**Draft Academy Health Annual Research Meeting Submission**

**Title:** Comparison of Exposure and Mortality Risk Estimation Across Two Covid-19 Risk Score Calculators

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**Research Objective:** Online Covid-19 risk estimation tools give valuable insight to the general public, educating users and providing information and guidance which may reduce risk of transmission and mortality. However, many risk calculators are available, and their methods vary widely. We compared estimated exposure and mortality risk for the Mathematica 19andMe Covid-19 risk calculator (“19adnMe”) and Nexoid Covid-19 Survival calculator (“Nexoid”) and examined sources of discrepancy. We chose these two calculators because Nexoid has made anonymous individual-level records publicly available and 19andMe has an API that can batch process large numbers of calculations.

**Study Design:** Using United States-based user records from Nexoid, we calculated exposure and mortality risk estimates using the 19andMe calculator and compared these risk estimates to the Nexoid exposure and mortality risk. We first compared mortality risk, establishing similarity via Spearman ranked correlation, and identified sources of discrepancy for cases where the 19andMe and Nexoid estimates deviated by over 10%. We then compared exposure risk using similar methods, identifying sources of discrepancy for deviations over 1%. We tested relevant hypotheses to establish significance of sources of difference.

**Population Studied:** We examined 51,799 anonymized records from the Nexoid calculator’s public records, for users located in the United States who input their demographic and medical information into the Nexoid calculator during the 90-day period from 2020-08-12 to 2020-11-10.

**Principal Findings:** Mortality risk estimates were consistent between 19andMe and Nexoid, with 98.5% of users within 10% (Spearman ranked correlation 0.91). 19andMe estimates exceeded Nexoid by at least 10% for 1.46% of users, and were smaller by at least 10% for 0.03% of users. Cases where 19andMe estimated at least 10% higher mortality risk were patients over age 60, with higher numbers of pre-existing conditions on average (p<0.001), indicating higher odds ratio adjustments for older patients with multiple pre-existing conditions. Cases where 19andMe estimates were at least 10% lower were Black patients over age 80 (p<0.001); Nexoid accounts for race, where 19andMe does not. We use matching to demonstrate that race accounts for this discrepancy.

Exposure risk estimates were also largely consistent between 19andMe and Nexoid, with 78.5% of estimates within 1%, 94.58% within 2.5%, and 99.98% within 5% (Spearman ranked correlation 0.36). 19andMe estimates exceeded Nexoid by at least 1% for 1.71% of users, and were smaller by at least 1% for 19.54% of users. Cases where 19andMe estimates were at least 1% higher were due to higher average numbers of primary contacts (p<0.001). In addition, users adhering to CDC hand-washing and mask guidelines were under-represented in this group (p<0.001); 19andMe considers adherence to CDC health guidelines in calculating the exposure risk, while Nexoid does not. Cases where 19andMe estimates were at least 1% lower were due to Nexoid adjusting for several factors which 19andMe excludes, including: working outside the home (p<0.001), public transit use (p<0.001), employment in the healthcare sector (p<0.001), and presence of Covid-19 symptoms (p<0.001). These factors represent both areas for 19andMe to consider additional user inputs, as well as methodological differences.

**Conclusions:** The 19andMe and Nexoid risk calculators estimate generally similar mortality and exposure risks. Discrepancies in mortality risk are largely explained by differences in accounting for age over 60, race, and multiple pre-existing conditions. Discrepancies in exposure risk are largely explained by differences in accounting for number of social contacts, adherence to CDC hand-washing and mask protocols, and circumstances such as working outside the home.

**Implications for Policy or Practice:** We establish confidence in the consistency of these two calculators and identify areas of discrepancy. These efforts may result in increased public trust in Covid risk prediction tools, and broader adoption of safety and social distancing recommendations disseminated by these tools.