



VR/AR Association White Paper

Virtual and Augmented Reality Best Practices for Healthcare

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Thank you Order 66 Labs¹ and Kelencontent² for
support making this white paper possible.

¹ www.order66labs.com

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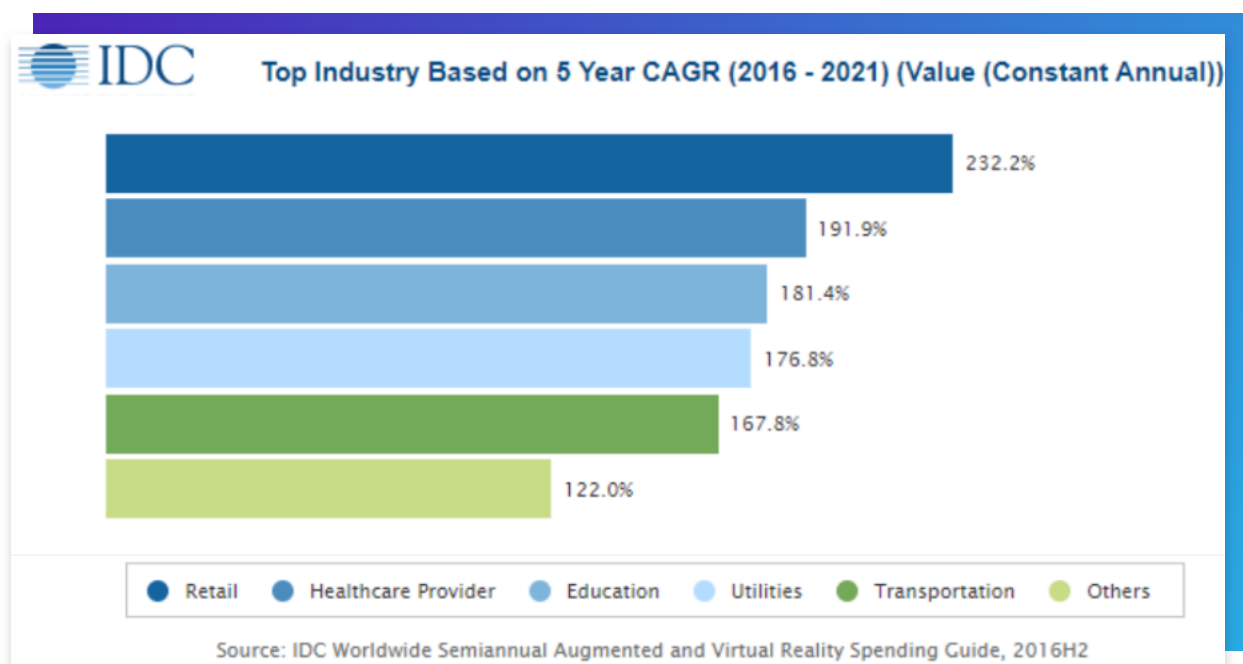
1 Introduction

Virtual & Augmented Reality (VR/AR) are immersive technologies that provide new and powerful ways for people to generate, use and interact with digital information. These technologies take traditional media beyond conventional screens. Photographic images, video or computer-generated graphics (sometimes provided as a 360-degree view within your field of vision) are melded in a new interactive medium that can be used for business, entertainment, research, education, data visualization and other applications yet to be imagined.

Healthcare is one of the top 5 use cases for VR/AR. Practitioners and entrepreneurs in traditional medicine, medical education, and health and wellness verticals are exploring practical use cases for everything from surgical planning to 3D anatomy lessons to pain mitigation.

The nascent medical VR/AR industry is multi-faceted. Tech companies are looking for markets, physicians are looking for applications, and medical institutions are looking for innovative tools to differentiate themselves and provide better patient care. While there is still a perception out there that VR/AR is a consumer product for entertainment and gaming, the healthcare industry is waking up to the transformative power of these technologies for patients and providers alike.

This paper is intended to help you understand key challenges to designing and commercializing VR/AR solutions for the healthcare industry.



