

# How Oura Measures Respiratory Rate From Your Finger



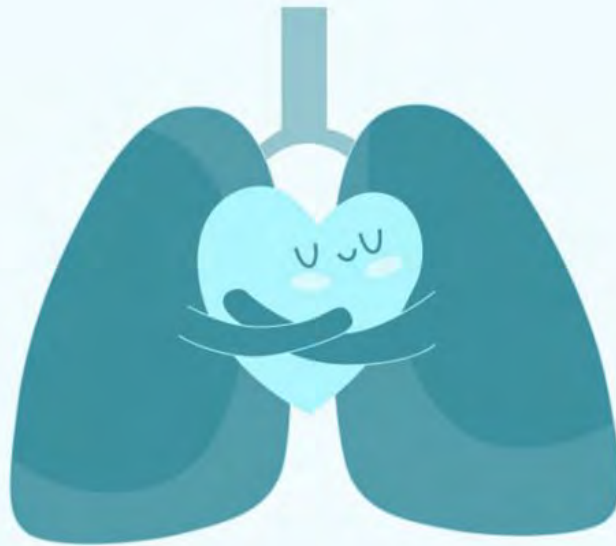
Author: Oura Team | May 12, 2020



Respiratory rate can be measured directly by counting the rise and fall of someone's chest or indirectly by reading it from another signal in your body, like your heart's activity. A widely used method is by deriving respiration from

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Night time is an ideal time to measure respiration because your body is in a consistent state. During the day, there are many factors that can influence your respiratory rate (e.g., caffeine, emotion, exercise) and it's even been shown that your rate increases when you know it is being counted.



The reason you can measure respiration in your heart beat is that your heart and lungs are closely connected by a process called respiratory sinus arrhythmia. Although it sounds serious, it's a completely normal and simple partnership:

- When you breathe in, your heart rate increases.
- When you breathe out, your heart rate slows down.

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(your heart speeding up as you breathe in and slowing down as you breathe out). Based on the number of times this happens in a minute, your respiratory rate is calculated.

Let's explore how that looks in the data.

1. Electrical signals power your heart to contract. This is what you see in a classic ECG signal showing a few heart beats:



2. Each time your heart beats, it sends a pulse of blood moving out through your arteries, including the ones in your finger where your Oura sits. You can read this activity without an ECG by using a PPG sensor to shine a light onto your skin. As the pulse of movement through your circulatory system changes, the amount of light that is reflected back changes with it, signaling precisely how your heart is beating. Oura uses infrared PPG which penetrates deeper than other green light wearables to measure as close to your arteries as possible.

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3. In this PPG data, your respiratory sinus arrhythmia pattern can be spotted by identifying when your heart rate speeds up (breathing in) or slows down (breathing out). This is done by calculating the interval between your heart beats, your interbeat intervals (IBI). You can follow that process in-depth with the image below:

BOOM!

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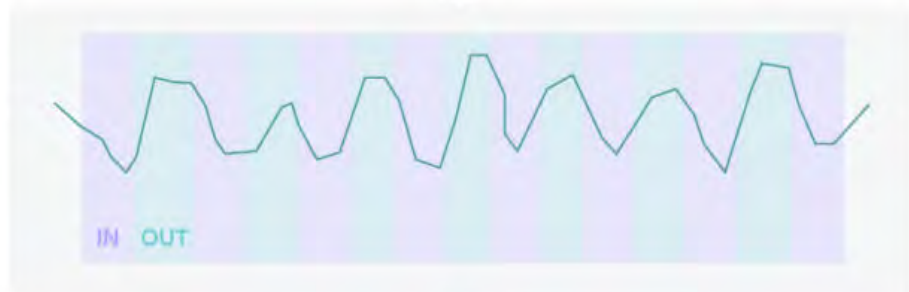
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IBI Is Mapped out Over Time



Decreasing IBI Periods Are ID-ed as Breathing In, Increasing IBI Periods as Breathing Out



Final Respiratory Rate Is Calculated



# How To Interpret Your Respiratory Rate

Currently, the Oura app gives the average respiratory rate from your night under the Readiness tab.

