Applying Artificial Intelligence to Improve Kidney Health

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At CVS Kidney Care®, our mission is to change kidney care for the better by empowering kidney health in communities across the nation. We use the unmatched resources of our parent company, CVS Health and our partners like Satellite Healthcare, a not-for-profit and top-rated provider of kidney dialysis and related services, to transform kidney care and provide those with chronic kidney disease (CKD) a more comprehensive, individualized care experience. That means leveraging our technological expertise in data science and innovative modeling with a human-centered approach that reaches everyone wherever they are and when they need it. This helps nephrologists provide more timely, effective care, which can result in better health outcomes and lower cost of care.

Changing for the better

Sophisticated predictive models that use artificial intelligence (AI) are helping nephrologists identify earlier those people who are at higher risk of disease progression. This allows more time to provide proper education, training and support to help them better manage their kidney health. Our predictive models go well beyond the standard approach to identification. Compared to stratifying by CKD stage alone, which is the status quo, our models can identify 2x more people who are expected to quickly progress to kidney replacement therapy.[1] This allows us to narrow patients into more defined risk pools so they can receive the most appropriate care for their disease status.

> Satellite Healthcare is a terrific partner for us. Their clinical expertise and patient-centered care combined with our data science knowledge and technology resources give us the ability to identify use cases where we can have the biggest impact on patient health.
>
> **Emily Kipping, Executive Director of Kidney Care Analytics, CVS Health**

Early interventions help aid in the slow down of kidney disease progression, this means we have more time to prepare people for the next stage of care, including at-home dialysis, which has been shown to improve overall quality of life and health outcomes.[2,3,4] Only 12% of people on dialysis utilize at-home dialysis[5] despite its shown benefits.

Our mission is to significantly increase the number of patients and physicians who feel confident with at-home dialysis and its life-changing benefits. Our joint venture with Satellite Healthcare has already achieved an at-home dialysis penetration rate that is 45% higher than the national average.[6]

Our partnership with Satellite Healthcare allows us to look at kidney treatment protocols from a more complete perspective and it also provides access to more complete kidney patient data. By more thoroughly understanding the entire clinical process and what data is available, we can build models that can better predict patient needs and enable earlier interventions.

The Challenges

The effective use of data and AI to improve care has its challenges. But by acknowledging and understanding what these challenges are, we are better able to overcome them.

Silos in health care

One of the biggest obstacles is that providers typically operate in silos. Primary care physicians, nephrologists, nurses, caregivers, health plans and pharmacies have their own unique roles and resulting patient data and insights. Sharing information to get a complete picture of a person's treatment process can be difficult, but very possible.

Data context

Not all data is the same. But recognizing this upfront helps avoid false assumptions which can significantly impact predictive model accuracy. Our models are constructed with a fuller understanding of data nuances and limitations, achieved through asking many questions including:

• How was this data captured?

• Why was this data captured?

• What is the actual source of this data?

By answering these and many other questions, we can understand the data better and take any limitations into consideration as models are being built.

> Nephrologists take many things into consideration for an individual patient. They can be skeptical of AI and predictive models because machines can't do what a doctor does. But then, doctors can't process data the way that a machine can. The bottom line is that, when done correctly, these models can be an important tool to help nephrologists get a better overall view of their patients.
>
> **Dr. Wael Hussein, VP of Research & Development, Satellite Healthcare**

Overcoming the Challenges

The key to overcoming the challenges to the effective use of data, is bringing together the combined expertise and resources of CVS Kidney Care and Satellite Healthcare.

CVS Kidney Care, in partnership with CVS Health®, brings the technical know-how with a wealth of predictive modeling and AI experience, plus access to data sets of 20 million patients. Satellite Healthcare, a consistent leader in quality and the top ranked dialysis provider for patient experience[7], provides the clinical expertise and patient perspective.

