

# Study finds variable accuracy of wrist-worn heart rate monitors

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In a study published online by *JAMA Cardiology*, Marc Gillinov, M.D., of the Cleveland Clinic, and colleagues assessed the accuracy of 4 popular wrist-worn heart rate monitors under conditions of varying physical exertion.

Wrist-worn fitness and heart rate (HR) monitors are popular. While the accuracy of chest strap, electrode-based HR monitors has been confirmed, the accuracy of wrist-worn, optically based HR monitors is uncertain. Assessment of the monitors' accuracy is important for individuals who use them to guide their physical activity and for physicians to whom these individuals report HR readings.

This study included 50 healthy adults; average age, 37 years; 28 participants were women. Participants wore standard electrocardiographic limb leads and a Polar H7 chest strap monitor. Each participant was randomly assigned to wear 2 different wrist-worn HR monitors. Four wrist-worn monitors were assessed: Fitbit Charge HR (Fitbit), Apple Watch (Apple), Mio Alpha (Mio Global), and Basis Peak (Basis). Heart rate was assessed with the participant on a treadmill at rest and at 2,3,4,5 and 6 mph. Participants exercised at each setting for 3 minutes to achieve a steady state; HR was recorded instantaneously at the 3-minute point. After completion of the treadmill protocol, HR was recorded at 30, 60, and 90 seconds' recovery.

Across all devices, 1,773 HR values were recorded. When compared with electrocardiogram, the HR monitors had variable accuracy. While

the Basis Peak overestimated HR during moderate exercise, the Fitbit Charge HR underestimated HR during more vigorous exercise. Analysis showed that variability occurred across the spectrum of midrange HRs during exercise. The Apple Watch and Mio Fuse had 95 percent of differences fall within -27 beats per minute (bpm) and +29 bpm of the electrocardiogram, while Fitbit Charge HR had 95 percent of values within -34 bpm and +39 bpm and the corresponding values for the Basis Peak were within -39 bpm and +33 bpm.

"We found variable accuracy among wrist-worn HR monitors; none achieved the accuracy of a chest strap-based monitor. In general, accuracy of wrist-worn monitors was best at rest and diminished with exercise," the authors write.

"Electrode-containing chest monitors should be used when accurate HR measurement is imperative. While wrist-worn HR monitors are often used recreationally to track fitness, their accuracy varies; 2 of 4 monitors had suboptimal [accuracy](#) during moderate exercise. Because cardiac patients increasingly rely on these monitors to stay within physician-recommended, safe HR thresholds during rehabilitation and exercise, appropriate validation of these devices in this group is imperative."

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