**Title:** Development of an Individual COVID-19 Risk Score amid Rapidly Evolving Science

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**Research Objective:** COVID-19is among the leading causes of death in the U.S. The total cumulative case counts and death counts have been reported daily to the public but it is challenging to put these numbers into perspective. Therefore, risk assessment tools using the latest scientific evidence and are customized to individual users can help them understand their risk profile as well as effective risk management strategies. Health care services need tools to screen patients and staff to protect the safety of everyone involved. The success of many public health measures to contain the pandemic, such as social distancing, mask-wearing, and getting the vaccine relies on strong public buy-in. We developed a framework to assess COVID-19 risks considering geography, demographics, health condition, and health behaviors (adherence to public health guidelines). The algorithm is reviewed periodically to keep up with the most recent evidence. We made this calculator available to the public through both a web-based tool, Mathematica 19andMe COVID-19 Risk Calculator (<https://19andme.covid19.mathematica.org/>) and Application Programming Interface (API). for easy integration with other decision support tools.

**Study Design:** Wedevelopeda risk score on a scale of 1 to 100 that consists of two modules: exposure and susceptibility. The exposure module characterizes the risk of catching COVID-19 through community transmission by incorporating information on local pandemic dynamics and self-reported symptoms. Due to insufficient testing and asymptomatic cases, the actual infections may exceed what is officially reported. We developed an empirical Bayes method to estimate the underreporting factor at the county level. The susceptibility module estimates the probability of severe health outcomes (defined as hospitalization/intensive care unit/mortality) if infected with COVID-19. We normalized the individualized COVID-19 risk by the average disease burden of seasonal flu. The resulted risk score informs the user whether one’s risk profile is low, normal, or elevated.

**Population Studied:** We applied the algorithm to U.S. adults (age 18 and older) in the 2017 National Health Interview Survey sample (n = 22,109) and U.S. residents in the Behavioral Risk Factor Surveillance System (BRFSS) “500 Cities: Local Data for Better Health” sample.

**Principal Findings:** Exposure risk estimates between 19andMe and county-level prevalence rates are consistent. The under-reporting factor has decreased over time. We compared the estimates of severe health outcomes to other similar COVID-19 risk calculators, including the “COVER” application from the Observational Health Data Sciences and Informatics (OHDSI) and the Nexoid Covid-19 Survival calculator, and observed moderate-to-strong convergence validity.

**Conclusions:** Individual risk assessment that combines publicly available information with user input provides the user a better understanding of their COVID-19 risk profile and explains why adherence to public health guidelines is effective at protecting themselves and those around them. Our method has been used by clinics to better manage their patient population. It can also be used to facilitate risk-based allocation of pandemic management resources (such as vaccine prioritization).

**Implications for Policy or Practice:** Our risk calculator empowers individuals to understand their risk profiles and encourage healthy behaviors that reduce the individual and community COVID-19 risk. On a population level, our calculator allows risk stratification and effective management of population health.