Together, we have created a fully collaborative process that overcomes the challenges to the effective use of data and AI. The process involves:

- Identifying goals we think we can influence
- Getting data and creating training models
- Making sure models work effectively
- Designing interventions to improve patient outcomes
- Looking at results and repeating cycles with refinements
- Identifying new goals

Current Projects

- **Fluid-related hospitalization** — this will help identify at-risk patients so we can set up processes for appropriate interventions, such as further education on fluid management, and/or additional dialysis sessions.
- **Home dropout** — provides key individual level risk factors to the renal nurse and patient, and defines additional interventions and/or respite care so they can continue their dialysis in the home or have a safe transition to the next modality.

With better care for patients as our mission, we continually look for ways to utilize AI to identify and support new use cases.

> It takes the combined effort of the full team — doctors, nurses, technicians, patients, caregivers, data scientists and software engineers all working together to produce algorithms that are tied to realistic use cases. And we need to be upfront about any limitations. This will allow us to use AI most effectively.
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> **Dr. Wael Hussein, VP of Research & Development, Satellite Healthcare**

> We and our colleagues at Satellite Healthcare firmly believe that home dialysis leads to better outcomes for suitable patients, so we want to support patients so they remain on home therapy. By working closely together, we can utilize AI to develop the right predictive model for early intervention to minimize drop-outs.
>
> **Mahesh Shukla, Lead Data Scientist at CVS Health**

The Future

Efficient use of data and AI is critical to our mission of changing kidney care for the better. And we are well on the way to do so with the help of Satellite Healthcare. We're breaking down health care silos and identifying the most effective use of data and AI to support nephrologists and care teams. As a result, our focus on overall kidney health will help improve health outcomes and reduce care costs.

Partnering with Satellite Healthcare adds the clinical data and expertise that's critical for building the right predictive models. With our combined resources, we can take a holistic view of kidney health and provide information that will help care teams provide better care to their patients.

Emily Kipping, Executive Director of Kidney Care Analytics, CVS Health

It takes a dedicated, qualified team to get predictive modeling right; the future holds a lot of promise. We are just scratching the surface now, but with CVS Kidney Care and Satellite Healthcare working so closely together, we expect great things to come.

Dr. Wael Hussein, VP of Research & Development, Satellite Healthcare

Become part of the solution to transform kidney health. **Find out more at CVSKidneyCare.com/contact-us**

[1] CVS Kidney Care analytics, 2020. Latest model performance metrics from CVS Kidney Care Analytics team. All data sharing complies with applicable law, our information firewall and any applicable contractual limitations. Actual results may vary depending on benefit plan design, member demographics, programs implemented by the plan and other factors.

[2] Foley RN, Gilbertson DT, Murray T, et al. Long interdialytic interval and mortality among patients receiving hemodialysis. The New England Journal of Medicine 2011; 1099-107. Accessed February 28, 2022.

[3] Jaber BL, Lee Y, Collins AJ, et al. Effect of daily hemodialysis on depressive symptoms and post dialysis recovery time: interim report from the FREEDOM (Following Rehabilitation, Economics and Everyday-Dialysis Outcome Measurements)Study. Am J Kidney Dis. 2010;56(3):531-539.

[4] Culleton BF, Walsh M, Klarenbach SW, et al. Effect of frequent nocturnal hemodialysis vs conventional hemodialysis on left ventricular mass and quality of life: a randomized controlled trial. JAMA. 2007;298(11):1291-1299.

[5] **2019 USRDS Annual Report** — United States Renal Data System. 2019 USRDS annual data report: Epidemiology of kidney disease in the United States. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2019.

[6] CVS Kidney Care analytics, 2021. — Through a joint venture partnership with Satellite Healthcare, the clinical provider of patient care at our centers, in the Austin, TX market.

[7] Satellite Healthcare Dialysis Centers: Rated the National Leader in Patient Experience. Available at: **https://www.businesswire.com/news/home/20210610005146/en/Satellite-Healthcare-Dialysis-Centers-Rated-the-National-Leader-in-Patient-Experience**. Accessed February 28, 2022.

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