A recent report¹ from ARTillery.co points out that as an industry, "healthcare operates differently than other enterprise segments...it's a double-edged sword (or scalpel): There's less cost-sensitivity but greater regulation and scrutiny." This dichotomy creates "more risk, more reward"; it might be harder to bring your idea to fruition, but the payoffs of doing so are significant. Start by leveraging the existing healthcare eco-system to bring successful VR/AR applications to market.

¹ <https://artillery.co/2018/03/02/xr-talks-ar-in-medicine-is-a-double-edged-scalpel/>

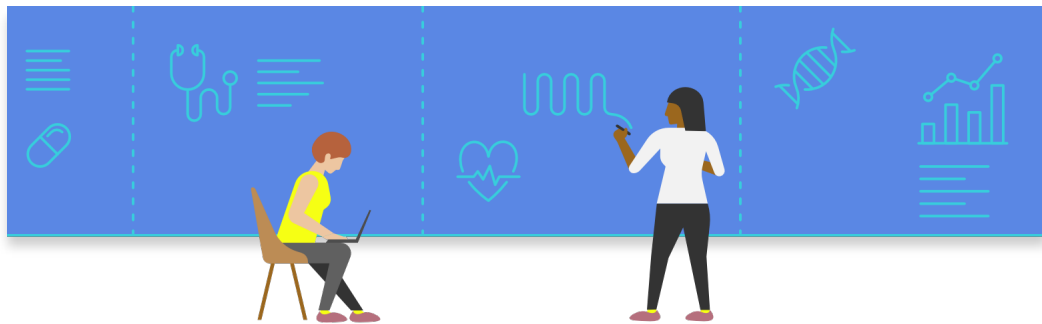
2 Blend Science and Technology Through Partnerships

AR/VR for healthcare is a team sport. There are many opportunities for creative partnerships between the healthcare community and developers looking to do good. Partnering with like-minded people can help share the cost and resources of developing out your vision.

Some considerations for partnerships:

- Programs that are sponsored by device manufacturers (i.e., HTC Content Division, Microsoft Partner Program, Meta Health)
- Partnerships between developers and hospitals, medical schools & product designers
- Hackathons with VR/AR and sponsors in the healthcare field
- Stakeholders in the medical field, such as administrators, community leaders, therapists, IT departments, local health interest groups and public health service groups
- Professors/researchers at local universities
- Incubators, accelerator programs (private/public and also those in partnerships with local hospitals and or universities)
- Organizations such as HIMSS to help with dissemination and education of new plans/uses for VR/AR in healthcare
- Engineering groups and visual artists
- Local VR/AR enthusiast groups

For instance, VRHealth partnered with Tel-Hashomer Medical Center in Israel under an open campus agreement. Likewise, Thomas Jefferson University¹ is collaborating with Plas.MD² to examine the effectiveness of cardiac rehabilitation and engagement with immersive technology.



¹ <http://jefferson.edu/>

² <https://www.plas.md/>

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Champion a Clinical Perspective

Application and hardware developers need to consult medical professionals and include them on advisory boards and boards of directors early in the planning phases of a new VR/AR healthcare venture. It's critical to identify individuals in your industry and the medical community at large who are passionate about the business of healthcare.

Virtual health developers with a viable business model to deliver significant cost or time-saving measures will attract investors and advisors more easily. Be thoughtful about how many VR/AR avenues your company chooses to explore; give serious consideration to staying focused on one aspect of medical specialty and do it better than anyone else.

New health and wellness applications have multiple stakeholders:

- Physicians (general practitioners and specialists), physician's assistants, nurse practitioners, psychologists, nurses, technicians, and first responders can inform your product design.
- Hospital and university administrators can assess the value of VR initiatives based on their ability to manage escalating healthcare costs and provide better patient care.
- Patients provide critical input for early design phases.
- Health IT project managers/informaticists and accounting and billing/coding experts can help refine go-to-market strategies.
- On a global scale, the World Health Organization is working to democratize access as VR/AR advances continue to demonstrate value to patients worldwide.

These people are busy, so establish a regular communications strategy for meetings (video or in-person), group emails and conference calls. Take advantage of Slack, web forums and others online tools to keep your team connected.

