Application of digital technology and artificial intelligence in nephrology

Summary

Healthcare around the world is under tremendous pressure, with rising costs of care and limited resources. This is also true in providing care for End Stage Kidney Disease (ESKD) patients. Coronavirus Disease (COVID) pandemic has added further burden to these vulnerable patients and clinical care teams caring for these patients. It is therefore particularly timely to look for ways to cut the cost and improve care with the help of technology driven solutions. With rise in healthcare data collected in Electronic Medical Records (EMR), we can use advancing technologies to harness this data. Traditionally computer-based algorithms in health care include a set of rules encoding expert knowledge on medical decisions. These rules are subsequently applied to draw conclusions about specific clinical scenarios. Artificial Intelligence (AI) algorithms, however, strive to learn from the data without concrete rules. **In Chapter 2** We summarized high level concepts related to AI and presented several areas where AI has been applied in the field of Nephrology.

While there are many articles in literature that present how AI can be applied in small cohort of patients, there are very few articles where outcomes are measured retrospectively in a large clinical application. Dialysis Hospitalization Risk Pilot (DHRP) application presented in **Chapter 3** is one such example. In this retrospective analysis of the clinical application, we found ML directed assessment and personalized interventions in the DHRP, were associated with lower all-cause hospitalization rates compared to control clinics. The DHRP findings detail how such applications can reduce the cost of care and should be considered by payors, providers, and clinicians.

In the future, AI application will be more impactful if such models are run in real time as the patient is receiving dialysis. This proof-of-concept analysis demonstrated in **Chapter 4** shows the potential of the creation and deployment of a real-time predictive model based on patient and dialysis treatment data.

The success of AI in the future will also depend on the data beyond the data collected in traditional EMR. Data collected from wearable devices, genomic data and other digital applications will be very important in deriving additional insights. Our findings in **Chapter 5** provide an example of one such digital application that can be used by Peritoneal Dialysis (PD) patients at home. We conclude frequent use of a Remote Treatment Monitoring (RTM) application associates with less hospital admissions, shorter hospital length of stay, and lower rates of sustained technique failure.

Similar to identifying patients at high risk of hospitalization, AI can also help with identification of high risk of other events such as SARS-CoV-2 infection and mortality. In **Chapter 6 and 7** we showed how such models can be developed using the data

collected in EMR and utilized during the Coronavirus Disease Pandemic. In **Chapter 8** we demonstrated the successful use of AI in predicting mortality on a large cohort of international HD patients.

AI has the potential to assist clinical teams in improving the quality of life of ESKD patients and reduce the overall cost of care. However, factors such as clinical effectiveness of an AI solution, and accountabilities in case of error, need to be carefully considered before implementing such solutions. Furthermore, policies and regulations need to evolve to guide the development of AI at an acceptable scale. Most importantly, the value of an AI solution to effectively deliver better outcomes needs to be demonstrated to patients, physicians, and providers to foster their trust.