Fatigue & Chronic Disease Notes:

Fatigue

- Fatigue has been identified as a probable cause in 21–23% of major aviation accident investigations over the past two decades (SCC analytical legal reports, 2024)
- 70% to 80% of fatal aviation accidents are caused by human error (Wiegmann; Shappel, 2001). Fatigue accounts for 15% to 20% of this total (Akerstedt et al., 2003)
- Working 10-hour shifts increases the risk for accidents and errors by 13%
- Working 12-hour shifts increases the risk for accidents and errors by 28%
- Most adults need 7 to 8 hours of good-quality sleep every 24 hours to perform during emergency operations.

https://archive.cdc.gov/www_cdc_gov/niosh/emres/longhourstraining/wakefulness.html

Chronic Disease

- 11-30% of pilots are reported to have hypertension (High blood pressure)
- FAA Standard: maximum systolic BP of 155 and a diastolic BP of 95 controlled with medication
- CDC Standards for hypertension:
    - Stage 1 hypertension: SBP 130–139 mm Hg or DBP 80–89 mm Hg
    - Stage 2 hypertension: SBP 140 mm Hg or higher or DBP 90 mm Hg or higher
- Multiple studies have shown diabetic patients have a 73% higher risk of dementia compared to non-diabetics, including a 56% increased risk of Alzheimer's Disease.
- Chronic inflammation in the brain is linked to conditions like ADHD, depression, and Alzheimer's (a degenerative condition that can be greatly prevented through good diet and exercise but not reversed). During sleep, your body does most of its recovering in all tissues of the body, especially the brain!
- During slow-wave sleep, the brain's glymphatic system clears metabolic waste like amyloid-beta, a protein linked to Alzheimer's. This detoxifying process is significantly reduced during sleep deprivation.

Smart Rings

Feature	circul+ Wellness Ring	Ultrahuman Ring AIR
Primary Focus	Oxygen/Oximetry & Clinical Sleep Metrics	Lifestyle, Biohacking & Workout Recovery
Design & Form Factor	Adjustable spring-loaded sizing (Small, Large, XL); bulkier medical-grade fit	Sleek, continuous titanium band; extremely lightweight (2.4g)
FDA Status & Tech	Sensor Stabilization Tech (SST); FDA 510(k) cleared SpO2 tech	Non-medical consumer sensor (Titanium + Epoxy build)
Key Metrics	Continuous SpO2 (ODI), Heart Rate, Sleep Stages, Skin Temp	Sleep Score, Circadian Alignment, HRV, Nudges, Temperature, VO2 Max
Sizing	No kit needed (3 adjustable sizes fit across fingers)	Requires a sizing kit (Standard ring sizes)
Price	$299	$349
Subscription Fee	None (Free PC Cloud Portal & App)	None for core metrics (Optional paid PowerPlugs)

Researchers have highlighted two major behavioral risks associated with continuous sleep tracking:

1. **Orthosomnia:** An unhealthy obsession with optimizing sleep scores or hitting specific percentages of deep/REM sleep, which paradoxically generates bedtime anxiety and worsens sleep quality.
2. **The Score-Induced Nocebo Effect:** Studies demonstrate that when participants are given a manipulated "poor sleep score" upon waking, they exhibit lower daytime mood, increased subjective fatigue, and reduced cognitive performance—even when their objective sleep quality that night was completely normal.

How to Best Use Wearable Sleep Data

- **Track Trends, Not Single Nights:** Use device data to observe rolling 14-day or 30-day averages in total sleep duration, bedtime consistency, and baseline Resting Heart Rate (RHR) / HRV.
- **Identify Environmental & Lifestyle Triggers:** Wearables excel at showing macro disruption patterns—such as how late-night alcohol consumption, heavy meals before bed, or irregular schedules alter night-long heart rate recovery.
- **Prioritize Subjective Sensation:** If you wake up feeling well-rested and alert, weight your internal subjective feeling above a low algorithmic recovery or sleep score.