Note: Many of these professionals have not yet been exposed to VR/AR and are not yet aware of its possibilities or limitations. They will need to work with and build on the experience of VR/AR experts to get it right.



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Photo courtesy of SkillReal

Screenshot from a medical Virtual Reality training simulation, showing a patient with an arm infection

Is it always necessary to test technology inside a hospital or clinical setting?

First, consider whether you should align your VR/AR healthcare venture with an established institution or university. These opportunities exist, but you'll want to be thoughtful about how you protect your intellectual property. It is important to have accurate clinical knowledge of any healthcare problem you are trying to solve. This will require collaboration with a healthcare professional if not an institute.

How can I interest a healthcare facility in giving me an opportunity to run a trial?

It's important to know the different "ways in" to bring technical innovations to the attention of the healthcare system at large. Physicians are the primary gateway for tools that provide direct patient benefits; supportive specialists will attempt to introduce new ideas to other stakeholders. MDs (especially surgeons) are a revenue-generating asset in the U.S. and hospitals will try to accommodate them, within reason. A simple preference for a new tool may be enough to get into the consideration set.

Who should I approach for permission or resources to support my venture?

Medical centers understand the value of innovation, and many are eager to engage with XR start-ups. C-level proponents include CEOs, CFOs, CIOs and executives charged explicitly with pursuing breakthrough ideas to improve productivity, reduce costs and most importantly, improve patient outcomes.

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For training applications, VR/AR companies should identify funding channels for medical schools and residency programs. They may prove to be the path of least resistance for competitive programs committed to financing cutting-edge education.

Many facilities open a center of innovation that help startups blend into the medical industry and operate from within the center. For instance, VRARA member Stambol Studios partnering with Canada's Health and Technology District and Conquer Experience¹ to launch a new XR LAB immediately adjacent to Surrey Memorial Hospital. The XR Lab is a demo studio leveraging mixed realities and other emerging exponential technologies to inspire future healthcare collaborations.

¹ <http://www.thevrara.com/blog2/2018/5/7/vrara-member-stambol-studios-partners-with-health-technology-district-to-create-xr-lab-to-embrace-vrar>

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Validate Your Approach

In the beginning stages, you will need to prove the value of your program. First, clearly define the problem(s) your VR/AR technology is trying to solve and lay out the current interventions and pilot studies that attempt to address this/these problem(s). Market research is important. You may want to do a SWOT Analysis to identify your market Strengths, Weaknesses, Opportunities and Threats, which will help you better assess the environment you are working within. Geography, population demographics and socioeconomic information should also be considered. Your chosen group of partnerships/advisory board members should also select a health promotion theory which can provide direction for development geared toward the desired therapeutic behavior change. You may also want to create a logic model that lays out inputs (stakeholders) outputs (activities, participation), and outcomes (short-term, medium, and long-term).

As you think about launching your prototype or conducting a pilot study, make sure you have addressed

- Who are you selling to (hospitals, physicians, patients, etc.)? What are their concerns and needs?
- Who is using the program? (it may be different than who is buying/implementing)
- Who is your competition? What value do they bring?
- What is the cost to the user now? Moreover, what will it be at scale?
- Do you have clinical support? (existing clinical data/ whitepapers/ peer-reviewed journal articles)

Also, especially for a pilot study:

- What is the primary and secondary outcome of the study?
- How long will you pilot the program before analyzing its effect?
- How will you recruit participants? What is the inclusion/exclusion criteria?
- Have you designed pre- and post- assessments to gauge the results?
- How will you collect and analyze the data?

FloreoVR conducted a 5-week pilot study with Children's Hospital of Philadelphia's Center for Autism Research and together was awarded an NIH Fast-Track STTR grant in 2017.

The digital poster from the conference can be found here:

https://cslide-us.ctimeetingtech.com/digimed_2017/attendee/eposter/poster/47

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The pilot abstract is entitled, Experiences With Virtual Reality Based Therapy for Joint Attention: A Usability and Initial Feasibility Pilot of FloreoVR's Joint Attention Module in a Special Education School Setting. The primary objective of the pilot was to evaluate the safety and tolerability of Floreo's Virtual Reality Joint Attention Module as used by students at a special education school. They also intended to learn about user enjoyment of FloreoVR as well as school personnel's sense of product value and interest in continued use. Also, they wanted to assess the initial use of a novel joint attention measure designed for school-age children, to capture changes in joint attention skills before and after use of Floreo's Joint Attention Module.

