White Paper:

Creating a Virtual Reality Healthcare Program for Pain Management

Since at least 1994, when the Oregon Research Institute (ORI) used virtual reality to train mobility-impaired children on how to control their motorized wheelchairs, VR has played a role in healthcare.[1]

Until recently, exploration and testing of virtual reality healthcare programs has been confined to researchers and clinical research organizations (CROs). But why? A quote from that 1994 ORI article sums up the adoption problems well: "Virtual reality technology is still expensive, and until the costs drop it will remain in the hands of theorists and developers. Even the crudest systems cost $30,000, and the imagery on most of the applications ... is more cartoonish than real. ... The hardware is complicated and often unwieldy. The user must don a headset that is hooked up to a computer and often weighs several pounds."[2]

In the last three to four years, however, those adoption challenges have vanished, making it easier for health facilities to institute both patient care and staff training programs. The emergence of high quality and affordable VR headsets that work with smartphones has put the use of virtual reality healthcare programs within reach of just about any healthcare facility.

This paper will explore the technology improvements that allowed this change, the promises of VR to manage pain and how any health facility can begin their own program.

Improved Technology, Lower Costs and Higher Quality Content

Patients who received a VR headset realized a 24 percent drop in pain scores after using the VR program.[4]

The days of bulky, expensive, wired VR equipment are gone. The improved computing and processing power of smartphones has opened the way for any health facility to create a VR program. High-resolution LCD and AMOLED display technology has greatly improved the immersive feel of VR environments. Gone are the cartoonish, less-than-impressive VR environments that suffered from latency due to delayed data and video processing. Today, for the cost of a smartphone paired with a lightweight headset,[3] VR is within reach of healthcare providers who want to explore it as a treatment option.

The use of VR in healthcare today draws on years of experience gained during clinical trials. In their trials, researchers learned how VR used for healthcare must differ from VR used by consumers. A patient's movement is often constrained in a health facility, for example, by being wired to IVs or machines that measure vital statistics. They may be further restrained due to the reason they are in the health facility in the first place, such as sickness, injury or surgery, and the weakness that recovery and certain medicines may cause. Content creators realized that VR health program content had to consider these limits.

Production and content companies have begun to crack the code on what makes VR content different from, and how it can be superior to, video or other two-dimensional environments. What it often comes down to is total immersion in a realistic 360-degree environment, as shown in trial results from a Cedars-Sinai study. In the study of 100 patients, the 50 who received a VR headset realized a 24 percent drop in pain scores after using the VR program, whereas the other 50 patients, who were allowed to watch 2-D nature videos that also showed relaxing scenes with soothing music, also experienced pain reduction, but at a less dramatic rate.[4]

## VR Not Just for Large Hospitals and Research Centers

"Big hospitals and research centers are using virtual reality, but significant interest is now coming from community hospitals and small health systems," says Josh Sackman, president of AppliedVR, a virtual reality platform and content provider.

What is generating that interest from smaller health facilities? Says Sackman, "For smaller systems, patient experience is a particular challenge. They are more reliant on Medicaid and Medicare reimbursements, and the opioid epidemic and addiction have a greater impact on their efficiencies."

The lower costs of VR sets also makes smaller facilities more open to using virtual reality. Yet Sackman says, "Offering an affordable product is not enough. It must fit seamlessly into the workflow and user experience." He continues, "If VR doesn't increase efficiency or reduce costs or increase differentiation or create better clinical results, then health facilities won't adopt it." AppliedVR partners with Samsung to deliver a turn-key VR program solution. "We make it as simple as possible. In a matter of 20 minutes, a team can be up and running," says Sackman.

