

ARE PULSE OXIMETERS RACIST? WHAT I LEARNED ABOUT HEALTH EQUITY AND STRUCTURAL RACISM AT ATS 2023

For those of you who have followed this podcast for awhile, you'll know that I'm a regular attendee of the American Thoracic Society annual Scientific Conference which happens in May. This year, it was held in Washington, DC. I hadn't been to Washington since 1995, when I went to the World Congress of Physical Therapy's annual Congress. In 1995 I was a fairly-recently graduated physical therapist (I graduated in 1994) and that conference seemed huge, and I didn't know anyone, so it was a bit intimidating. Fast forward to 2023, and I was back in Washington. The city had changed quite a bit – of course the White House was now quite heavily fortified! but I noticed other things I didn't see in 1995, like bike lanes!

Another thing that had changed for me was that although the ATS conference is much bigger than WCPT, I now know people and it wasn't intimidating. It was actually a great conference, and I enjoyed the discussions, the presentations, chatting with colleagues, meeting new people, watching my students present their work so confidently. And of course, great science and innovation related to respiratory-related health care including of course pulmonary rehab.

But on this episode, I'm going to talk about what I learned at ATS related to health equity. That's the nice thing about big conferences. I mean, you can't see more than a tiny fraction of what's available. And I don't like being overly focused – I do go to a lot of things related to pulmonary rehab but my work and interests span across multiple areas, like COPD epidemiology, global health, determinants of health, and...health equity. Again, if you've been listening to this podcast, you'll know that health equity as a clinical, research, and advocacy area has always been an interest of mine. I can trace it back to my early days in my Masters program, where I took an amazing course in social determinants in rehabilitation, delivered by Professor Isabel Dyck. That course opened my eyes to social determinants of health, discrimination, racism, and other factors which contribute to health inequity. Omigosh, such an eye opener for a new health care professional! We didn't get any of that content when I was in training. I wish we still had that course. I would take it again, now.

The session I want to focus on, which I think might be one of the best sessions I went to in the whole conference was entitled "Dismantling Structural Racism from Risk and Disease Prediction in Pulmonary and Critical Care Medicine". There were 5 speakers who talked about different aspects of structural racism in pulmonary medicine, but two really stood out for me was one entitled "Colour-blind or context-blind? Understanding Race in Pulmonary Function Testing" which was delivered by Aaron Baugh from UCSF, and "Hold Your Breath: The Journey to an Equitable Pulse Oximeter" which was delivered by Thomas Valley of University of Michigan.

Dr. Baugh gave a fantastic presentation with some of the content presented related to the paper he published in 2022 in the American Journal of Respiratory and Critical Care Medicine. That paper was called "Reconsidering the Utility of Race-Specific Lung Function Prediction Equations" and investigated whether race-specific prediction equations could contribute to health inequity because they overestimate true lung function. In that study, and what he summarized in his presentation, they looked at whether race-specific equations or universal equations better modeled the relationship between FEV₁, FVC, and other outcomes including imaging parameters, physical function and health status. They found that, and I quote: "...using race-specific equations, African American individuals were calculated to have better lung function than non-Hispanic White individuals (FEV₁, 76.8% vs. 71.8% predicted; $P = 0.02$). Using universally applied equations, African American individuals were calculated to have worse lung function." I'm not sure if that paper is open access but the link to the paper is [here](#).

Dr. Baugh also commented on the many areas that this problem impacts. Of course, it impacts disease classification. African American people with COPD might not be diagnosed with COPD if a race-specific equation is used, leading to a delay of diagnosis and treatment. There are other downstream effects of overestimation as

well, including whether or not you're eligible for specific medication, the safety determination of your upcoming surgery, your disability evaluation, or your eligibility for certain professions, like firefighting.

In the context of pulmonary rehabilitation, this is HUGE. Why? Well in some places of the world, you have to meet a specific FEV1 in order to be referred for pulmonary rehab. And that possible overestimate of 5 percentage points could mean that you're not referred, when in fact you are eligible. Some of our prognostic indicators or other categorizations, like the BODE index, or GOLD classification, rely on accurate spirometry. And referral to interventions where rehab is involved, such as lung transplantation, has specific spirometric criteria. So this overestimation may mean a delay in accessing important treatments, and ultimately worse health outcomes.

Dr. Baugh also commented on several areas for action. Reference equations need to be addressed, obviously, but this is complex. Likely we need to go beyond specific hard thresholds for yes/no decisions. We also need to focus on education, including raising awareness of this problem (which I guess is what I'm doing a bit of here I guess with this podcast episode). And we need to address this through research, and he commented on the need for more representation in research. I'd like to add to that, and say that also needs to extend to more oversight from guideline and statement committees when considering their recommendations, how well the evidence represents the population. I've been on guideline committees and I have to say the topic doesn't come up, but maybe when we are grading the evidence, it needs to be an element of that grading process. That would be a wonderful evolution of the grading process! And as Dr. Baugh said "...being explicit about inequity allows problem-solving..." to happen.

