



Intelligent Virtual Assistants—Think Siri and Alexa—in Medicine and Continuing Education: Small Devices With Big Concerns and Big Potential!

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A Clinical Care Options (CCO) White Paper

The marketplace has exploded with “smart speakers” for sale, and the media is saturated with advertising for the latest Amazon Echo or Google Home. However, privacy experts have expressed concern that the same companies producing these devices are also known to harvest user data.^[1] This can be especially troubling when considering their use in the healthcare setting, due to privacy laws such as Health Insurance Portability and Accountability Act of 1996 (HIPAA). From a privacy perspective, the entity we are truly concerned with is not the smart speaker itself but the cloud-based intelligent virtual assistant (IVA) loaded into these devices. Although IVAs are not yet HIPAA compliant, they have *enormous* potential for the medical field.

How Do Cloud-Based IVAs Work?

IVAs use “on-device listening” with microphones that are always “listening” unless specifically turned off; when they detect their “wake” or “hot” word such as “Okay, Google” or “Alexa,” they record your input and then upload it to the cloud for processing.^[1-3] Some newer smart speakers use lights to show when input is streaming to the cloud.^[4] These IVAs are truly impressive, using natural language understanding (also known as natural language processing) to match speaker input to executable commands:

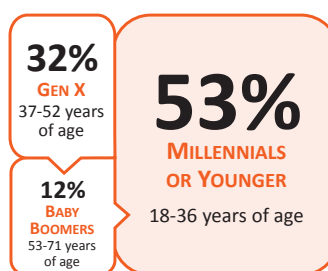
“[Natural language understanding] is all about providing computers with the necessary context behind what we say and the flexibility to understand the many variations in how we might say identical things.”^[5]

This is *how* IVAs infer that you are asking for the local weather forecast when you say, “Alexa, what’s it like outside?” Like other artificial intelligence (AI) uses such as social media platforms and facial recognition programs, IVAs continually improve using machine learning algorithms.^[5] “[T]he output of a machine learning algorithm is entirely dependent on the data it is exposed to. Change the data, change the result.”^[5] The more data provided to the IVA, the better it can serve its purpose. Thus, whereas each cloud-based IVA has a way to delete recordings, users are warned this “may degrade” the experience since this removes data for algorithms.^[4]

Who Is Using Smart Speakers Enabled With IVAs?

A good picture of the user base will provide a clear sense of whether one should incorporate smart speakers within one’s engagement strategy.^[6] Smart speakers are gaining adoption faster than any technology since the mobile phone.^[7,8] As of December 2018, 26.2% of adult Americans had access to a smart speaker, a 40% growth rate in 2018 alone, and more than 40% of owners now have more than 1 device.^[9] Initial smart speaker users were affluent, older millennial males^[7]; however, these devices are quickly gaining traction with a younger demographic.^[10] According to a

2017 survey of 1000 American consumers, 53% of smart speaker owners are millennials or younger (18-26 years of age), 32% are Gen X (37-52 years of age), and only 12% are Baby Boomers (53-71 years of age).^[6]



Apple introduced the first cloud-based IVA, Siri, via the iPhone in April 2011,^[11] but the first stand-alone device was the Amazon Echo released in November 2014.^[12] Uptake has been rapid; between May 2017 and May 2018, US smart speaker ownership more than doubled.^[10,13] By June 2018, 24% of US households had smart speakers,^[14] and this number was expected to have risen dramatically after the 2018 holidays.^[15] Tech watchers were not disappointed: 8% of people in the United States received a smart speaker for the holidays, bringing the number of smart speakers in circulation to almost 119 million!^[16] Healthcare industry researchers expect that by 2020, one half of all searches will be conducted by voice.^[17] Smart speakers are expected to reach 55% of US households by 2022.^[17] Consistent with this home use trend, the global healthcare industry's IVA market size is expected to reach \$2.95 billion by 2025, representing an explosion of these devices into the medical field.^[18] By way of illustration, the global healthcare IVA market was valued at approximately \$186.3 million in 2017.^[19]



Which IVA Could Continuing Education Developers Target?

The top 5 IVAs in the United States (with their delivery devices) currently are:

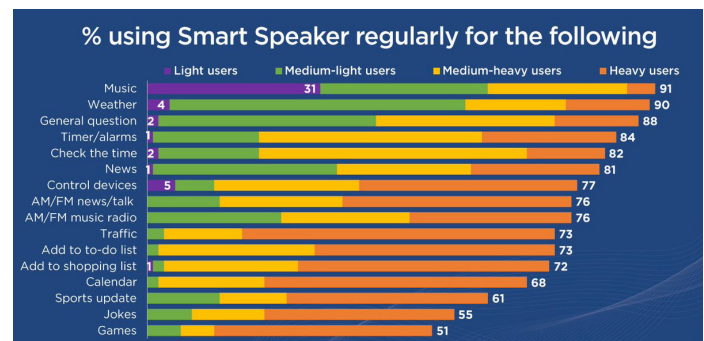
1. Alexa (Amazon Echo, many other devices)
2. Google Assistant (Google Home, Bose, Sony, many other devices)
3. Siri (Apple devices)
4. Cortana (Microsoft/Windows devices)
5. Bixby (Samsung devices)^[20-22]