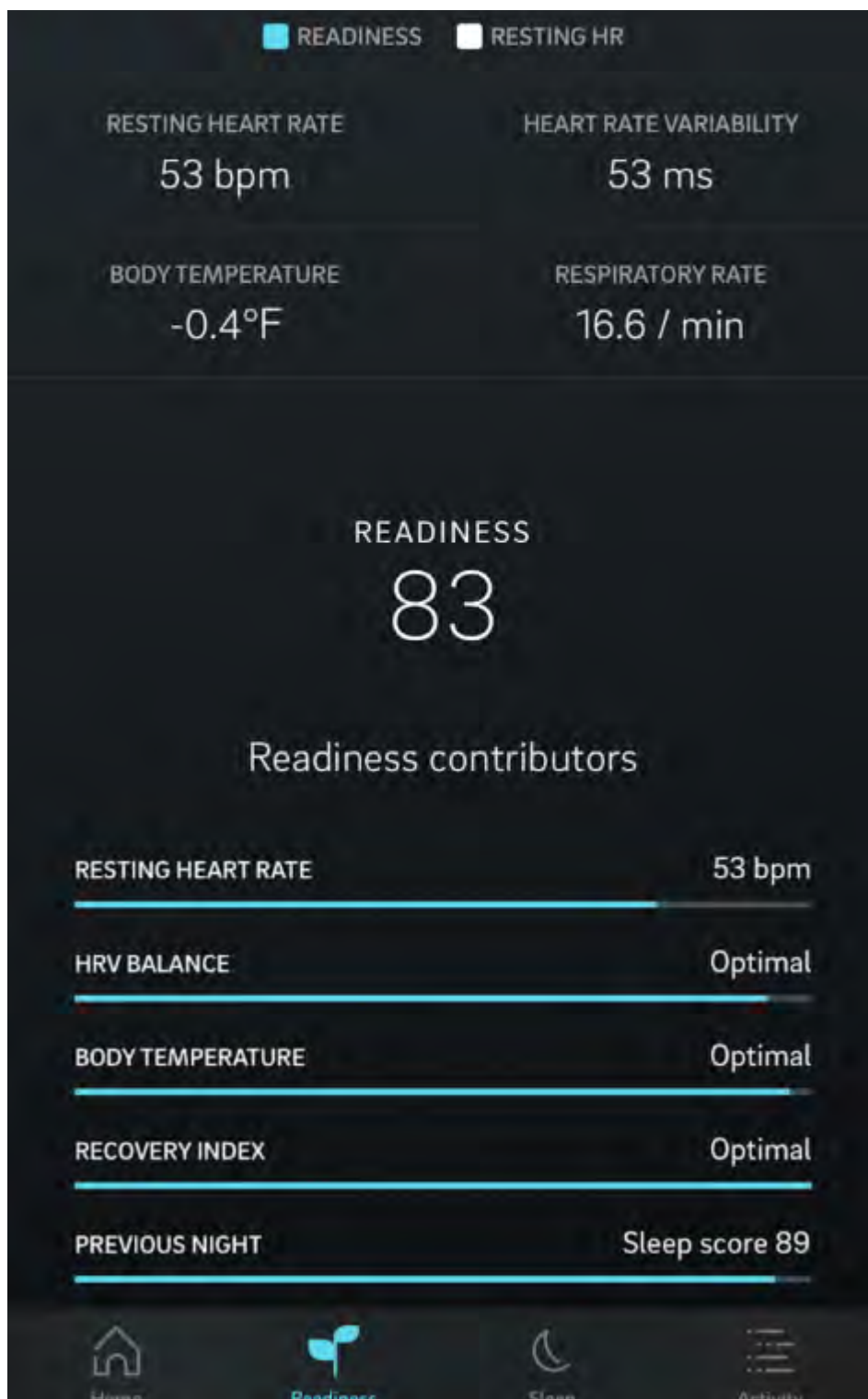
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more than 12 breaths per minute is notable.