The abstract includes sections on primary and secondary objectives, inclusion criteria, recruitment, screening, number of VR sessions, and corresponding assessments. It also contains data such as tolerability, completion rates, sentiment, and joint attention skill outcomes.

The rationale for a 5-week timeframe had many factors including having enough time (at least a month) to test feasibility. In addition, the 5 weeks were primarily driven by the schedule of the kids and the summer camp at the school. If they didn't take that 5-week window, they would have had to wait a couple of months to find a new window.



5 Obtain Grants and Funding

AR/VR is “hot.” Investors are pouring billions of dollars into hardware and software companies purporting to be the next big thing in XR. That doesn’t mean it’s easy to tap into funds exactly when you need them.

Typical sources of funding include:

- City, state, and federal grants
- Incubators and accelerators (local and or those in partnership with hospitals/educational institutes)
- Venture capitalists/angels

When pitching your idea to get funding, remember to have answers to the following questions:

- What is the problem you are solving?
- What is the market potential (in dollars)?
- Who is on your team? (This should include a healthcare expert)
- Who are your current partners or customers?
- How much money do you need to achieve goals?
- What are your milestones and deliverables?
- What is your ongoing revenue growth plan?



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Grants can be awarded for application and technology development or clinical implementation. Examples of recent grants include \$2.2 million in funding from the National Institutes of Health (NIH) to SentiAR¹ Inc. to advance its work designing AR software to improve visualization in cardiac surgeries. NIH also awarded \$1.7 million to Floreo² to deliver virtual-reality driven autism learning tools.

Don't limit yourself to the U.S. when seeking grants. You may find funding in places like Israel³ or even Unicef⁴, the United Nations International Children's Fund, which has a new VR initiative to fund start-ups developing open-source VR/AR platforms. The European Union Horizon 2020⁵ program is also an excellent platform to build consortiums that address challenges and topics of interest in the EU.

Governing bodies responsible for evaluating and certifying practitioners of medical or surgical specialties are another source of funding worth looking into. The American Board of Orthopedic Surgery and the Orthopedic Research Education Foundation⁶, for example, are interested in using VR simulation to train and assess orthopedics residents. Combined, they have introduced the first-ever grant on validating VR/AR technologies specifically for Orthopedic residents. Surgical education paradigms are changing rapidly; the benefits of VR/AR cannot be overlooked as health organizations seek more ethical, economical means to train specialists in every field.

Finally, for private funding, Google is your friend. There are hundreds of VCs interested in the VR/AR space, with more coming online every day. Follow the latest deals on sites like TechCrunch, Index, and PitchBook to see who's getting funded and what they're getting funded for. Software developers can approach hardware companies to partner on new content. Google, Oculus, Samsung, HTC, and others have corporate accelerators that may be interested in working with you.

¹ <https://www.dicardiology.com/content/nih-issues-22-million-grant-augmented-reality-cardiac-hologram-research>

² <https://floreotech.com/2017/10/31/floreo-awarded-1-7m-nih-grant-to-test-whether-vr-can-improve-police-safety-in-individuals-with-asd/>

³ http://www.matimop.org.il/Growth_RnD_Fund.html

⁴ <http://unicefstories.org/vr/>

⁵ <https://ec.europa.eu/programmes/horizon2020/>

⁶ <https://www.abos.org/research/abos-funded-research.aspx>

6 Address Barriers in the Real World

Working in healthcare brings its own unique set of challenges. This highly regulated environment is focused on ensuring patient safety and personal data protection. Providing safety and security in the clinical setting is not only a nice thing to do, but it's also the law.