Amazon Alexa currently dominates mostly because it was first to market.^[23] Although many cloud-based platforms do support HIPAA compliance requirements, including Amazon's secure cloud computing platform Amazon Web Services, Google Cloud, and Microsoft Azure, and can be used for content delivery,^[23-25] their capabilities are not currently smart speaker-friendly. Since the groundwork is already in place for healthcare providers to use these platforms, the tech companies simply need to incorporate appropriate safeguards into their IVAs to meet the requirements of HIPAA.^[23]

Cortana is expected to do well in the business space because it is already integrated into so many Microsoft devices,^[26] but Google Assistant is being integrated with Chrome OS devices, such as Google Pixelbook.^[27]

What Types of Content Are Users Currently Accessing via IVA?

In the pre-IVA world, speaking to a machine was awkward for both the person speaking and those listening, but smart speakers have changed this experience; 72% of smart speaker owners are now comfortable using them in front of others.^[15] Indeed, with the recent leap in smart speaker usage, voice interaction is now becoming a habit.^[28] Smart speaker owners use them for a multitude of tasks, including asking general questions, checking the weather, setting timers/alarms, controlling other devices, managing lists, receiving news or radio broadcasts, and hearing jokes or playing games.^[15,29] However, the most frequent use—and important for continuing education—is playing and streaming audio: Users are growing accustomed to syncing data from mobile devices to their voice-based devices.^[14] NPR Chief Marketing Officer Meg Goldthwaite said, “[S]mart speaker owners are turning off their TVs and closing down their laptops to spend more time listening to news, music, podcasts, and books, fueling the demand for more audio content.”^[30]



THE smart audio REPORT

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Source: NPR & Edison

Most owners use smart speakers in their homes, and the location of home use is trending toward the living room, bedroom, kitchen, and home office.^[14,31] It is only natural that innovators have begun to think of other applications for cloud-based IVAs and are increasingly being integrated into other types of products. For example, homebuilders are integrating Alexa into entire houses, and Toyota is adding Alexa to its cars.^[32]

Smart Speakers Come With Privacy and Security Issues

Using IVA-enabled smart speakers creates issues that derive from an individual's right to privacy that is part of the makeup of the laws of the United States, including HIPAA.^[33] Legal analysts put it this way: It is no problem for Dr. Jones to encourage Mr. Smith during an office visit to use his own Google Assistant to remind him to take his blood pressure medication at home at a certain time. However, Dr. Jones should not ask her own Alexa to set a reminder to tell Mr. Smith at Monday's clinic to avoid salty foods due to his hypertension. This would be a HIPAA violation "synonymous with leaving a handwritten note with the same information out in your office lobby for anyone with a hint of curiosity to read."^[34] However, since continuing education itself does not usually include any private patient data, it is not likely to run afoul of HIPAA.

Since IVAs are voice activated, they can misinterpret sounds as their "wake" word and record conversations not meant for them.^[2] For example, an Amazon Echo recently accidentally released a couple's private conversation to a third party without their knowledge or consent.^[35] This is not likely to be a problematic issue for continuing education since learners will not be disclosing sensitive patient information to their IVA while using it to participate in continuing education.

It has been shown that hackers can potentially send "hidden" audio commands directly embedded into music or spoken text undetectable to human ears but detectable to IVAs that can manipulate them into doing things without the user's knowledge, such as dial phone numbers, send messages, make purchases, open Web sites, or even transfer money.^[36,37] For continuing education developers, this could translate to a potential for loss of proprietary information. To help combat this, some IVAs, including Google Assistant and Alexa, have voice recognition feature users can enable to restrict access to sensitive actions unless the device recognizes the user's voice or is given a spoken code.^[37]

By using their device, most cloud-based IVA manufacturers state that the user agrees to be bound by their conditions of use and privacy policies.^[38,39] An important question remains: Have others exposed to a smart speaker provided informed consent for their conversations to be recorded?^[34] If smart speakers become as prevalent as smartphones, will society as a whole waive their rights to privacy? Have we done so already? The relevant law is still evolving; some legal experts believe that places once deemed private, like the inside of a home, will lose the expectation of privacy with the onset of technology.^[40] Others feel smart product manufacturers are taking consumers' privacy and security concerns very seriously since they believe consumers will not buy these items if they do not trust them.^[3] As part of the solution, component makers like Qualcomm, Inc (San Diego, CA) are

creating processing chips that encrypt incoming and outgoing data.^[3] In addition, some smart product manufacturers such as Google have internal AI ethics boards to ensure proper application of AI technologies.^[41]

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How Are IVAs Being Used in Medicine Now?

