

TECHNOLOGY IN HEALTHCARE

RECAP

OFFICE OF TECHNOLOGY STRATEGIES (TS)

INTRODUCTION

This Tech Insight Recap revisits three previous Tech Insights and combines their highlights into one document. Specifically, this review addresses telehealth, nanomedicine, and three dimensional (3D) printing, examining how technological updates and innovations are beneficial to healthcare. This Tech Insight begins with an overview of the field of telehealth, followed by nanomedicine innovations for healthcare, and then a discussion of 3D printing in the healthcare field. In closing, we address innovations in healthcare at the Department of Veterans Affairs (VA).

WHAT IS TELEHEALTH?

Telehealth is the use of electronic information and telecommunications technologies to deliver healthcare, health information, or health education at a distance. This includes video conferences, the Internet, store-and-forward imaging, streaming media, and wireless communications. Telehealth does not create new or different healthcare services; rather it provides new ways to deliver existing services. The term telehealth is sometimes confused with telemedicine, yet there is an important distinction between the two. Telemedicine refers only to remote clinical services, while telehealth refers to a broader scope of remote healthcare services that includes non-clinical and clinical services. Non-clinical services include roles related to administration, customer service, and finance. The boundaries of telehealth are limited only by the technologies available; new applications are invented and tested every day. While telehealth offers numerous benefits to both patients and providers in terms of cost reduction, quality of care, and access to resources, there are still some obstacles to effective implementation. One of the biggest challenges is state licensing. Telehealth has the ability to eliminate borders and provide care across distances, yet state-to-state inconsistencies in physician licensing requirements are making it difficult for the service to reach its full potential. While innovations such as nanomedicine and 3D printing cannot solve this problem, they can

contribute to creating and building smaller medical and communication devices that reduce cost and increase accessibility.

WHAT IS NANOMEDICINE?

[Nanotechnology](#) is the process of designing, developing, and implementing technology on the nanoscale. When nanotechnology is applied to medical purposes, it is called “nanomedicine.” Nanomedicine is the application of nanotechnology the size of human biomolecules to treat sicknesses, perform surgeries, and diagnose diseases, conditions, and disorders. In terms of its structure, nanotechnology ranges from simple [nanoparticle structures](#), still in testing but used in simple surgeries, to the more complex [nanobots](#), which are being conceptualized and developed. Nanobots, as envisioned, are made up of several different material components and shaped to resemble and function as a small machine with the capability to perform multiple functions.

Today, nanomedicine is contributing to telehealth. As an example, nanobots and nanoparticles can diagnose infections and diseases in vivo, or inside the body. One form of telehealth already developed using nanotechnology, is in vivo medical imaging. For example, when clinicians need to study a patient’s digestive tract, they rely on devices like pill cameras or endoscopes. In the near future, these might be replaced by nanobots able to transmit images to a clinician for diagnosis. Similarly, nanobots and nanoparticles are in development that could act as [biosensors](#), devices that monitor, compute, and relay health information to clinicians. When developed, these nanomedical biosensors will allow for faster and more accurate diagnoses, while reducing the need to perform many diagnostic tests.

HOW DOES 3D PRINTING CONTRIBUTE TO HEALTHCARE?

By the late 1990s, 3D printing became a strategic healthcare tool. 3D printing is a process that uses a digital file to make three-dimensional, solid objects. Because the creation of 3D printed objects is achieved using an additive process, it is also referred to as “additive manufacturing.” In essence, a 3D printer is a type of industrial [robot](#). This technology provides the capability to produce objects of different geometries or shapes, using different materials, such as polymers, free-standing liquid metals, solid metals, ceramics, clays, epoxy resin, and even living cells and organs. The need to replace damaged or diseased bone is not new, and with innovative 3D printing we can manufacture needed body parts. 3D printing is an advancement that brings down cost and offers supply on demand.

In 1999, the Wake Forest Institute for Regenerative Medicine opened the door to applying 3D printing for engineering not only bones, but organs as well. With this development, 3D printing became vital for patients who needed organ transplants on short notice. Timely reception of these organs determined whether patients live or die. Further efforts include printing scaffolds of stem cells, cartilage, bone, disease cells, blood vessels, and human hearts. In 2008, a medical research firm, Organovo, [printed functional blood vessels](#) and cardiac tissue using cells obtained from a chicken. Today, researchers at the University of Rostock in Germany, Harvard Medical Institute, and the University of Sydney, are developing methods of heart repair, called "[heart patches](#)," made with 3D printed cells.

CONCLUSION

[VA Telehealth Services](#) uses health informatics, disease management, care/case management, and telehealth technologies to increase access to care and improve the health of Veterans. They use technology with the intent of providing the right care in the right place at the right time. Whenever possible, VA aims to make the home the preferred place of care. As more Veterans seek healthcare, telehealth allows them to avoid traveling long distances and to reduce their wait time to access medical attention. Currently, Veterans can receive over 40 clinical services through VA's telehealth programs. With its increased funding, the agency plans to expand its specialty programs to include telesurgery, telerehabilitation, telemental health, and telecardiology. As of July 2016, the VA telehealth portal had 3.5 million registered users and was accessed 9,000 times a day by Veterans. It processed 72 million prescription requests since its launch 10 years ago. Further, about 12 percent of VA patients in a given year receive some amount of care through telehealth. VA performed 2 million events of care through telehealth in 2016, which is an increase from previous years. VA hopes to create new innovative prosthetics and assistive technologies that will improve the care and quality of life for our nation's Veterans. As further research and development continues to support the viable application of nanomedicine and 3D printing, hospital systems, including the Veterans Health Administration (VHA), will plan strategic adoption of cutting edge technology.

For more information on telehealth, nanomedicine, and 3D printing, please read the original Tech Insights: Telehealth (Volume 2, Issue 4), Nanomedicine (Volume 3, Issue 8), and 3D Printing (Volume 3, Issue 9). You can also view Enterprise Design Patterns (EDPs) on [mobility](#). Learn about a variety of technology topics in the Office of Technology Strategies' [Tech Insights](#).

If you have any questions about this Tech Insight, don't hesitate to [ask TS](#) for assistance or more information.

TS TECH INSIGHT SERIES

The monthly Tech Insight series aims to help readers make better decisions and be more informed customers (of Office of Information & Technology's products and services) by providing them with high-level overviews of technology issues that impact or will impact VA's Information Technology (IT) environment. Tech Insights introduce topics in an easily digestible fashion by presenting background information on the topic, clearly explaining its importance within VA, and providing recommendations for success from TS. View all TS Tech Insights [here](#).

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