New tool predicts risks of hospital admission and death from COVID-19

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A new risk tool, developed by UK researchers to predict a person's risk of being admitted to hospital and dying from COVID-19 has been published by The *BMJ* today.

With cases increasing in the UK and elsewhere, and winter approaching, there is an urgent need for reliable models that predict the likely course

of COVID-19, to support decisions about shielding, hospital admission, treatment, and vaccinations.

The risk prediction tool (known as QCOVID) uses readily available information about people, such as their age, ethnicity and whether they have certain pre-existing conditions (comorbidities) to help identify individuals at highest risk of developing severe illness. It is designed to be applied across the general adult population in the UK.

The tool provides nuanced information on people's risk of serious illness due to COVID-19 and is designed for use by clinicians with patients to reach a shared understanding of risk.

The tool will need to be updated regularly as the pandemic evolves and its performance closely monitored.

Some previous risk prediction models have been developed. They have been identified as having a high risk of bias, raising concerns that these models may be unreliable when applied in practice.

The UK-wide research group set out to develop and validate a population-based prediction model to estimate the overall risks of becoming infected with and subsequently being admitted to hospital or dying from COVID-19. Steps were taken to mitigate known sources of bias.

Their findings are based on data from more than 8 million patients aged 19-100 years at 1,205 general practices in England, linked to COVID-19 test results and hospital and death registry data.

Data from 6 million patients were used to develop the model over a 97 day period (24 January to 30 April 2020), and a further 2.2 million patients to validate its performance over two separate time periods (24 January to 30 April 2020 and 1 May to 30 June 2020) during the first

wave of the pandemic.

To develop the model, known factors such as age, ethnicity, deprivation, body mass index, and a range of comorbidities were used to estimate the probability and timing of hospital admission or death from COVID-19.

Over the study period, 4,384 deaths from COVID-19 occurred in the development group, 1,782 in the first validation time period and 621 in the second validation time period.

The model performed well, predicting 73% and 74% of the variation in time to death from COVID-19 in men and women, respectively.

People in the top 5% for predicted risk of death, accounted for 76% of COVID-19 deaths within the 97-day study period. People in the top 20% for predicted risk of death accounted for 94% of COVID-19 deaths.

The researchers point out that the model aims to provide predictions of risk—it does not aim to provide explanations of which individual factors causally affect risk and the results should not be interpreted in this way.

The absolute risks obtained from the model will change over time, in line with the prevailing COVID-19 infection rate and the extent of social distancing measures in place, so these should also be interpreted with caution. However, the ordering of individuals in terms of their risk is expected to remain relatively stable over time, so that those at highest risk can be identified.

The researchers say that QCOVID represents a robust risk prediction model that has the potential to support public health policy, from enabling shared decisions to mitigate health and workplace risks to targeted recruitment for clinical trials and prioritisation for vaccination.

The model can also be recalibrated for different time periods and has the potential to be updated regularly as the pandemic evolves.

Although QCOVID has been specifically designed to inform UK health policy and interventions to manage COVID-19 related risks, it has international potential, subject to local validation, they conclude.

In a linked editorial, researchers at the University of Manchester agree that QCOVID and the ISARIC (International Severe Acute Respiratory and emerging Infection Consortium) 4C (Coronavirus Clinical Characterisation Consortium) Mortality Score represent steps forward in the quality of COVID-19 prognosis models, but say care must be taken when interpreting the predictions generated by these models.

Given the rapidly changing nature of the disease and its management, they also emphasise the need to update these models regularly and closely monitor their performance over time and space.

They acknowledge that improved data on incident cases of COVID-19 "will allow greater granularity in prediction" and say with these caveats, "we support the continued validation and impact assessment of these models."

More information: Living risk prediction algorithm (QCOVID) for risk of hospital admission and mortality from COVID-19 in adults: national derivation and validation cohort study, *BMJ* (2020). DOI: 10.1136/bmj.m3731 , www.bmj.com/content/371/bmj.m3731

Editorial: Prediction models for coronavirus 2019 outcomes, *BMJ* (2020). www.bmj.com/content/371/bmj.m3777

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