Voice-activated content was pioneered in the field of medicine by major health systems like Mayo Clinic (Rochester, MN) and Boston Children's Hospital (BCH, Boston, MA). Mayo Clinic's Sandhya Pruthi, MD, stated that "voice-enabled experience is a new and growing channel for reaching people and delivering information they are seeking."^[42] Alexa is being used in hospitals to help surgeons comply with safety checklists before procedures, and several healthcare providers including Mayo Clinic ("Mayo First Aid"), WebMD, BCH ("KidMD"), and HealthTap ("Dr. AI") created apps to deliver voice-driven self-care instructions for ordinary medical needs like cuts, fevers, and burns.^[1,23,42-45] A Samsung company is releasing an IVA-based device in 2019 called ElliQ designed to encourage older adults to engage in healthy lifestyle choices.^[46] Going forward, healthcare-related use of IVA technology will likely focus on medical record navigation, medical transcription, and medical information searches.^[47]

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Delivering Continuing Education via Smart Speaker Is a Both a Challenge and an Opportunity

In general, consumer sentiment regarding smart speakers is highly positive: 75% of smart speaker owners want to learn to do more with their devices and would recommend them or purchase them as a gift.^[14] Continuing education, however, targets a very specific audience. The prospects appear good. For instance, one survey indicated 48% of pediatricians queried would be willing to try voice-assistant technology in their practice.^[17] Thus, it is likely that even more doctors would consider smart speakers for non-HIPAA-related uses. “In homes that have had smart speakers for at least a year, they are now the number one device for consuming audio,” says Tom Webster, Senior VP of Edison Research.^[30] To take advantage of this tidal wave, continuing education providers could consider creating modules that can easily be streamed by a smart speaker, whether it is placed in the home or the clinician’s office. One continuing education provider has already begun to seize this opportunity by teaming up with the AudioEducate platform to create an accredited programs delivered via Alexa skill.^[48]

Each IVA has unique building tools. For example, the Alexa Skills Kit can be used to create Alexa apps using the Alexa Voice Service, a collection of interfaces that “allow developers to voice enable connected products with a microphone and speaker.”^[26] User-friendly straightforward step-by-step interfaces will make it easy to create and deliver education aimed at the medical community. Google Assistant has an app developer program designed to be used by nonprogrammers.^[49] To take advantage of Siri on Apple’s HomePod, continuing education developers can use “SiriKit” to interface the IVA with iOS apps.^[49] Microsoft’s Cortana has an online editor and tutorial to create a “skill” that walks you through the entire process.^[49]

Cutting-edge continuing education developers will need to consider several questions when designing modules for delivery via IVA. First, how will the educator assess whether learning has occurred? In addition to AudioEducate, educators can look to education platform Canvas by Instructure, with whom Alexa partnered to create a skill that allows learners to engage with their course materials using voice.^[50] It is not a great leap to extrapolate how clinicians could interact with continuing education modules delivered via smart speaker/IVA in a similar way.

Another interesting question to consider is whether audio content alone is enough in our modern lifestyle where most education content is delivered in a multimedia fashion or live. However, audio content may still be a preferred format for some users, and audio is certainly a convenient format to consume at times when it is not possible or desirable for the user to view a screen.^[51]

Furthermore, as every educator knows, reducing barriers is a key to learner success. Smart speakers with IVAs can do this in spades—language barriers are reduced since education modules can be programmed to be delivered in any language necessary.

Smart speakers have additional potential: They are easy to use, convenient, cost-effective, and appealing to the increasing numbers of “digital-native” clinicians entering the practice of medicine. They are also accessible for older clinicians or other-abled professionals who have difficulty using their hands or have poor eyesight. Another barrier reducer is the need to introduce the IVA to the education provider’s mobile or Web account just once, and as such, an IVA also can reduce the time involved in logging progress in an education module.^[52]

One caveat is that educators may need to frequently monitor or update modules delivered via smart speaker because technology is changing at a rapid pace.^[53] Furthermore, smart speakers, like other cutting-edge technology, have been released prior to being entirely ready, leading to debugging in real time.^[32]

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Takeaways for Continuing Education Developers

Smart speakers have enormous relevance and potential for continuing education. The privacy issue is not as simple as *not* having a smart speaker in the medical office because most smart phones already carry a cloud-based IVA that can be activated—either intentionally or accidentally—by uttering a phrase or by pushing a button while the device is in a pocket or bag. The medical industry should not be overly concerned about introducing a smart speaker into the office for fear that an IVA is listening and occasionally erroneously recording snippets of medical conversations—that has probably already happened when a practitioner’s cell phone was inadvertently activated in a patient room. IVAs are simply more conspicuous when they are in a larger device sitting in a dedicated spot on the counter or desk. The key takeaway is this: For now, the medical community should make informed choices about how, when, and where we choose to use IVA-enabled devices and keep a keen eye on developing laws and security upgrades.

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