Reducing Patient Pain and Stress

There's a reason why VR enthusiasts in the healthcare sector have focused on pain and anxiety management.
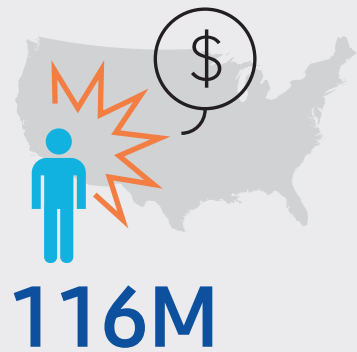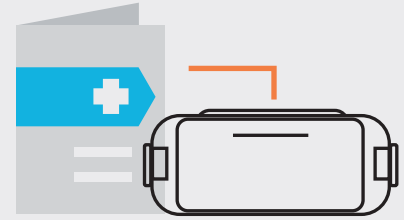
116M

In the U.S. alone, 116 million adults struggle with chronic pain[5] at a cost of $635 billion in lost productivity and treatment.[6]
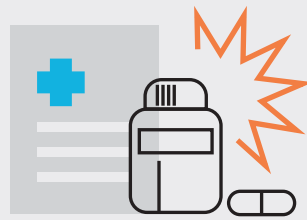
259M

In 2012, healthcare providers wrote 259 million prescriptions for painkillers, which is enough for every American adult to have a bottle of pills.[7]

CDC

The Centers for Disease Control and Prevention (CDC) issued guidance to healthcare providers to choose alternatives to prescribing opioids for chronic pain.[8]

Some of the most promising results of VR use in healthcare have focused on relieving or managing pain and anxiety. Consider these examples, which not only show success in relieving pain but also in reducing other related measures, like pain medication use and pain scores.

AppliedVR, a company that offers both virtual reality content and a VR platform, describes their experience in a VR program at Buena Vista Surgery Center in Burbank, California:

A six-year-old child was scheduled for reconstructive surgery on a tumor in his hand. Standard procedure is to give pediatric patients an anti-anxiety medicine as part of pre-op preparation. The medicine can cause drowsiness and can decrease anxiety in their pediatric patients, but sometimes the drug has unwanted side effects, such as nausea or lingering drowsiness even after the procedure is complete. Instead of the medicine, the child was given a Samsung Gear VR headset that immersed him in a distracting game.[9] The novelty of the experience immediately attracted the child and reduced his anxiety level. Anesthesia was used during the surgery, but even after regaining consciousness post-surgery, the child displayed no anxiety and was eager to recount his experience in the VR environment.

VR has also proven beneficial to patients undergoing long and grueling chemotherapy treatments. Start VR, a Sydney-based VR studio, collaborated with Samsung Australia and the cancer treatment center Chris O'Brien Lifehouse in a program that used VR to relieve stress for diagnosed oncology patients undergoing chemotherapy treatment.[10] In this case, VR is used as distraction therapy. Patients put on VR headsets and then can choose an experience from a catalog of content that ranges from visiting a travel destination to petting koalas, to skydiving.

"Allowing patients to escape the experience of chemotherapy gives them a bit of space to forget what's going on. In settings such as before surgery, patients are even more anxious. This gives them a distraction and allows them to keep their spirits

up. Wellness isn't just about the physical side of things, it's also about mental well-being," says Michael Marthick, complementary therapy director at Chris O'Brien Lifehouse.

VR can also be used to lower pain scores. Cedars-Sinai has been using VR with hospital patients who score pain as a three or higher on a scale of 10.[11] These patients are fitted with VR headsets and then immersed in a virtual experience that may include a ride through an Icelandic landscape or swimming with whales. After the experience, the patients reported a 24 percent overall drop in their pain scores. After the success of this trial, the hospital is now conducting a larger trial to test how VR may impact pain medication use, the length of hospital stays and patient satisfaction scores after discharge.