The other talk was the one by Dr. Thomas Valley which looked at pulse oximetry. And of course, if you're involved in pulmonary rehab you know that a pulse oximetry is one of the most important devices we have in our program. It's used for assessment and monitoring, signals the need for supplemental oxygen (or further testing to determine that), supplemental oxygen titration, and of course heart rate. All of which we use for an accurate understanding of our patient's baseline, their response to exercise, their exercise prescription...you all know how important a tool this is.

I confess I hadn't explored this topic at all. I had heard of other types of sensors being investigated, for example if various wearables like FitBits or smartwatch heart rate monitors were providing accurate measurements on people with various levels of skin pigmentation. But Dr. Valley summarized several high-impact papers on disparities in hypoxemia detection. One paper by Dr. Nicole Henry (here's the [link](#)) found that Black patients were more likely to have undetected hypoxemia using hospital grade oximeters. Similarly, another study by Dr. Ashraf Fawzy that overestimation of oxygen saturation in COVID patients in racial and ethnic minority groups. That paper is [here](#). And this leads to worse health outcomes – a paper by Dr. An-Kwok Ian Wong found that, and I quote "...there was greater variability in oxygen saturation levels for a given SpO2 level in patients who self-identified as Black, followed by Hispanic, Asian, and White..." and also "...those with hidden hypoxemia subsequently experienced higher organ dysfunction scores and higher in-hospital mortality." And amazingly, a similar finding was reported 33 YEARS AGO by Dr. Amal Jubran in CHEST ([here](#)), suggesting that pulse oximetry overestimated by on average, three percentage points, in Black patients. Really, this topic has been around a long time, but gained more prominence in the media and more attention by the FDA when COVID-19 hit, because of its widespread use in emergency settings, triaging, and also the recommendation to the public about when to seek emergency help based on home oximetry measurements.

Now let's think about that, in terms of pulmonary rehab. 3 percentage points! That's a lot. And think of your clinical decision-making when you see an SpO2 of 88% versus 91%. If you work in an clinical environment that has specific thresholds for supplemental oxygen, this is important. If the reading was 88%, you might start supplemental oxygen or increase it to bring it above 90% or whatever your threshold is. At 91%, you might not do this. And that might mean that your patient is now exercising at a lower level of oxygen than what you would

normally be comfortable with. Maybe that means your patient now exercises at a lower intensity, reducing their potential for physical function gains. Maybe they are enduring the discomfort of lower oxygen. 88% versus 91% may have important implications on the patient's partial pressure of O₂ depending on their oxyhemoglobin dissociation curve. There may also be judgments placed on these patients, if they are told "your oxygen levels are still okay" but they report discomfort or an inability to maintain an exercise intensity. They may be denied supplemental oxygen, in settings that use pulse oximetry for decision-making. I think you can appreciate the ramifications of inaccuracies with this measurement. And, to be clear, the quote "the system isn't broken, it was designed this way..." applies to this situation. These devices are designed to be accurate within a certain spectrum of skin pigmentation, which did not extend to darker skin tones. This is an example of systemic racism in the health care system, which in our programs can have serious outcomes.

It's difficult to provide clinical advice for this situation, but I think awareness will go, well maybe not a long way, but at least a bit of the way to rectifying this issue. I suggest that you rely on all your clinical reasoning skills when assessing patients, as these studies used self-reported identity and there's no specific level of pigment that you could use where you would now suspect the accuracy of your oximeter. But recognize the potential magnitude of error, and that your patient may be hypoxemic even if their measured values are above your threshold, and this may be especially true in people with darker skin tones.

So how can we address this? The same suggestions made by Dr. Baugh apply here. First, we need accurate oximeters for use in health care settings. I realize that anyone can buy one from the local pharmacy, and the horse may be out of the barn in some ways, but I think the devices made and licensed for medical use should be able to provide accuracy data on patients with varying levels of skin pigmentation. And certainly there is indications that the industry is responding with better devices. And perhaps there is a place for correction factors, although again the decision to use one or not would be based on a subjective assessment of skin tone, which would be problematic. Of course, blood gases provide an accurate measure, but you can't further exacerbate health inequities by requiring blood gases on specific populations but not others! So that's a no. And I think less dichotomous, hard thresholds for implementation/no implementation of supplemental oxygen. And we really need to educate all clinical trainees, and clinicians in existing programs. I'd like to think this podcast episode will help, but we need much, much more amplification of this issue from the different societies and leaders. And we need better messaging to the general public about what safe values are, now that oximeters might be as common in households as thermometers.

Health equity was a resonant theme in many of the conference sessions, including equity in training, equity in research, and equity for patients. I thought it was great, and would like to see it further expanded with more exploration on systemic racism and discrimination related to respiratory care, research and training.

I hope you enjoyed this episode, and when you go back to your program you'll take a closer look at the pulmonary function tests and oximeter readings of your patient population. Realizing that these tests and measures were designed in a non-inclusive way allows us to question more, reason more, and ultimately deliver programs that have a better chance at maximizing health outcomes for ALL our patients.

Thanks for listening to LungFIT, and we'll see you soon! Stay well.