



CARDI•OH

Ohio Cardiovascular and Diabetes Health Collaborative



In partnership with:



Cardi-OH ECHO

*Innovations in Diabetes and Cardiovascular Health*

February 2, 2023

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## Today's Presenters

### FACILITATOR

**Goutham Rao, MD**  
*Case Western Reserve University*

### DIDACTIC PRESENTER

**Adam Perzynski, PhD**  
*Case Western Reserve University*



### LEAD DISCUSSANTS

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*Ohio University Heritage College of Osteopathic Medicine*

# Disclosure Statements



- The following speakers have a relevant financial interest or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of their presentation\*:
  - Danette Conklin, PhD; Kathleen Dungan, MD, MPH; Ian Neeland, MD; Adam T. Perzynski, PhD; Goutham Rao, MD; Christopher A. Taylor, PhD, RDN, LD, FAND; Yasir Tarabichi, MD; Jackson Wright, MD, PhD
- The remaining speakers have no financial relationships with any commercial interest related to the content of this activity:
  - Karen Bailey, MS, RDN, LD, CDCES; Kristen Berg, PhD; Elizabeth Beverly, PhD; Carolyn Ievers-Landis, PhD; Kelsey Ufholz, PhD; James Werner, PhD, MSSA
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\*\* For more information about exemptions or details, see [www.acme.org/standards](http://www.acme.org/standards)



# New and Emerging Wearable Devices

Adam Perzynski, PhD

Associate Professor of Medicine and Sociology

Center for Health Care Research and Policy

The MetroHealth System

Case Western Reserve University

# Learning Objectives



1. List a minimum of 3 useful indications for a wearable device to monitor cardiovascular risks.
2. List and describe a minimum of 3 such new devices.
3. Describe the incorporation of data from wearable devices into routine care.

# Many People Love Wearables!

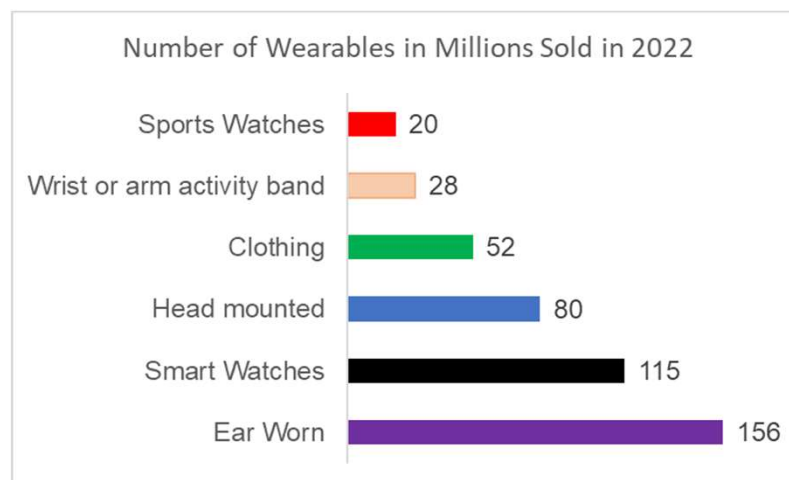
*In 2022 a staggering 453 million wearable gadgets were purchased!*



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Annual Global Expenditures have reached almost:  
\$100 billion dollars



Compare to:  
2.4 million home blood pressure cuffs  
2.3 million home pulse oximeters  
13.7 million blood-glucose meters

# Many Flavors! \$49 to \$1400



Sports watches/bands (as opposed to smart watches) typically do not require users to have a cell phone!

# Many [Advertised] Features



- Heart rate monitoring
- Blood pressure tracking
- Sleep actigraphy monitoring
- EKG (aFib screening)
- Calorie expenditure tracking
- Activity monitoring (step counting and other activity)
- Blood oxygen levels
- e-VO2MAX
- Route mapping
- Blood glucose monitoring
- Body composition measurement



# Types of Sensors

- Motion [accelerometer]
- Microphone
- Optical
- Bioelectrical
- Chemical
- *Potentially limitless wireless accessory bands and devices*

# Wearable Hydration Monitor

*D.R.INK.: Device that Recognizes Need to INtake water*

Clinical effectiveness of a wearable hydration device (1 R42 AG080886-01, MPIs Johnson, Piktel, Roach, 9/30/22-8/31/2024)

