How AI can help improve hospital stays and outcomes for older patients with dementia

September 29 2022

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By using artificial intelligence, Houston Methodist researchers are able to predict hospitalization outcomes of geriatric patients with dementia on the first or second day of hospital admission. This early assessment of

outcomes means more timely interventions, better care coordination, more judicious resource allocation, focused care management and timely treatment for these more vulnerable, high-risk patients.

Because geriatric patients with dementia have longer hospital stays and incur higher health care costs than other patients, the team sought to solve this problem by identifying modifiable risk factors and developing an artificial intelligence model that improves patient outcomes, enhances their quality of life and reduces their hospital readmission risk, as well as reducing hospitalization costs once the model is put into practice.

The study, appearing online Sept. 29 in *Alzheimer's & Dementia: Translational Research and Clinical Interventions*, looked at the hospital records of 8,407 geriatric patients with dementia over 10 years within Houston Methodist's system of eight hospitals, identifying risk factors for poor outcomes among subgroups of patients with different types of dementia that stem from diseases such as Alzheimer's, Parkinson's, vascular dementia and Huntington's, among others. From this data, the researchers developed a machine learning model to quickly recognize the predictive risk factors and their ranked importance for undesirable hospitalization outcomes early in the course of these patients' hospital stays.

With an accuracy of 95.6%, their model outperformed all other prevalent methods of risk assessment for these multiple types of dementia. The researchers add that none of the other current methods have applied AI to comprehensively predict hospitalization outcomes of elderly patients with dementia in this way nor do they identify specific risk factors that can be modifiable by additional clinical procedures or precautions to reduce the risks.

"The study showed that if we can identify geriatric patients with dementia as soon as they are hospitalized and recognize the significant

risk factors, then we can implement some suitable interventions right away," said Eugene C. Lai, M.D., Ph.D., the Robert W. Hervey Distinguished Endowed Chair for Parkinson's Research and Treatment in the Stanley H. Appel Department of Neurology. "By mitigating and correcting the modifiable risk factors for undesirable outcomes immediately, we are able to improve outcomes and shorten their hospital stays."

Lai, a neurologist, has worked for many years with these patients and wanted to look at ways to better understand how they're managed and their behavior when hospitalized, so clinicians could improve care and quality of life for them. He approached Stephen T.C. Wong, Ph.D., P.E., a bioinformatics expert and Director of the T. T. and W. F. Chao Center for BRAIN at Houston Methodist, with this idea, because he had previously collaborated with Wong and knew his team had access to the large clinical data warehouse of Houston Methodist patients and the ability to use AI to analyze big data.

Risk factors for each type of dementia were identified, including those amenable to interventions. Top identified hospitalization outcome risk factors included encephalopathy, number of medical problems at admission, pressure ulcers, urinary tract infections, falls, admission source, age, race and anemia, with several overlaps in multi-dementia groups.

Ultimately, the researchers aim to implement mitigation measures to guide clinical interventions to reduce these negative outcomes. Wong says the emerging strategy of applying powerful AI predictions to trigger the implementation of "smart" clinical paths in hospitals is novel and will not only improve clinical outcomes and patient experiences, but also reduce hospitalization costs.

"Our next steps will be to implement the validated AI model into a

mobile app for the ICU and main hospital staff to alert them to geriatric patients with [dementia](#) who are at high risk of poor hospitalization outcomes and to guide them on interventional steps to reduce such risks," said Wong, the paper's corresponding author and the John S. Dunn Presidential Distinguished Chair in Biomedical Engineering with the Houston Methodist Research Institute. "We will work with hospital IT to integrate this app seamlessly into EPIC as part of a system-wide implementation for routine clinical use."

He said this will follow the same smart clinical pathway strategy they have been working on to integrate two other novel AI apps his team developed into the EPIC system for routine clinical use to guide interventions that reduce the risk of patient falls with injuries and better assess breast cancer risk to reduce unnecessary biopsies and over-diagnoses.

Wong and Lai's collaborators on this study were Xin Wang, Chika F. Ezeana, Lin Wang, Mamta Puppala, Yunjie He, Xiaohui Yu, Zheng Yin and Hong Zhao, all with the T.T. & W.F. Chao Center for BRAIN at the Houston Methodist Academic Institute, and Yan-Siang Huang with the Far Eastern Memorial Hospital in Taiwan.

Provided by Houston Methodist