

# Racial disparities in care tied to differences in pulse oximeter performance

July 11 2022

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For most patients, a pulse oximeter is a familiar device from visits to the doctor's office. Placed on a finger or a patient's ear lobe, pulse oximeters are an easy way to quickly get a measure of someone's oxygen saturation

(SpO<sub>2</sub>), which should generally be above 90 percent. But the device may be contributing to disparities in care based on a patient's race. For decades, it's been known that skin pigmentation and melanin can affect a pulse oximeter's ability to accurately measure oxygen saturation.

A new study, led by investigators at Brigham and Women's Hospital and Beth Israel Deaconess Medical Center (BIDMC), finds evidence that those inaccuracies may also be associated with disparities in care. Researchers found that, compared to white patients, Black, Hispanic and Asian patients treated in the Intensive Care Unit (ICU) had greater discrepancies between SpO<sub>2</sub> levels detected using pulse oximeters versus levels detected in blood samples and received less [supplemental oxygen](#) than white patients. Results are published in *JAMA Internal Medicine*.

"It's important to keep in mind that pulse oximeters give us an estimate, but it's more than just a number. We use that estimate to make clinical decisions, such as how much supplemental oxygen to give a patient," said corresponding author Eric Gottlieb, MD, MS, who completed this work while a fellow in the Renal Division at the Brigham and in the Laboratory for Computational Physiology (LCP) at MIT. "It has real meaning for the patients that we care for because we can track back racial disparities in treatment to these differences in measurements."

Pulse oximeters measure how much light passes through the skin to offer an estimate of how much oxygen is in a patient's red blood cells. The most accurate way to measure true blood hemoglobin [oxygen saturation](#) levels is by taking a sample of a patient's [arterial blood](#), which requires inserting a needle into the radial artery in the wrist or putting in an arterial line—procedures that are uncomfortable for patients and cannot be done as regularly or as easily as taking measurements with a pulse oximeter. When a patient has falsely elevated SpO<sub>2</sub> readings, they may be at heightened risk for hidden hypoxemia—a condition associated with higher mortality rates and one that occurs at higher incidence among

racial and ethnic minority patients.

To conduct their study, Gottlieb and colleagues used data from the MIMIC-IV critical care dataset, which includes critical care data for over 50,000 patients admitted to intensive care units at BIDMC. This dataset includes both pulse oximeter readings and oxygen saturation levels detected in patient blood samples for patients in the ICU. The dataset also included rates of supplemental oxygen, provided by nasal cannula.

More than 3,000 participants were included in the study, of whom 2,667 were white, 207 were Black, 112 were Hispanic, and 83 were Asian. When the researchers compared SpO<sub>2</sub> levels taken by pulse oximeter to oxygen saturation from [blood samples](#), they found that Black, Hispanic and Asian patients had higher SpO<sub>2</sub> readings than [white patients](#) for a given blood oxygen saturation level. As a result, Black, Hispanic and Asian patients also received lower rates of supplemental oxygen.

"Understanding biases that exist within real-world data is crucial before we use them to train algorithms to assist clinicians with decision-making," said senior Leo Anthony Celi, MD, MS, MPH, of the Department of Medicine at Beth Israel Deaconess Medical Center.

"Before we invest more money on developing [artificial intelligence](#) for healthcare using [electronic health records](#), we have to recognize all the drivers of outcome disparities including those that arise from the use of technology. Otherwise, we risk perpetuating and magnifying health inequities with artificial intelligence."

The authors note their study's limitations, including that their findings are based on data from one institution, only included [patients](#) receiving supplemental oxygen by nasal cannula, and race/ethnicity was self-reported and not assessed by skin tone. Future studies could measure skin tone and oxygen delivery more directly and examine other

comorbidities and sociodemographic factors that may contribute to disparities.

"To date, there has been limited interest in solving the problems inherent in [pulse](#) oximeters, but we show that these measurements are clinically relevant and pose a real problem that needs to be solved," said Gottlieb. "It's important that this kind of research continue and clinicians engage with engineers, regulators and other stakeholders to insist that this is an issue worth addressing."

**More information:** A Retrospective Cohort Study of Racial Differences in Oxygen Supplementation in the Intensive Care Unit, *JAMA Internal Medicine* (2022). [DOI: 10.1001/jamainternmed.2022.2587](#)

Provided by Brigham and Women's Hospital

Citation: Racial disparities in care tied to differences in pulse oximeter performance (2022, July 11) retrieved 24 April 2024 from <https://medicalxpress.com/news/2022-07-racial-disparities-tied-differences-pulse.html>

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