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Digital continuous care: Future of artificial intelligence-based healthcare

Leon Eisen*

Oxitone Medical Inc, 20 Church Street, Mezzanine, Hartford CT 06103, USA

Dr. Leon Eisen is a Digital Continuous Care pioneer, inventor, speaker, entrepreneur, and executive with 15+ years of experience in HealthTech. Passionate about transforming homecare for chronic diseases, Leon invented the world's first FDA-cleared wrist-sensor medical monitor and artificial intelligence-based Digital Continuous Care platform. He is an author of 10 patents and more than 20 scientific publications.

INTRODUCTION

Utilization of new technology disrupts the paradigm of many ecosystems and is often resisted in healthcare.[1] However, when a natural evolution of technology is incorporated into an existing organization, the innovations can outweigh the disruptive effects, thereby encouraging widespread adoption. In the UK, NHS Chief Executive Simon Stevens is committed to ≤850 million savings from the community health-care budget, and digital technologies are seen as an important enabler in achieving this target.[2]

Digital continuous care incorporates modern wearable medical technologies and enables reliable patient supervision as a natural evolution of medical monitoring. The combination of artificial intelligence (AI)'s predictive power with the convenience of comfortable wearable medical technology can be fine-tuned to support and enhance existing health-care ecosystems.

Digital home care is nothing new in today's medical world – everyone is familiar with medical devices for patient home monitoring, such as glucometers, fingertip pulse oximeters, blood pressure monitors, thermometers, and other devices connected to smartphone applications and clouds. The common denominator for all these instruments is that they are generally designed for sporadic measurements rather than continuous monitoring and are usually taken from the shelf when patient already feels bad. Transformation from episodic, manual, and fragmented care toward continuous, automated, and prolonged monitoring can have an impact on the quality of life and well-being of the chronic disease patient by addressing three key health-care objectives:

1. Improved patient quality of life
2. Improved quality of care
3. Reduced cost and risk.

Digital continuous care focuses on these three objectives with tools to plan and deliver personalized health monitoring products and services.

INFORMATION–CARE FLOW CIRCLE

The power of digital transformation comes from collecting specific, detailed, and accurate data about patients and their medical life flow. These insights enable the application of predictive algorithms to detect any minor deviation from the patient's established baseline. For example, lack of medication adherence or missing a dose of medicine can be immediately recognized by medical intelligence algorithms and alerts sent to a family member or care team. As we look to the future, patient-generated real-time information will interact with medical professionals in a

***Address for correspondence:**
Dr. Leon Eisen, 20, Church Street, Mezzanine, Hartford, CT 06103, USA.
E-mail: leon.eisen@oxitone.com

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so-called digital information–care circle manner, where passively generated continuous, precision data support the patient-care processes [Figure 1].

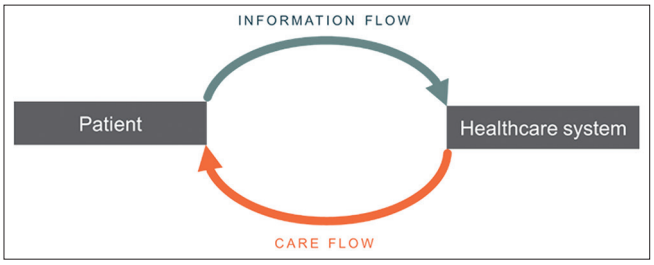

Figure 1: The digital information - care circle

The basis of this circle is that the patient continuously generates precise medical data on their medical life flow. In exchange, the patient receives proactive care based on their current health status, monitored in real time with high resolution. By applying flow processing algorithms to the patient–healthcare system as a whole and to each flow node separately, professionals should be able to optimize cost and performance of patient-care delivery.

DIGITAL CONTINUOUS CARE – HOW IT WORKS

An example of the suggested real-time digital continuous care system is presented in Figure 2.

Real time means that the system can continuously process digital biomarkers and their derivatives and so be synchronized with what's happening with the patient. AI-powered software can continuously monitor against the patient's baseline and adapt the care plan and intervention protocols, rather than relying on episodic data and prescribed actions. This intelligent software is referred to as augmented medical intelligence – the enhanced ability to predict events, provide insights, and communicate with caregiver and clinician to support medical decision-making. A digital continuous care platform increasingly leverages the usability and intelligence embedded within wearable medical devices and software systems, thus allowing providers to analyze data from continuous tracking, empower patients to participate in their own care plan, and predict and alert against future potential complications. Digital continuous care is the next step in the evolution of modern remote patient monitoring and management. For example, one of the reasons healthcare providers are likely to employ digital continuous care is to passively reduce hospital stay and risk of readmission. With the digital continuous care mechanism, the hospital stay could be ultimately optimized without additional medical staff involved, so the hospital does not have to keep patients for extended stays – patients will continue medical-grade, digital care at home.

WHY WEARABLES?