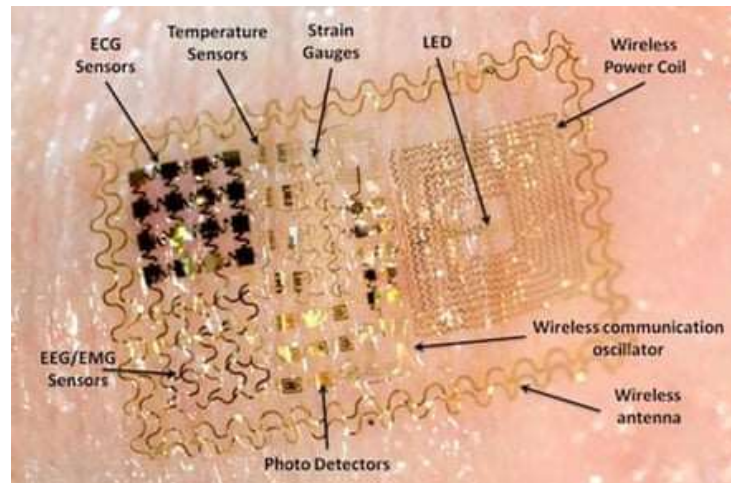
- In a clinical trial, examine the effectiveness of continuous home monitoring of fluid levels.
  - Hypothesis 1: A wearable hydration device improves recovery after acute care for dehydration
  - Hypothesis 2: A wearable hydration device reduces acute negative health events among a vulnerable population of older adults.



# Coming Soon: Not Wearable but Like Wearable



- Implantable [e.g. CWRU COSMIIC Study]
- Tattoos and skin-printed electronics



<https://www.technologyreview.com/2013/03/11/179469/electronic-sensors-printed-directly-on-the-skin/>

# Does any of this stuff work?

- Sensor accuracy is generally worse than comparable clinical devices
- Many RCTs, mostly with modest sample sizes
- Many Qualitative and Mixed Methods Studies
- The pandemic made us more sedentary, and more likely to use wearables.

“Wearables on vogue”: a scoping review on wearables on physical activity and sedentary behavior during COVID-19 pandemic

[Rohit Muralidhar Panicker](#) & [Baskaran Chandrasekaran](#)   
*Sport Sciences for Health* 18, 641–657 (2022) | [Cite this article](#)



## Evaluating the Impact of Physical Activity Apps and Wearables: Interdisciplinary Review

[Claire McCallum](#) ; [John Rooksby](#) ; [Cindy M Gray](#) 

*Ann Transl Med*, 2019 Sep; 7(17): 417.  
doi: [10.21037/atm.2019.06.79](https://doi.org/10.21037/atm.2019.06.79)

PMCID: PMC6787392  
PMID: [31660316](https://pubmed.ncbi.nlm.nih.gov/31660316/)

Apple Watch, Wearables, and Heart Rhythm: where do we stand?

[Joel M. Raja](#),<sup>1</sup> [Carol Elsakt](#),<sup>2</sup> [Sherif Roman](#),<sup>3</sup> [Brandon Cave](#),<sup>4</sup> [Issa Pour-Ghaz](#),<sup>1</sup> [Amit Nanda](#),<sup>1</sup> [Miguel Maturana](#),<sup>1</sup> and [Rami N. Khouzam](#)<sup>5</sup>

# Ok, but does any of it work...?

“The results were mixed when assessing the impact on a predefined primary outcome, with 50% (15/30) of studies finding a positive influence on the studied outcome and 50% (15/30) demonstrating a nil effect.”

Published on 1.7.2022 in Vol 24, No 7 (2022): July

📌 Preprints (earlier versions) of this paper are available at <https://preprints.jmir.org/preprint/36690>, first published January 26, 2022.



## The Influence of Wearables on Health Care Outcomes in Chronic Disease: Systematic Review

Graeme Mattison <sup>1,2,3</sup> ; Oliver Canfell <sup>1,3,4,5</sup> ; Doug Forrester <sup>1,2</sup> ;  
Chelsea Dobbins <sup>1,6</sup> ; Daniel Smith <sup>2</sup> ; Juha Töyräs <sup>6,7,8</sup> ; Clair Sullivan <sup>1,2,4</sup> 

# Ok, but what are some of the examples of the stuff that works?



**Nike+ FuelBand plus exercise prescription on peripheral vascular disease improved walking distance and quality of life.**

Normahani P, Kwasnicki R, Bicknell C, Allen L, Jenkins MP, Gibbs R, et al. Wearable sensor technology efficacy in peripheral vascular disease (wSTEP): a randomized controlled trial. *Ann Surg* 2018 Dec;268(6):1113-1118.

**Wearables used in combination with physical activity counseling have a modest benefit, increasing physical activity levels.**

Hodkinson A, Kontopantelis E, Adeniji C, Van Marwijk H, McMillian B, Bower P, Panagioti M. Interventions using wearable physical activity trackers among adults with cardiometabolic conditions: a systematic review and meta-analysis. *JAMA network open*. 2021 Jul 1;4(7):e2116382-.

