News and Perspectives

Can Your Fitness Tracker Actually Predict an Injury?

Anna Zucker, JMIR Correspondent

Abstract

Fitness wearables promise the ability to gauge physiological readiness for exercise and avoid injury with personalized insights. In this *News and Perspectives* article, JMIR Correspondent Anna Zucker reports on the evidence behind these claims and how data from wearables should be used and interpreted in clinical practice.

Key Takeaways:

- Wearable fitness devices—smart watches, bands, or rings with sensors tracking heart rate, physical activity, and sleep—provide a "readiness" score marketed to predict increased risk of injury.
- Research suggests these scores don't predict injury in a straightforward way, but that the data are useful for seeing trends over time.
- While many wearable users are open to sharing data with a clinician, little guidance exists on how clinicians should integrate data into treatment.

In addition to her work as a freelance writer, Anna Zucker is a National Council on Strength & Fitness–certified personal trainer. She has no financial or advisory relationships with wearable device companies.

Over one-third of adults in the United States use a wearable device, and many rely on the "readiness score" to guide their training. But the research, including a recent narrative review of 16 studies of physically active wearable users published in the *Journal of Orthopaedic Reports*, raises questions about how much that absolute score can actually tell you—and experts agree.

The Readiness Score

In most wearables, the readiness score is built on heart rate variability (HRV), sleep, and workload data. HRV is the "fluctuation in time intervals between consecutive heartbeats." At rest, relative to your own baseline, a higher HRV generally indicates a relaxed, well-recovered nervous system; a lower HRV indicates stress. Longitudinal HRV trends can support a patient's perception of fatigue or the onset of symptoms. The second component is sleep, well-known to be physiologically relevant to recovery—chronic sleep deprivation is associated with a higher risk of injury. The third is workload, which wearables approximate using steps, miles, or activity minutes, but not "sport-specific mechanical stress."

When patients experience overuse symptoms or recurring injuries, sports medicine and orthopedic clinicians evaluate recent workload and recovery. According to the workload-injury etiology model, injury risk may result from the interaction of "an athlete's preparedness and the demands placed upon them." This model reflects two ideas in sports medicine: an abrupt spike in training relative to what the body is used to raises injury risk, and tissue needs time to gradually adapt to a heavier load.

The readiness score offers a clue, says outpatient orthopedic and sports physical therapist John DeLucchi, PT, DPT, MBA, Director of Digital Recovery at HURT! "One data point doesn't tell you much. Look at the trend, how sleep and workload are tracking against each other over the past weeks. That's where you see the imbalance that creates problems."

What Experts Are Saying

Katy Vieira, PT, DPT, a physical therapist and owner of ReMove Rehab and Performance, treats runners and says workload is one of the first things she asks about when evaluating an injury: "It's been strongly supported in the literature that spikes in training load, whether volume, intensity, or external factors like terrain, is one of the biggest risk factors for running-related injuries."

She adds that "sleep has also been associated with injury risk and can decrease the capacity someone has in tolerating spikes in workload," and research backs her up. For example, shorter sleep duration has been associated with a higher risk of injury in military recruits and endurance athletes, and—combined with workload characteristics—in collegiate soccer players.

DeLucchi considers sleep the "strongest, most consistent signal of the three." He doesn't consider a workload spike on its own as an injury predictor, but rather "in relation to what sleep is already telling" him.

HRV is often the most marketed variable in relation to the readiness score, and DeLucchi finds patients tend to overtrust it. "Wearable marketing has done a good job selling that number as the answer, and patients absorb it," he says. "I

don't correct that head-on. I start where they already are, then walk them toward how I actually read the data and what I'd recommend [focusing on] instead."

Research so far seems to suggest that it is *trends* in HRV, interpreted alongside workload, that may be most informative.

"I'm not looking for high or low," says DeLucchi. "I'm looking for consistency. A stable number, even a modestly lower one, tells me more than a single reading moving in either direction." Vieira calls it "a nice screening tool," but agrees it "isn't valid enough on its own," partly because, she notes, "HRV data from smartwatches is not fully accurate." She advises patients to check in with themselves. "If they are already feeling 'off' or sick, and their HRV is significantly altered, it might be worth taking a rest day or choosing a less intense run."

Incorporating and Interpreting Wearable Data

Wearable data is relevant to overuse injuries because both the data and these kinds of injuries develop over time. As DeLucchi explains, unlike acute injuries due to a sudden incident, overuse injuries build gradually as repetitive load outpaces the tissue's capacity to repair—"discomfort that slowly turns into pain rather than pain that shows up all at once."

> *Listen to your body first. Then check that against the trend your tracker is showing you. When they don't agree, that disagreement is worth paying attention to. The score by itself isn't.*
>
> John DeLucchi, PT, DPT, MBA

When it comes to using this data, 80% of wearable users report they are willing to share data with their clinicians, yet only 26.5% actually do so.

And even if users *do* share their data, the *Journal of Orthopaedic Reports* review notes that there has been no clear framework for how orthopedic and sports medicine clinicians should incorporate wearable data in the treatment of injuries, and cautions that consumer wearable accuracy varies by manufacturer and isn't equivalent to research-grade devices. Still, it can offer useful insights when interpreted cautiously alongside a patient's clinical history and examination. The authors suggest treating wearables as "patient-generated context" to support clinical reasoning, grounded in a conservative, case-by-case framework that incorporates trends and patterns in HRV, sleep, and workload "in relation to recovery and load exposure."

DeLucchi occasionally finds discrepancies between patients' self-reports and their data. "Self-reported training history isn't always reliable; memory of 'how much I trained' tends to drift from what actually happened. I've had patients tell me nothing changed in the weeks before they got hurt, and their own data showed otherwise."

Vieira finds that obtaining a thorough patient history is often sufficient for assessing overuse injuries, and patients report "what their training load has been like, and if they have noticed any changes in life (ie, sleep quality, daily stressors, feeling sick more frequently)." She adds that when a patient's history doesn't add up or is difficult to recall, "data can help offer a better lens into what may have happened."

While wearable data offer extra clues for diagnosis and treatment, pain and injury can be subjective, and DeLucchi reminds users to pay attention to their instincts. "Listen to your body first," he advises, "Then check that against the trend your tracker is showing you. When they don't agree, that disagreement is worth paying attention to. The score by itself isn't."

Keywords: wearable; wearable technology; wearable devices; physical therapy; injury; rehabilitation; heart rate variability

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