Digital wearable medical technologies allowing comfortable and reliable patient continuous monitoring could shift home healthcare from reactive postevent intervention to real-time and predictive systems and processes. When smart wearable technologies and patient home-care planning come together, they can dramatically change the way clinicians plan and react. Digital continuous care combines the convenience of a wearable, tracking device, with state-of-the-art monitoring capabilities, previously only available in the hospital or care facility.

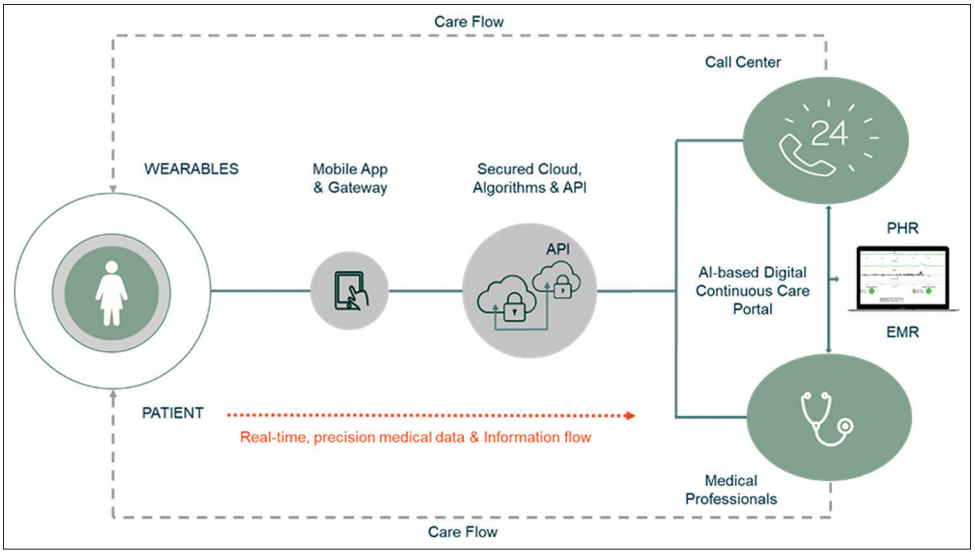

Figure 2: Digital continuous care model

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USE CASE: HEALTHCARE SUPPLY CHAIN OPTIMIZATION

When thinking of ways to reduce the costs of healthcare and improve efficiency, three words come to mind: supply chain management. Health-care supply chain management is the second largest expense for health-care providers. About 45% of nonlabor operating budget is driven by the supply chain.[3] Health-care supply chain resources are possibly wasted due to lack of access to patient monitoring data that could result in ineffective processes for analyzing, planning, and delivery. As a result, supply chain leaders face pressure to rethink traditional distribution and supplier models. The current, one-directional supply chain model does not take into account patient clinical outcomes as a valuable factor for optimizing the whole system's cost-effectiveness.

Digital continuous care model is a critical link in the health-care digital supply chain focusing on patient outcomes. It clearly defines patients at risk, accelerates care delivery, and optimizes access to care for chronic patients. Augmented medical algorithms can identify critical health issues at an early stage and deliver proactive, data-driven decision support. This technology creates some short-term and long-term opportunities as well as transactional opportunities to make processes increasingly more efficient. Being able to collect and process patient's outcome information in real time is an invaluable resource when assessing the cost-effectiveness of the supply chain.

In addition, value-based reimbursement models require care delivery to be based on patient outcomes. To make it as efficient as possible, providers should identify and reduce supply chain inefficiencies that prevent value-based reimbursement success. Digital continuous care offers invaluable insights to build bi-directional supply chain technologies and practices that incorporate patient's real-time data and outcomes into each step of health-care delivery within the information–care flow circle.

CONCLUSION

Predictive and preventative healthcare requires real-time accurate information, a personal medical profile/history, and intelligent processing algorithms capable of recognizing critical health factors and making appropriate interventions at the right time. In today's health-care system, critical information on a patient's real-time and predicted future health status is often missing or incomplete. With rapid advances in digital technologies for collecting, monitoring, processing, and communicating health-care data, digitally enabled prediction will become a central input into decision-making in healthcare. Digital continuous care is a key and cost-effective mechanism, able to generate information we do not currently have, especially outside a hospital environment. It has many different components and functionalities and can be uniquely configured for each specific use case. However, the ability to generate and analyze the patient real-time data, build a dynamic baseline, and predict future complications is the common denominator.

Transforming from conventional remote monitoring to accurately predicting patient health status is slowly becoming a reality. Clinicians and payers understand that digital continuous monitoring with predictive analytics can enable mitigation of patient risk much faster than has previously been possible. They are seeing the greatest value and momentum to start their journey, at least in small steps. However, it is challenging to try out some new technologies while maintaining current processes and workflows that hamper wider adoption and implementation of digital continuous care. Hence, to accelerate further penetration of digital continuous care into the healthcare system, any new technology should be carefully tuned and integrated into the current clinical workflow without dramatic disruption and added cost.

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