Therefore, specific considerations need to be addressed:

- If data is being saved (people's email, engagement, and or payment history), people may be concerned about their privacy and their data. How are you ensuring any patient data collection complies with HIPAA rules and regulations? Moreover, to be transparent, what is your documentation to prove that you are?
- What is the safety consideration with using headsets with children under 13?
- What additional precautions do you need to take to help avoid falls and motion sickness while in use?
- Will clinicians be able to monitor and control the simulated environment for their patient?
- How are you complying with a facility's sanitation protocols, or more specifically, sterile environments like burn units or the ICU?
- People may be reluctant to engage with new technology. Is there a fear of possible side-effects?
- People may not justify the interactions with the new tech. Is it essential? Is there a resistance to change?
- Is there a lack of human infrastructure and IT skills after a technology has been embraced in a facility?
- Does the software need FDA approval? Alternatively, when researching with patients, does it require IRB approval?



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In addition to safety and privacy considerations, there are financial considerations. Who will pay for the software or applications and the hardware that supports it?

- What type of headset (mobile, standalone, tethered, etc.) will be optimal for both experience and accessibility?
- Are there grants available to help institutions acquire the necessary equipment?
- Would an out-of-pocket/patient pay model work?
- Is the high cost of the technology justifiable? Or do VR/AR technologies play only a supplemental role?

So there are general barriers that are not unique to medical VR/AR, but are important to consider:

- Who are your competitors? Is there an opportunity for collaboration and partnership?
- Who are the stakeholders and is there good communication between them?
- Is there a champion within the facility who will advocate for you?
- Are the end users ready for immersive experiences (training, therapy, etc.)?
- How will the hardware be stored and secured at the facility?
- Are there physical spaces designed for testing/development/implementation?
- What are the real costs for on-going development, staffing (for implementation, assessment, data analysis, maintenance), repair of hardware and software?
- How will you promote your offering? Consider the costs and time of dissemination and or marketing (in local communities, local businesses, local clinics and hospitals, social media, social service organizations, conferences, conventions)
- How accessible is the technology and does it need to scale? Are you expecting 1-2 AR or VR systems or hundreds? If high volume, always consider mobile devices. We are noticing new systems such as Oculus Go (VR platform) offers low-cost, relatively easy to manage solutions for high volume usage.
- Deployment and management of content can be aided by similar content management systems used in VR Arcade companies.

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Know Your Buyer

Most clinicians attend annual meetings to update and refresh their knowledge, which makes meetings and conferences an ideal place to introduce new technology. You can participate as a speaker in large forums and break-out sessions, or set up a booth in the exhibit space. VR/AR demos are almost always an “aha” experience, especially for anyone who has never tried the technology in a live setting, and physicians are no exception. Nearly every medical specialty hosts a specific meeting that allows companies and developers to present their ideas and refine their business model.

Administrators, procurement specialists, and IT experts also influence business-to-business (BTB) buying decisions. A typical buying cycle includes research, product comparisons, expert validation and price negotiations leading to purchase. BTB technology marketers try to provide persuasive information at each stage of the buyer’s journey; they use a variety of marketing tools to generate awareness, create demand and acquire leads for their products.

You should be able to describe your market, your audience and your value proposition with precision before launching your product.

Consider the following factors as you create your go-to-market plan:

- Who is making buying decisions inside healthcare institutions?
- What information do they need to buy in at scale?
- How long is the purchase cycle?
- What’s the best way to reach critical influencers at each step of the buyer’s journey?
 - Networking with stakeholders
 - Online/traditional advertising
 - Social media
 - PR and content marketing (blogs, webinars, infographics, ebooks, etc.)
 - Dissemination marketing (in local communities, local clinics, and hospitals, social service organizations)
 - Trade shows, conferences, and conventions
- What is your brand positioning (is it distinctive, relevant and accurate?)

8 Summary

As healthcare leaders across the globe continue to embrace the practical benefits of this emerging technology, there is no shortage of new challenges and options to consider. It is vital to look at parallel industries for solutions that may be adapted to fit the highly regulated contexts of healthcare.

Funding is typically seen as the primary barrier to entry when pursuing a new VR/AR product or service, however, in the vertical of healthcare, the strength of concept and sustainable implementation plan is just as critical as startup financing.

For VR/AR technology to seize market potential, it is essential for content creators and physicians to partner and address real-world issues as they seek to elevate medical education and delivery of patient care.