Pain's Impact on Healthcare

One crucial step for healthcare providers to take in the growing national addiction to opioids is to choose therapies that avoid ever prescribing opioids in the first place.
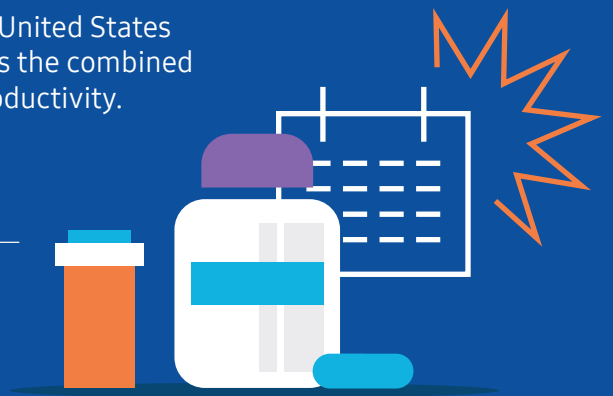
$560B
The annual cost of pain in the United States is $560 to $635 billion.[12] That is the combined cost of healthcare and lost productivity.

3 weeks
In 2015, the amount of opioids prescribed was enough for every American to be medicated around the clock for 3 weeks.[13]

15x
Even at low doses, taking an opioid for more than 3 months increases the risk of addiction by 15 times.[14]

46
people in the U.S. die each day from an overdose of prescription opioid or narcotic painkillers.[15]

Creating a Virtual Reality Healthcare Program at Your Facility

Many conditions make this a favorable time for health facilities to start VR programs for anxiety and pain management: the need to address pain management in ways that don't lead to opioid use and subsequent addiction, the advice from health organizations to explore therapeutic treatments for pain, the lowered cost of VR devices and improved content. These are just a few of the driving forces leading healthcare facilities to consider using VR as part of their treatment options.

If your goal is to create a VR program, where do you start? Consider these steps on how to choose a viable project, develop and execute a plan, and measure success.

Step 1: Make a Plan

Start with a viable project

A good starter VR project is one that has low startup costs, creates high impact in therapeutic areas where VR is proven to work and delivers measurable results.

VR has proven particularly effective at distracting patients experiencing acute pain or high anxiety. It does this by flooding the brain with sensory input through immersion into a realistic virtual world. VR takes advantage of how the human mind works. When patients have nothing to focus on but their pain or anxiety, then the pain and anxiety are amplified. The use of VR overwhelms the brain, removing the focus from, and thereby lessening, their pain.

The VR program at Buena Vista Surgery Center described above is a good example of a starter project. The focus of the project was narrow: helping children cope with pre-op anxiety. The program's goal was to reduce the use of a pre-op anti-anxiety medicine that did lower anxiety, but also came with unwanted side effects. This was an easy goal to track simply by comparing the use of the anti-anxiety medicine before and after the VR program started. Having a specific target audience also helps with program success. Their target group was children, arguably a technology-enthusiastic group that would be both open to and intrigued by the use of VR.

Another reason for the project's measurable success was the limited time frame for when VR was used. In this program, it was only used during pre-op. That small window allowed for easier device tracking and management. The program also delivered measurable results in the decreased use of the anti-anxiety medicine and the enthusiastic reception of the program by the patients.

Choose equipment and content

In selecting a VR headset, consider quality, comfort, reliability and availability of content. When researching hardware providers, look for those experienced in the use of VR in healthcare. Choosing vendors that have worked with other hospitals and health facilities is valuable as healthcare has more limitations and parameters than other sectors. Consider how the VR products address the need for sanitation and infection control between uses. Check that the equipment provider offers a variety of products you can choose from so you can pick the gear that is suitable for your patient population.

For content providers, again, seek those experienced in creating content and platforms for healthcare programs. Find out if the provider creates content that considers limitations patients may have when using VR. For example, in many instances, patients will be seated or lying down. They may have limited mobility due to the condition they're being treated for or because they're attached to IVs, heart monitors or other wired machines.

Another consideration is the content itself, particularly when the VR program is being used to address pain and anxiety. Pain requires attention. If you can draw the patient's attention away from pain, the perception of that pain lessens. That requires VR content that provides constant distraction.

Motion and the speed of that motion are other areas that content providers must respect. Patients, in addition to physical limits of their condition, may also be prone to motion sickness and nausea due to anesthesia or other medicines.

