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Prediction research in a Pandemic: results of the COVID PRECISE living systematic review of diagnostic and prognostic models

Introduction

Diagnostic and prognostic models for covid-19 provide an evidence-based, individualized approach to shielding, priority vaccination, diagnosis, triage, and treatment. Soon after the outbreak, AI and risk models appeared in research and the clinic, and the number kept growing.

Methods

A living systematic review of studies that developed or validated a covid-19 related prediction model for diagnosis or prognosis, using any combination of predictors including demographic, clinical or imaging data. Data sources are PubMed and Embase through Ovid, arXiv, medRxiv, and bioRxiv. Pairs independently extracted data using CHARMS (critical appraisal and data extraction for systematic reviews of prediction modelling studies); risk of bias was assessed using PROBAST (prediction model risk of bias assessment tool).

Results

37 420 titles were screened, 170 studies describing 236 prediction models were included. We identified 11 models for identifying people at risk in the general population; 118 diagnostic models for detecting covid-19; and 107 prognostic models for adverse disease outcomes. The models were built using logistic regression (34%), neural networks/deep learning (32%) or other (34%). The predictive performance of 212 newly developed models was evaluated with external validation (24%), internal validation only (53%), or neither (24%). Twenty-four studies independently validated an existing model. C-indexes ranged from 0.54 to 0.99. Risk of bias was low in 4 models, unclear in 6, and high in 226 (94%). All data is available on www.covprecise.org/living-review.

Conclusion

This review indicates that most proposed prediction models are at high risk of bias, and their reported performance cannot be trusted. We have identified promising models that need validation in multiple cohorts, which is ongoing research by the COVID PRECISE consortium. The review is regularly updated.

Reference

Wynants L, Van Calster B, et al. Prediction models for diagnosis and prognosis of covid-19: systematic review and critical appraisal. BMJ 2020; 369 :m1328