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Title

Explainable machine learning model to predict COVID-19 severity among older adults in the province of Quebec

Priority 1 (Research Category)

Big Data

Presenters

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Abstract

Context: Patients over the age of 65 years are more likely to experience higher severity and mortality rates than other populations from COVID-19. Clinicians need assistance in supporting their decisions regarding the management of these patients. Artificial Intelligence (AI) can help with this regard. However, the lack of explainability—defined as "the ability to understand and evaluate the internal mechanism of the algorithm/computational process in human terms"—of AI is one of the major challenges to its application in health care. We know little about application of explainable AI (XAI) in health care.

Objective: In this study, we aimed to evaluate the feasibility of the development of explainable machine learning models to predict COVID-19 severity among older adults.

Design: Quantitative machine learning methods.

Setting: Long-term care facilities within the province of Quebec.

Participants: Patients 65 years and older presented to the hospitals who had a positive polymerase chain reaction test for COVID-19.

Intervention: We used XAI-specific methods (e.g., EBM), machine learning methods (i.e., random forest, deep forest, and XGBoost), as well as explainable approaches such as LIME, SHAP, PIMP, and anchor with the mentioned machine learning methods.

Outcome measures: Classification accuracy and area under the receiver operating characteristic curve (AUC).

Results: The age distribution of the patients (n=986, 54.6% male) was 84.5⬚19.5 years. The best-performing models (and their performance) were as follows. Deep forest using XAI agnostic methods

LIME (97.36% AUC, 91.65 ACC), Anchor (97.36% AUC, 91.65 ACC), and PIMP (96.93% AUC, 91.65 ACC). We found alignment with the identified reasoning of our models' predictions and clinical studies' findings—about the correlation of different variables such as diabetes and dementia, and the severity of COVID-19 in this population.

Conclusions: The use of explainable machine learning models, to predict the severity of COVID-19 among older adults is feasible. We obtained a high-performance level as well as explainability in the prediction of COVID-19 severity in this population. Further studies are required to integrate these models into a decision support system to facilitate the management of diseases such as COVID-19 for (primary) health care providers and evaluate their usability among them.