Finally, content must be chosen that is appropriate for the ages and demographics targeted by the VR program. The content may need to be appropriate for a wide range of ages, or it may need to be targeted to specific age groups.

Choose between a DIY or turn-key implementation

There are two main options when executing a VR healthcare project: DIY or turn-key. DIY requires having team members who can manage the VR project. This includes choosing software, choosing content and educating team members and patients on equipment use. It also includes keeping the VR equipment updated with any needed software patches, following a security plan to keep patient data off the system and locking the equipment so patients can't browse other sites or download unwanted files during use. Turn-key means contracting an expert partner to manage these tasks before the VR systems arrive at the health facilities. VR systems can be shipped as preconfigured kits that include a phone, VR headset, headphones and liners designed to be sanitized between use, as well as training guidance. Mobile device management solutions also allow for automated software and content updates that occur whenever the system is connected to Wi-Fi.

Step 2: Execute the Plan

Train your team

After identifying the VR project you want to implement, the next step is to gather and train your team. Specify exactly which patient group is being targeted by the program. Describe when the VR headset should be introduced during the patient visit. If your VR program is tied to specific goals that you plan to measure (pain medicine use, length of stay, pain scale scores, etc.), create a plan for when and how data points should be gathered and reported. Let your team become familiar with the devices by using them. Schedule practice sessions so the team can role-play the process of teaching a patient who has no experience with a VR headset how to use the device.

Decide how to deploy devices and content

Your VR program should outline exactly when and how patients receive the devices. Determine how long patients will keep the devices by deciding if it will be throughout their entire stay or used only before or after procedures. Ensure the content you chose works well with your patient group. You may need to test content with a few rounds of patients before you know that you've chosen the right option for your program.

Manage device inventory and use

Hospitals and health facilities manage valuable equipment every day. Determine how the VR program devices will be incorporated into the current inventory system. Base the number of devices you use on estimates of the number of patients being served daily by the VR program.

Another focus for device use is maintenance and management. There are some VR content providers who manage both software and content updates for healthcare users automatically via Wi-Fi connections. If your team does not choose a third party to provide this service, divide up responsibilities for these steps among your team members. Plan for how the devices will remain charged and ready for use. User instructions that come with the devices will indicate how often charging will be needed. To ensure no program interruptions, consider the life expectancy of the devices. Note if life expectancy is different for the phones versus the headsets. If the phone or headset is damaged, find out what replacement, exchange or service plans are available.

There are some key differences to note between VR sets and other hospital equipment. Unlike monitoring or diagnostic devices, VR sets may be solely in the use of the patient for an extended period of time without staff supervision. If your VR program is used only as a pre- or post-procedure therapy, staff supervision and duration of use may be less of a problem. But if your VR program will be used as an alternative or a complement to pain medicine, the patient will likely have the device for longer and without any supervision. Depending on your program, you may need to develop a protocol for your team to follow about encouraging patients to use the device. This is particularly important if your team is measuring the impact of the program and requirements include thresholds for minimum use.

Plan for sanitation and infection control

Generally, consumers using VR don't have to worry much about sanitation or infection control. This is another way in which VR use in the healthcare setting requires a different

approach. It also illustrates why it's important to work with providers familiar with using VR in a healthcare setting. Some providers include sanitary liners for infection control. Before purchasing devices for your program, ensure that they can withstand the effects of cleaning solutions between each patient's use. Another concern is unauthorized use. Curious patient visitors or even curious staff may be tempted to use the device. Develop a process to discourage unauthorized use. Part of that process may include informing patients and staff about the negative impact non-patient use may have on sanitation and infection control.

