Association Between 10-Year ASCVD Risk Score and COVID-19 Complications and Mortality: Analysis of Data From The National COVID Cohort Collaborative (N3C)

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Background
The SARS-CoV-2 outbreak is challenging to health care systems due to wide variation in health risk with most patients experiencing few or no symptoms while a minority of patients experience high complication rates and death. Patients with prior cardiovascular events have an increased risk of COVID19 related mortality compared to those without. Less is known about healthy patients who have not yet developed an overt CV event and may also be at risk of developing the disease. The 10-year ASCVD risk score is an important clinical decision tool developed to predict the need for risk stratification and interventions to prevent ASCVD. This score may inform patient’s future risk of developing COVID19 complications.

Methods
Study Design
A retrospective cohort analysis using the N3C database

Study Population
- Adult patients with a positive COVID-19 reverse transcription polymerase chain reaction (PCR) test between Jan 2020 – Sept 2021
- Patients were eligible regardless of testing location (i.e. inpatient vs outpatient)
- Patients with history of ASCVD were excluded
- Patients missing 10-year ASCVD risk score data were excluded

10-Year ASCVD Score Definition
- Defined using the ACC calculator and included age, sex, race, SBP, DBP, total cholesterol, LDL-C, HDL-C, diabetes history, smoking, hypertension treatment, statin therapy, aspirin therapy, categorized into low (<7.5%), moderate (7.5%-20.0%), and high (>20.0%)

Results
A total of 120,335 patients from 18 institutions were diagnosed with COVID and did not have a history of ASCVD. (Figure 1)

- The mean age was 59.1+16.5, 59.4% were females, 57.6% white, 15.3% black, and 13.7% Hispanic. Additional patient characteristics broken down by patients 10-Year ASCVD Score category are presented in Table 1. Overall patients at moderate risk (7.5%-20.0%) had the most patients (38.7%), followed by those at low risk (5.3%) and high risk (10.2%).

Table 1: Patient Characteristics by 10-Year ASCVD Risk Score

<table>
<thead>
<tr>
<th>Age</th>
<th>Low Risk (N=66,409)</th>
<th>Moderate Risk (N=32,086)</th>
<th>High Risk (N=15,780)</th>
<th>Overall (N=114,275)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>71.5+15.4</td>
<td>69.6+14.9</td>
<td>67.8+15.2</td>
<td>71.1+14.1</td>
</tr>
<tr>
<td>Female</td>
<td>74.4+15.5</td>
<td>71.0+14.9</td>
<td>69.9+15.3</td>
<td>72.2+14.2</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>White</td>
<td>81.1 (95%CI 0.97–2.34)</td>
<td>2.34 (1.95–2.82)</td>
<td>3.26 (2.71–3.95)</td>
</tr>
<tr>
<td></td>
<td>African American</td>
<td>0.90 (0.84–0.96)</td>
<td>2.12 (2.02–2.23)</td>
<td>3.92 (3.31–4.75)</td>
</tr>
<tr>
<td></td>
<td>Hispanic/Latino</td>
<td>2.38 (2.21–2.57)</td>
<td>3.76 (3.44–4.11)</td>
<td>4.57 (4.18–5.07)</td>
</tr>
<tr>
<td></td>
<td>Other/Unknown</td>
<td>1.09 (1.00–1.09)</td>
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Table 2: Patients 10-Year ASCVD Risk Score Components

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<th>Component</th>
<th>Low Risk (N=66,409)</th>
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<th>High Risk (N=15,780)</th>
<th>Overall (N=114,275)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDL-Cholesterol (mg/dL)</td>
<td>130.4+19.8</td>
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</tr>
<tr>
<td>HDL-Cholesterol (mg/dL)</td>
<td>68.7+10.3</td>
<td>68.7+10.3</td>
<td>68.7+10.3</td>
<td>68.7+10.3</td>
</tr>
<tr>
<td>Total Cholesterol (mg/dL)</td>
<td>174.9+28.3</td>
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</tr>
</tbody>
</table>

Conclusion
Analyses from this large and diverse cohort indicates that patients free of ASCVD events but at risk of developing an overt CV event on the 10-year ASCVD risk score are at low risk of developing COVID-ASCVD. This is concerning especially given the high prevalence of patients at risk of ASCVD in the US and worldwide, many of which remain underdiagnosed adding further challenges during this epidemic.

Table and Figure Abbreviations:
- ASCVD: Advanced Cardiovascular Disease
- BP: Blood Pressure
- HDL: High density lipoprotein
- LDL: Low density lipoprotein
- SBP: Systolic Blood Pressure

Figure 1. Patient Flow
Figure 2. 10-Year ASCVD Risk Score Components
Figure 3a. Association between Death and 10-Year ASCVD Risk Score
- 10-Day Mortality
- Age
- Sex
- Race/Ethnicity
- White
- Other/Unknown
- African American
- Hispanic/Latino
- Smoking
- On Hypertension Treatment

Figure 3b. Association between Death and 10-Year ASCVD Risk Score
- 90-Day Mortality
- Age
- Sex
- Race/Ethnicity
- White
- Other/Unknown
- African American
- Hispanic/Latino
- Smoking
- On Hypertension Treatment

Figure 4a. Association between Hospitalization and 10-Year ASCVD Risk Score Components
- 10-Year Hospitalization
- Age
- Sex
- Race/Ethnicity
- White
- Other/Unknown
- African American
- Hispanic/Latino
- Smoking
- On Hypertension Treatment

Figure 4b. Association between Hospitalization and 10-Year ASCVD Risk Score Components
- 10-Year Hospitalization

Hospitalization within 14 Days of Diagnosis
- In unadjusted analysis, patients who were older (OR 1.02, 95% CI 1.01–1.03), African American (OR 2.92, 95% CI 2.42–3.53), Hispanic/Latino (OR 2.12, 95% CI 2.02–2.22) compared to White, diabetic (OR 1.79, 95% CI 1.72–1.85), smoked (OR 1.57, 95% CI 1.51–1.63), or were taking bp medication (OR 2.21, 95% CI 2.13–2.28) were more likely to die within 90 days of COVID diagnosis. Patients who were female (OR 0.87, 95% CI 0.84–0.90) were less likely to die within 90 days of COVID diagnosis. (Figure 4a) In fully adjusted analysis, patients at moderate risk (OR 1.49, 95% CI 1.40–1.59) and high risk (OR 2.11, 95% CI 2.02–2.21) were more likely to die within 90 days of COVID diagnosis than patients at low risk. (Figure 4b)

- In unadjusted analysis, patients who were older (OR 1.02, 95% CI 1.01–1.03), African American (OR 2.92, 95% CI 2.42–3.53), Hispanic/Latino (OR 2.12, 95% CI 2.02–2.22) compared to White, diabetic (OR 1.79, 95% CI 1.72–1.85), smoked (OR 1.57, 95% CI 1.51–1.63), or were taking bp medication (OR 2.21, 95% CI 2.13–2.28) were more likely to die within 90 days of COVID diagnosis. (Figure 4a) In fully adjusted analysis, patients at moderate risk (OR 1.49, 95% CI 1.40–1.59) and high risk (OR 2.11, 95% CI 2.02–2.21) were more likely to die within 90 days of COVID diagnosis than patients at low risk. (Figure 4b)