

RACIAL BIAS WITHIN PULSE OXIMETRY SATURATION MEASUREMENT

Audrey Marlar, Bradley Knabe, Fatima Yusuf, Neha Vonger, Neal Fleming, MD, PhD
Department of Anesthesiology and Pain Medicine, University of California, Davis

Background

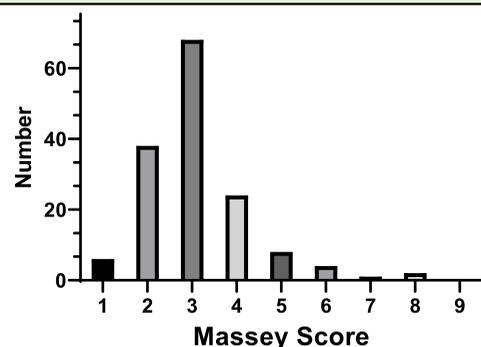
- Pulse oximetry is a ubiquitous measurement in health care used to assess oxygen perfusion status and guide oxygen therapy.
- There is ongoing discussion as to whether pulse oximetry measurements are accurate in patients with darker skin colors. A recent study showed higher rates of occult hypoxemia in Black patients compared to White patients, based on self-reported race¹.
- This report triggered an FDA Safety Communication emphasizing the interpretation and limitations of pulse oximetry particularly in monitoring of patients with COVID-19 infections
- Race is not binary. There is a wide range of graded skin colors².
- We investigated this issue by evaluating correlations between skin color and occult hypoxemia using a retrospective review and a more discriminating assessment of skin color.

Methods

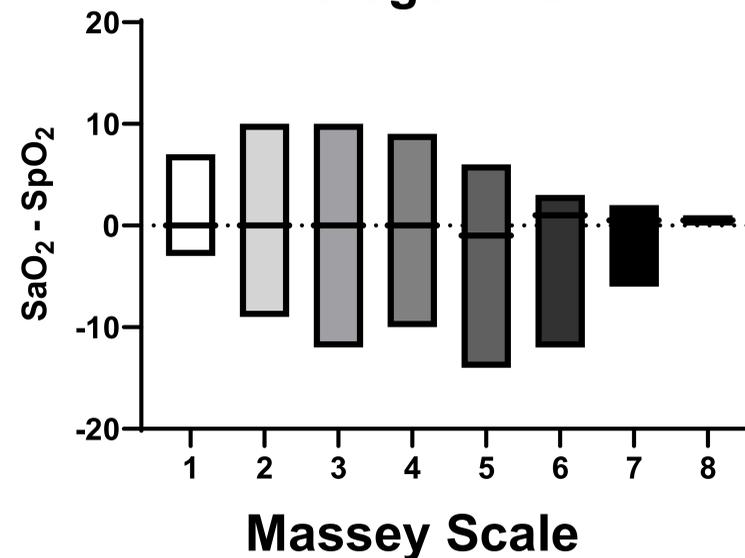
- Obtained Human Subjects Research Committee approval.
- EMR and Case Report Form review conducted to collect demographic information, including reported race and ethnicity as well as skin color (NIS Massey and Martin Skin Color Scale), arterial blood gas PaO₂, SaO₂ and the corresponding SpO₂ values.
- PaO₂ values less than 125 mm Hg were identified and corresponding SaO₂ and SpO₂ values were compared.

Results

- Data was available from 936 patients.
- The number of patients at each rating varied widely from 435 (Massey 1,2) to 445 (Massey 3,4,5) and 47 (Massey 6,7,8,9,10).



Average Error



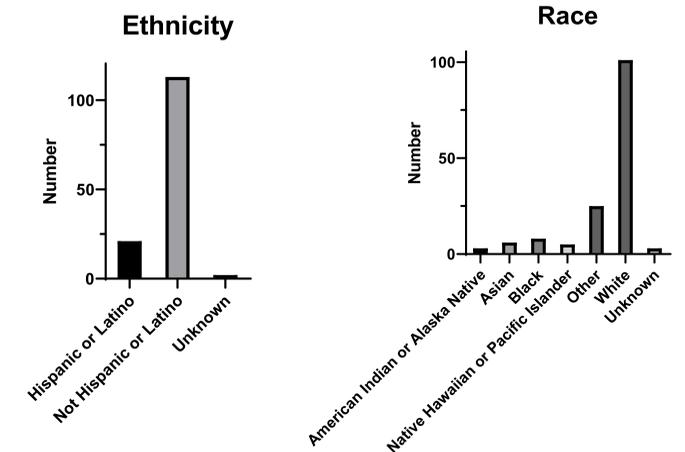
No correlation found between incidence of occult hypoxemia and darker skin color



Download the Abstract

Results

- Race and ethnicity provide limited characterization of the population.
- For PaO₂ values ≤ 125 mmHg, there was no trend in incidence of occult hypoxemia with respect to Massey Scale (Kruskal-Wallis test).



Discussion

- These trends suggest no increase in occult hypoxemia with respect to Massey Skin Scale.
- Additional investigation is warranted to better understand potential racial bias within pulse oximetry measurements.

Limitations / Next Steps

- Limitation: Lack of exact time-matched SpO₂ values with corresponding SaO₂ and PaO₂ values.
- Next steps: conduct prospective study to better assess matched real-time SpO₂ values with ABG values.

References

1. Sjoding, M. W., Dickson, R. P., Iwashyna, T. J., Gay, S. E., & Valley, T. S. (2020). Racial Bias in Pulse Oximetry Measurement. *The New England journal of medicine*, 383(25), 2477–2478. <https://doi.org/10.1056/NEJMc2029240>
2. Massey, D. S., Charles, C.Z., Lundy, G., Fischer, M.J. (2003). *The Source of the River: The Social Origins of Freshmen at America's Selective Colleges and Universities*. Princeton: Princeton University Press.