Avoid misuse

Take steps to ensure VR sets are used for their intended purpose. For example, put in place safeguards so people don't remove the phone from the headset and use it to surf the web, check social media or text friends. Some content and hardware providers can offer advice and solutions for this challenge. For example, the Samsung Knox Customization solution allows providers to configure devices to deliver only the approved VR applications and content. Part of patient and staff education can include information that the devices are locked and will not work beyond the reach of hospital Wi-Fi. Of course, device locking is also a security measure that protects the patient and the hospital facility. Since the device is locked, the patient cannot access their own private information, inadvertently leaving that information on the phone for later users to see. Staff cannot use the devices to access hospital systems or databases, again, to protect sensitive information. Additionally, this is another way to improve user experience, since the device always remains in VR mode.
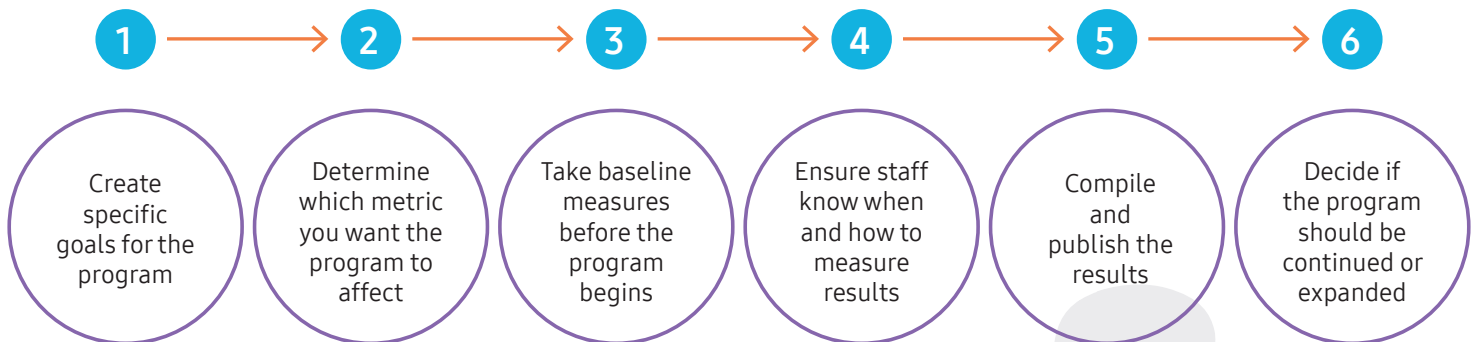

Step 3: Measure Success

Train your team

In planning a VR deployment, providers should set objectives and metrics for success, and use those to measure the value of their investment.

Metrics should be tied directly to the objective of your program. Is the goal to reduce patient length of stay? Is the objective to drop the frequency and amount of pain medicine used? Is the purpose to reduce anxiety before a procedure without using medicine? Or is it to provide a distraction, and therefore greater patient comfort, during long or uncomfortable medical procedures?

Treat your VR program like a small clinical trial, during which you should:

1	2	3	4	5	6
Create specific goals for the program	Determine which metric you want the program to affect	Take baseline measures before the program begins	Ensure staff know when and how to measure results	Compile and publish the results	Decide if the program should be continued or expanded

