AI to predict your health later in life: Researchers develop software to analyze bone density scans

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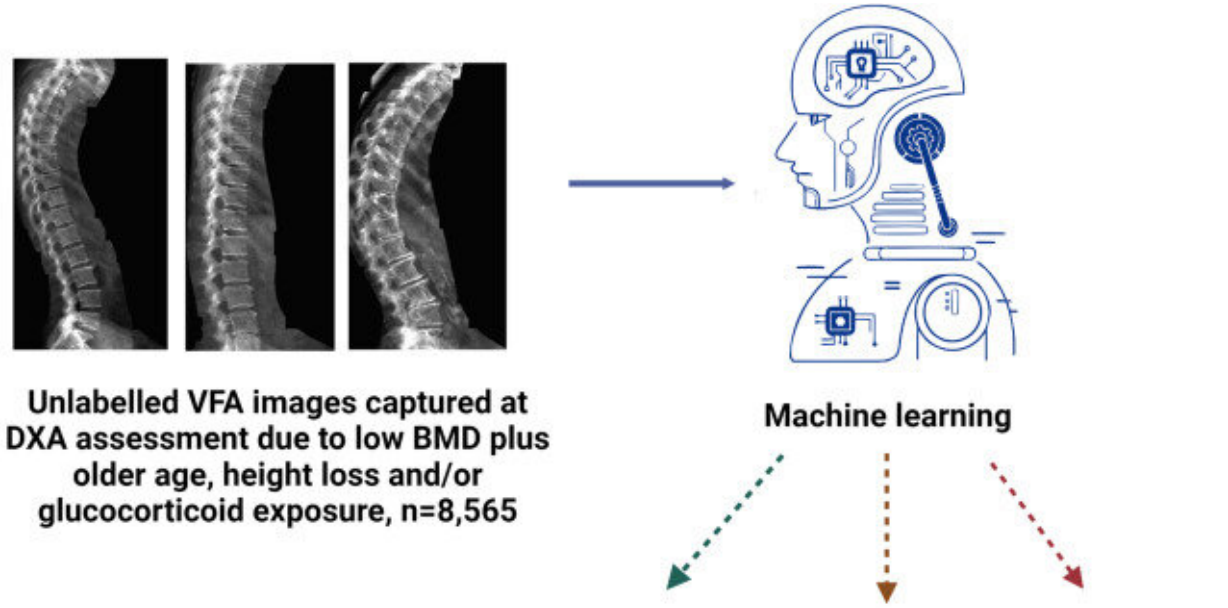

Incident CVD events (mean follow-up 4 years)	Low AAC n = 3,400	Moderate AAC n = 2,840	High AAC n = 2,325
MACE, Primary endpoint	7.9%	14.5%	21.2%
All-cause mortality	6.3%	11.4%	17.3%
Myocardial infarction	1.2%	2.9%	4.0%
Cerebrovascular disease	1.2%	2.6%	3.9%
Secondary endpoints			
Coronary artery disease	3.2%	5.9%	10.2%
Coronary revascularization	0.9%	1.8%	2.8%
Congestive heart failure	3.0%	5.9%	8.5%
Peripheral arterial disease	0.6%	1.5%	2.3%
Any secondary endpoint	5.6%	10.2%	16.1%

Proportion with clinical outcomes stratified by machine-learning abdominal aortic calcification groups from dual-energy Lunar Prodigy and iDXA images captured at the time of bone density testing. “Created with BioRender.com.” . Credit: *eBioMedicine* (2023). DOI: 10.1016/j.ebiom.2023.104676

Abdominal aortic calcification, or AAC, is a calcification which can build up within the walls of the abdominal aorta and predicts your risk of developing cardiovascular disease events such as heart attacks and stroke. It also predicts your risk of falls, fractures and late-life dementia.

Conveniently, common bone density machine scans used to detect osteoporosis, can also detect AAC.

However, highly trained expert readers are needed to analyze the images, a process which can take five to 15 minutes per image.

But researchers from Edith Cowan University's (ECU) School of Science and School of Medical and Health Sciences have collaborated to develop software which can analyze scans much, much faster: roughly 60,000 images in a single day. "Machine Learning for Abdominal Aortic Calcification Assessment from Bone Density Machine-Derived Lateral Spine Images" was published in *eBioMedicine.*

Researcher and Heart Foundation Future Leader Fellow Associate Professor Joshua Lewis said this significant boost in efficiency will be crucial for the widespread use of AAC in research and helping people avoid developing health problems later in life.

"Since these images and automated scores can be rapidly and easily acquired at the time of bone density testing, this may lead to new

approaches in the future for early cardiovascular disease detection and disease monitoring during routine clinical practice," he said.

The results were from an international collaboration between ECU, the University of WA, University of Minnesota, Southampton, University of Manitoba, Marcus Institute for Aging Research, and Hebrew Senior Life Harvard Medical School. Truly a multidisciplinary global effort.

Though it's not the first algorithm developed to assess AAC from these images, the study is the biggest of its kind, was based on the most commonly used bone density machine models, and is the first to be tested in a real-world setting using images taken as part of routine bone density testing.

It saw more than 5,000 images analyzed by experts and the team's software.

After comparing the results, the expert and software arrived at the same conclusion for the extent of AAC (low, moderate or high) 80% of the time—an impressive figure given it was the first version of the software.

Importantly, only 3% of people deemed to have high AAC levels were incorrectly diagnosed to have low levels by the software.

"This is notable as these are the individuals with the greatest extent of disease and highest risk of fatal and nonfatal cardiovascular events and all-cause mortality," Professor Lewis said.

"While there is still to work to do to improve the software's accuracy compared to human readings, these results are from our version 1.0 algorithm, and we already have improved the results substantially with our more recent versions.

"Automated assessment of the presence and extent of AAC with similar accuracies to imaging specialists provides the possibility of large-scale screening for cardiovascular disease and other conditions—even before someone has any symptoms."

"This will allow people at risk to make the necessary lifestyle changes far earlier and put them in a better place to be healthier in their later years."

More information: Naeha Sharif et al, Machine learning for abdominal aortic calcification assessment from bone density machine-derived lateral spine images, *eBioMedicine* (2023). DOI: 10.1016/j.ebiom.2023.104676

Provided by Edith Cowan University