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AI tool predicts kidney failure six times faster than human expert analysts

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Kidney doctors and clinical scientists at Sheffield Teaching Hospitals NHS Foundation Trust are using artificial intelligence (AI) to better predict when a person's kidneys might fail. Credit: University of Sheffield

Kidney doctors and clinical scientists at Sheffield Teaching Hospitals

NHS Foundation Trust are using artificial intelligence (AI) to better predict when a person's kidneys might fail.

Professor Albert Ong, consultant nephrologist and clinical lead for genetics at Sheffield Teaching Hospitals NHS Foundation Trust, who has been using the tool in his specialist kidney clinic, said the software was six times faster than manual processes and could be used in kidney clinics throughout the world.

The tool provides an accurate and super-fast analysis of total kidney volume, a measurement used to assess future kidney lifespan in patients with autosomal dominant polycystic kidney disease (ADPKD), a common inherited kidney condition caused by the growth of fluid-filled sacs in the kidneys.

Between 30,000 to 70,000 people in the U.K. have the disease, which is currently monitored using repeated measurements of kidney enlargement from patient MRI scans.

These scans are made up of two-dimensional "slices" stacked on top of each other, with analysts having to go through 50–60 slices, and carefully trace round the edge of each kidney on a computer screen.

Vital results predicting future kidney lifespan ready in a minute

This is a labor-intensive process and takes approximately an hour, per patient case, of staff time. By automating the segmentation of the MRI scans, the AI has the results available in less than a minute.

"Our AI tool performed as well as the human expert analysts and did the job approximately six times faster. Our radiographer colleague Richard

Thomas manually traced round the kidneys in all images from a previous European research study. We then fed this collection of images and kidney tracings to an AI algorithm until it had learned to do the tracing process itself to a high standard," Professor Ong explained.

The AI was developed from an algorithm trained by Principal Scientist Jonathan Taylor, also based at Sheffield Teaching Hospitals NHS Foundation Trust, and tested on hundreds of kidney MRI scans from a previous European-wide research project.

The software has been in use at Sheffield Teaching Hospitals NHS Foundation Trust's 3D Lab since 2022, with the team saying it could be used in kidney clinics worldwide.

"ADPKD is a painful disease which typically causes kidney failure in patients at the relatively young age of 50. By automating kidney volume measurements, we have been able to predict when kidney failure is going to happen faster and with a high degree of accuracy.

"This is important in this group of patients as once kidney failure is reached, the disease is irreversible, and treatment can only be given through dialysis or transplant," Professor Albert Ong, who is also a Professor of Renal Medicine at the University of Sheffield, said.

"This tool will enable kidney clinics worldwide to measure kidney volume quickly and accurately. It will make the measurement of kidney volume possible at clinics where there is a lack of specialist expertise," he added.

Provided by University of Sheffield

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