APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN CKD

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ARTIFICIAL INTELLIGENCE: TERMINOLOGIES AND OVERVIEW

In this section we will enumerate and define terminologies that are used in relation to artificial intelligence (AI). We will also state how AI can be applied in the identification and management of CKD patients.

PERSPECTIVES OF ARTIFICIAL INTELLIGENCE IN CKD

In this section, we will discuss on how AI could assist in caring for CKD patients, such as by forecasting critical changes among dialysis patients and creating a cloud-based comprehensive healthcare ecosystem. We will also highlight key findings of a real world study that suggested that the use of AI could help stratify and direct treatment strategies for patients with diabetic kidney disease (DKD).

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CONTACT US:

For suggestions and comments email us at: medical_information_education @fmc-asia.com. Global Medical Education and Information, Fresenius Medical Care Asia Pacific, 51/F Sun Hung Kai Centre, 30 Harbour Road, Wan Chai, Hong Kong

FRESENIUS MEDICAL CARE

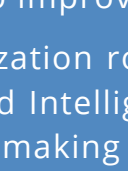
ARTIFICIAL INTELLIGENCE: TERMINOLOGIES AND OVERVIEW[1]

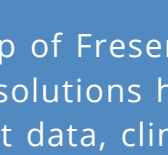
Artificial intelligence (AI)	The capability to imitate intelligent human behavior using machines based on computer science, statistics, algorithms, machine learning, information retrieval, and data science
Machine Learning (ML)	A major branch of AI in which computers are trained using algorithms and statistical models to learn sample data and analysis data processing experience instead of being definitively programmed to perform specific tasks
Artificial neural network (ANN)	A mathematical model based on nonlinear statistical data modelling tools where complex relationships occur between inputs and outputs
Deep learning (DL)	A branch of ML based on ANN and is regarded as a more sophisticated implementation of ML capable of performing more detailed analyses, combining more data, and representing higher abstraction levels
Convolution neural network (CNN)	A newer model of networks that was introduced to overcome the limitations of shallow ANNs. Their features include local connections, shared weights, and pooling

Table 1. Important terminologies in AI. Adapted from CEH 2021;4:51-61.

Clinical Applications of Artificial Intelligence in Kidney Disease	
Acute kidney injury (AKI)	Early diagnosis and treatment (burns, post-operative AKI)
Chronic Kidney Disease (CKD)	Identification and predicting progression (diabetic kidney disease, IgA nephropathy)
Dialysis	Haemodialysis (anaemia, blood pressure, vascular access) and peritoneal dialysis (forecast risk, peritonitis)
Nephropathology	Image analysis
Kidney Transplantation	Prediction of graft rejection, optimization of immunosuppressive therapy

Table 2. Adapted from CEH 2021;4:51-61.





PERSPECTIVES OF ARTIFICIAL INTELLIGENCE IN CKD

Artificial intelligence (AI) has enabled solutions in the management of kidney disease such as determination of risk scores incorporating data related to demographics, vitals, diagnoses, procedures, diagnostic tests, biomarkers, genetic tests, and patient behaviors or symptoms. [2]

A company in Taiwan reported a platform aimed at digitizing healthcare information through a cloud-based, dialysis management system. The system is a personalised dialysis AI system which aids healthcare professionals in forecasting critical changes in individual patients. The company also launched a healthcare platform that connects medical institutions and the healthcare industry together to provide a comprehensive healthcare ecosystem among patients with chronic diseases. [3]

A late-breaking ePoster session presented last month at the American Diabetes Association 82nd Scientific Sessions showed real world evidence on the utility of a laboratory-developed AI-based test. This was developed as a reliable bioprognostication tool that yields a simple to understand, custom risk score, enabling prediction of which adult patients with type 2 diabetes and early CKD (stages 1-3) are at low, intermediate or high risk for rapid progressive decline in kidney function. The analysis which involved 1,112 patients, helped physicians overcome the inertia seen with novel therapeutics proven to slow CKD progression and reduce associated patient cardiovascular event risk. As compared to patients who scored low risk, those who were classified as high-risk demonstrated increased use of anti-hypertensives, a 6-fold increase in the initiation of guideline-recommended treatments (SGLT-2 inhibitors or GLP-1 receptor agonists), and nearly a 3-fold increase in referrals to nephrologists, endocrinologists or dietitians. [4]

"Fundamentally, a patient's condition manifests itself to the health care provider through data in the broadest sense," commented Dr Peter Kotanko, head of research at the Renal Research Institute. "Think about clinical information, imaging studies, laboratory data, etc. AI methods can be used to analyze and interpret them and complement the health care provider's assessment." [5]

"AI in kidney care and healthcare employs the use of algorithms and software engineering principles to approximate decisions made by clinicians in the analysis of complex health care data," commented Len A. Usvyat, PhD, and colleagues in a 2019 article on AI in Nephrology News & Issues. [5]

EXPERT COMMENTARY (With Mr Eric Liu, Associate Director, Clinical Information Systems and Advanced Analytics, Asia-Pacific)

What are the promises of current AI initiatives that our clinics in the Asia-Pacific region are adapting to improve patient care?

"Year 2021 marks a significant milestone in the digitalization roadmap of Fresenius Kidney Care clinics in the Asia Pacific region – Advanced Intelligence solutions have been implemented in pilot dialysis clinics after EuCliD, making patient data, clinical information systems and mobile applications available in the clinics.

We have been adapting various AI solutions which could recommend to physicians alternative treatment options for our patients, for example, related to anemia management. Utilizing the power of real-world data from the EuCliD system, AI solutions greatly assist physicians in improving patients' clinical outcomes, eventually extending patients' life expectancy."

References:

(1) Yau L, et al, Application of artificial intelligence in renal disease. *Clinical eHealth* 2021;4:51-61; (2) Tangri N, Ferguson T, Artificial Intelligence in the Identification, Management, and Follow-Up of CKD. *KIDNEY360* 2022;3:554–556; (3) https://www.biospec- trumasia.com/news/27/20498/taiwanese-medtech-firm-introduces-digitised-dialysis-management-system.html [Accessed 2 July 2022]; (4) https://renalytix.com/1112-patient-study-demonstrates-clinical-utility-and-care-benefits-of-kidneyintelx-risk-stratification-in-stage-1-to-3-diabetic-kidney-disease-patients/ [Accessed 2 July 2022]; (5) https://www.healio.com/news/nephrology /20210610/artificial-intelligence-aids-nephrologists-in-directing-kidney-care [Accessed 2 July 2022]