities for awe be more likely in your everyday life?
4. As a mission-driven ministry, what opportunities do you see for the use of Medical Extended Reality in our call to provide for the spiritual, emotional and mental well-being of patients? How might related treatment options support patients as they may be facing their own mortality, contemplating the existence of God or considering what lies beyond their physical lives?

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