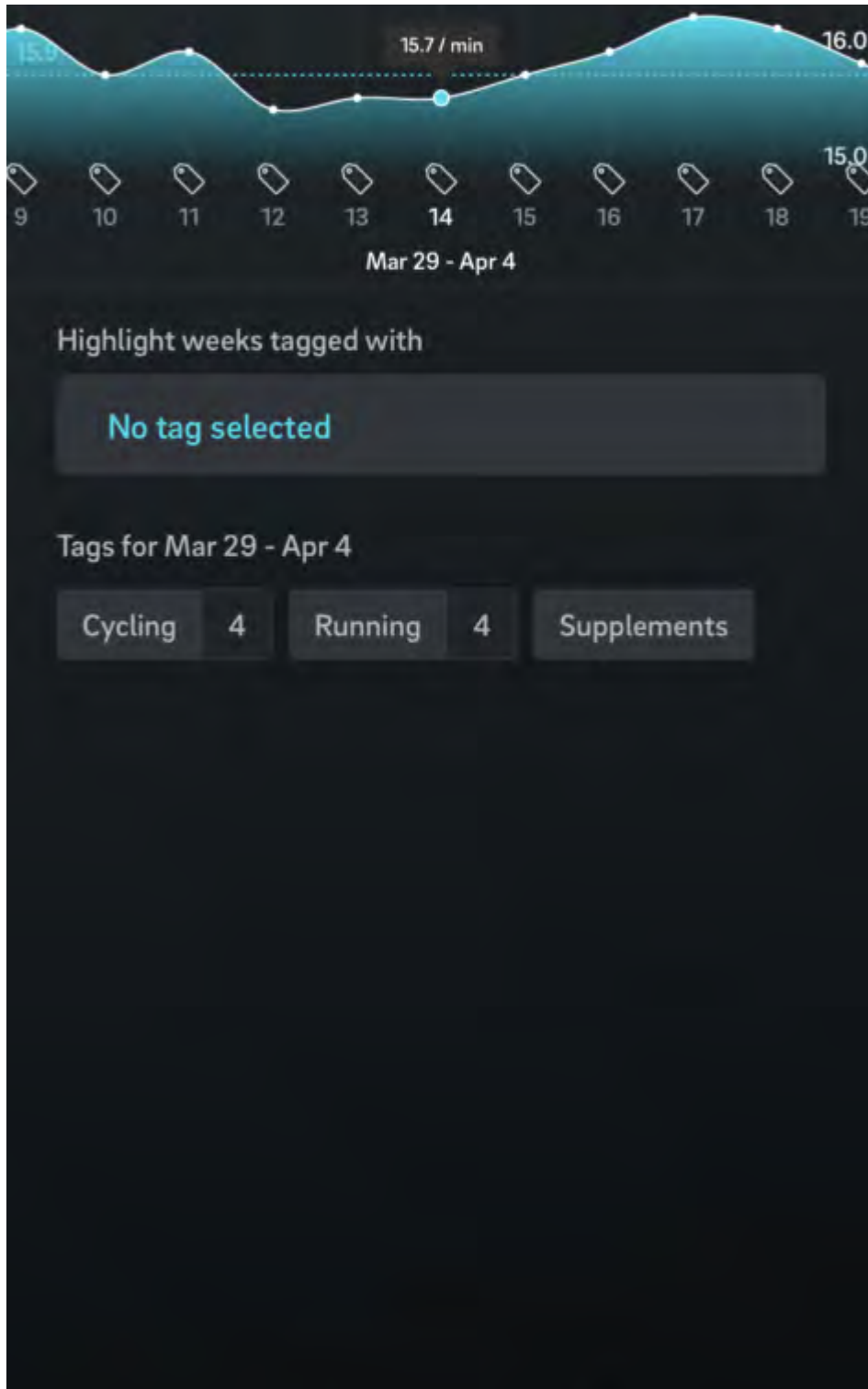
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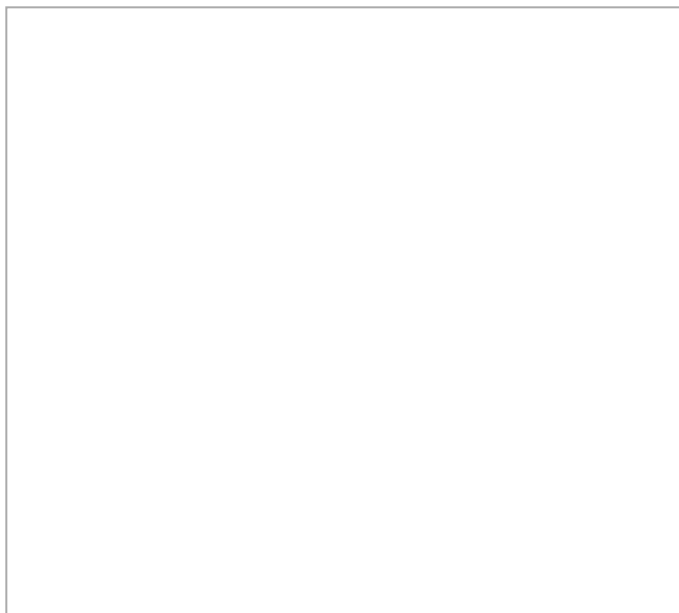
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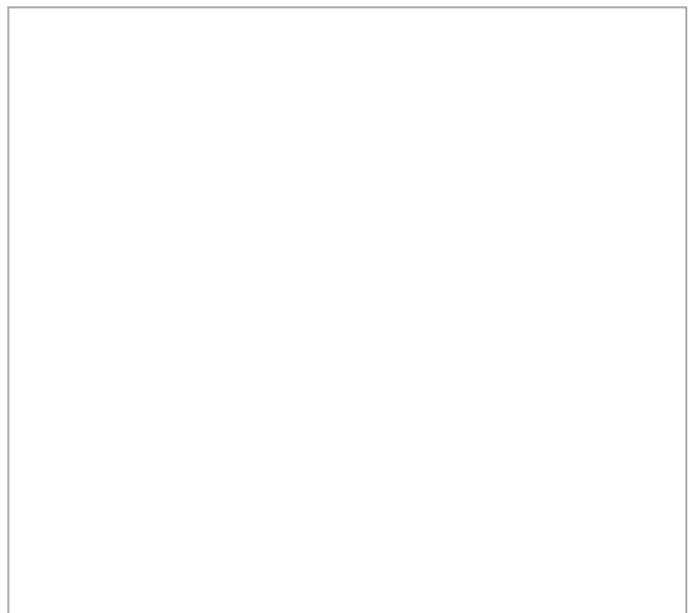
the highly signal. In most cases, this will not impact the accuracy of their data, but is worth noting.

For example, for an individual with sleep apnea, their heart may keep beating in a the pattern that anticipates a normal respiratory sinus arrhythmia (breathe in – speed up, breathe out – slow down), however, the actual air flow can be restricted for the individual and may result in a different number of breathing cycles than can be seen in the PPG signal. For most individuals, this is not a problem, especially when you look at long-term trends and deviations from your baseline.

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