If your aim is to expand the use of VR in your facility, measuring and reporting results is essential in achieving that goal. In hospitals, it may also be helpful to track the impact on patient satisfaction data gathered in HCAHPS (Hospital Consumer Assessment of Healthcare Providers and Systems) surveys. In addition to these measures, it would be a good idea to survey patients as well. Ask them about the experience, if it had an impact on their satisfaction as a patient and for their ideas on how the VR program could be improved. This is especially important if your goal is to expand the use of VR to other areas.
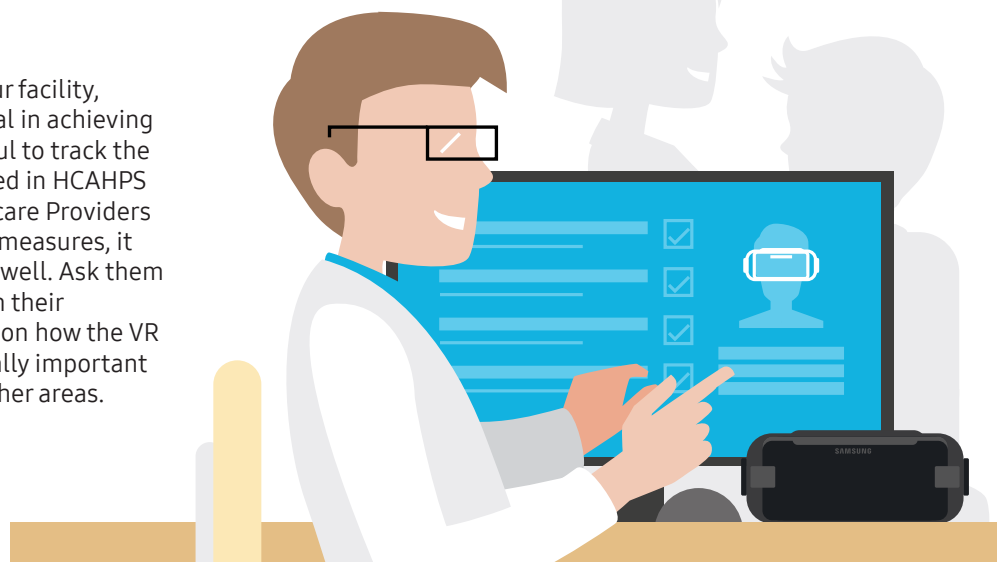
Benefits of A Virtual Reality Pain Management Program

Reduces the cost of care

Virtual reality healthcare programs can reduce the stress and pain experienced by patients during hospital visits. Pain and stress can lengthen treatment time and produce a negative impact on the body's ability to recover. Significantly reducing stress and pain, especially through non-pharmacologic means, can shorten the length of a hospital stay.

Improves patient satisfaction scores

The HCAHPS (Hospital Consumer Assessment of Healthcare Providers and Systems) survey is making an impact on the level of service and satisfaction that patients expect. Hospitals pay attention to these scores since they can affect a 2 percent gain or loss to Medicare payments. Patients with less pain and shorter stays would have a positive impact on those scores.

Lowers prescription pain medicine use overall

The effects of the opioid epidemic are well-known among the public, making them leery of using pain medicine that could lead to addiction. This can make them more open to trying alternative therapies. Physicians can prescribe these medicines less, lowering the use of powerful pain medication among the general public.

The Future of Virtual Reality in Healthcare

As the use of virtual reality healthcare programs moves steadily into its next quarter-century, what's on the horizon?

The benefits of using VR to treat acute pain, procedural pain and anxiety are well-documented. More work is being done to explore how it can be used to treat chronic pain by educating patients about mindfulness and coping strategies.

Lowered costs, greater computing power and improved equipment and content have put VR healthcare programs within reach for hospitals, health facilities and research organizations of all sizes. Facilities that pursue these programs now should be well-positioned to reduce prescription pain medicine use, improve patient satisfaction scores and reduce the length of hospital stays. Taking advantage of today's VR research will drastically improve the experience of the patients of tomorrow.

Will Healthcare's Newest Role Be the "Virtualist"?

Dr. Brennan Spiegel is director of Cedars-Sinai Health Services Research. He directs the Cedars-Sinai Center for Outcomes Research and Education (CS-CORE), which investigates how digital technology can work in a healthcare setting to improve treatment outcomes and save money.

Some of his most popular work has involved the use of virtual reality. That work convinces him that a new healthcare role will emerge: the 'Virtualist."

He says this new role "will be trained in clinical medicine, bio-psycho-social illness models, and VR technology ... and will evaluate patients to determine the correct VR prescription."

Similar to a pharmacist's role, Spiegel says, "The Virtualist will determine the best combination of experiences, dosages, frequency, intensity and outcome measures to evaluate treatment response."

Spiegel has seen "near exponential growth in interest" among his colleagues at Cedars-Sinai. He believes that may indicate a successful future for the use of VR in hospitals.[16]

Samsung has partnered with several leading companies with expertise in VR healthcare deployments and can assist you in creating your own virtual reality healthcare program.

Click here for more info: Samsung Wearables for Healthcare

Footnotes

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