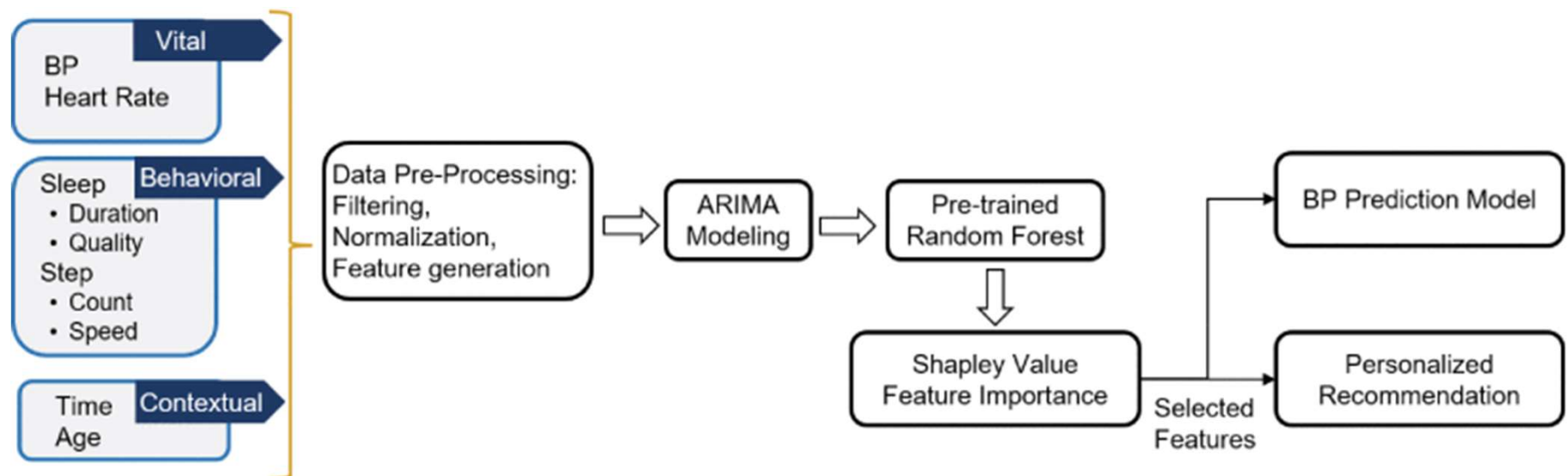
**Other findings suggest that setting activity goals is the most important intervention component.**

Ringeval M, Wagner G, Denford J, Paré G, Kitsiou S. Fitbit-based interventions for healthy lifestyle outcomes: systematic review and meta-analysis. *Journal of medical Internet research*. 2020 Oct 12;22(10):e23954.

**Among patients who sleep <6 hours per night and who have hypertension, a sleep wearable PLUS smartphone app PLUS weekly didactics PLUS telephone coaching reduced blood pressure and improved sleep.**

Baron KG, Duffecy J, Richardson D, Avery E, Rothschild S, Lane J. Technology assisted behavior intervention to extend sleep among adults with short sleep duration and prehypertension/stage 1 hypertension: a randomized pilot feasibility study. *J Clin Sleep Med*. 2019;15(11):1587-1597.

# What is coming soon that seems to be efficacious? **Personalization.**



# Your BP report from 3/30-7/1



## Summary of your SBP/ DBP (254 readings)

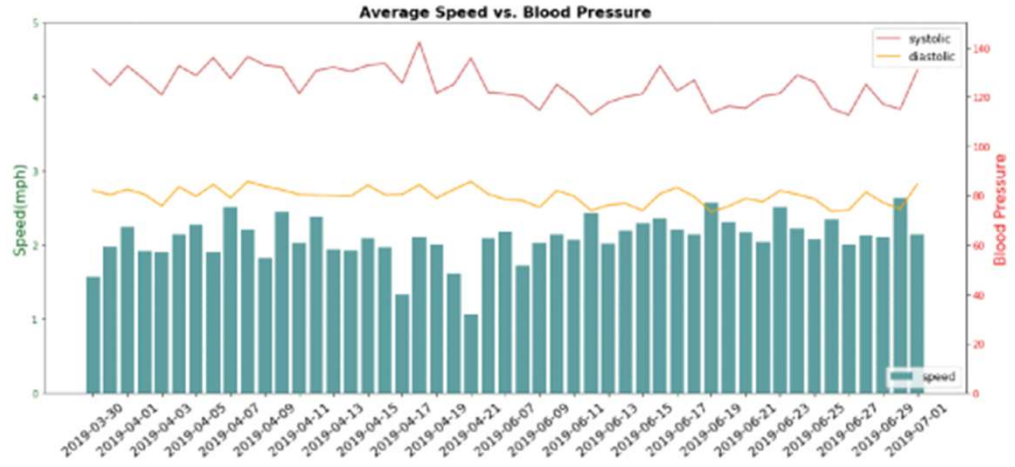
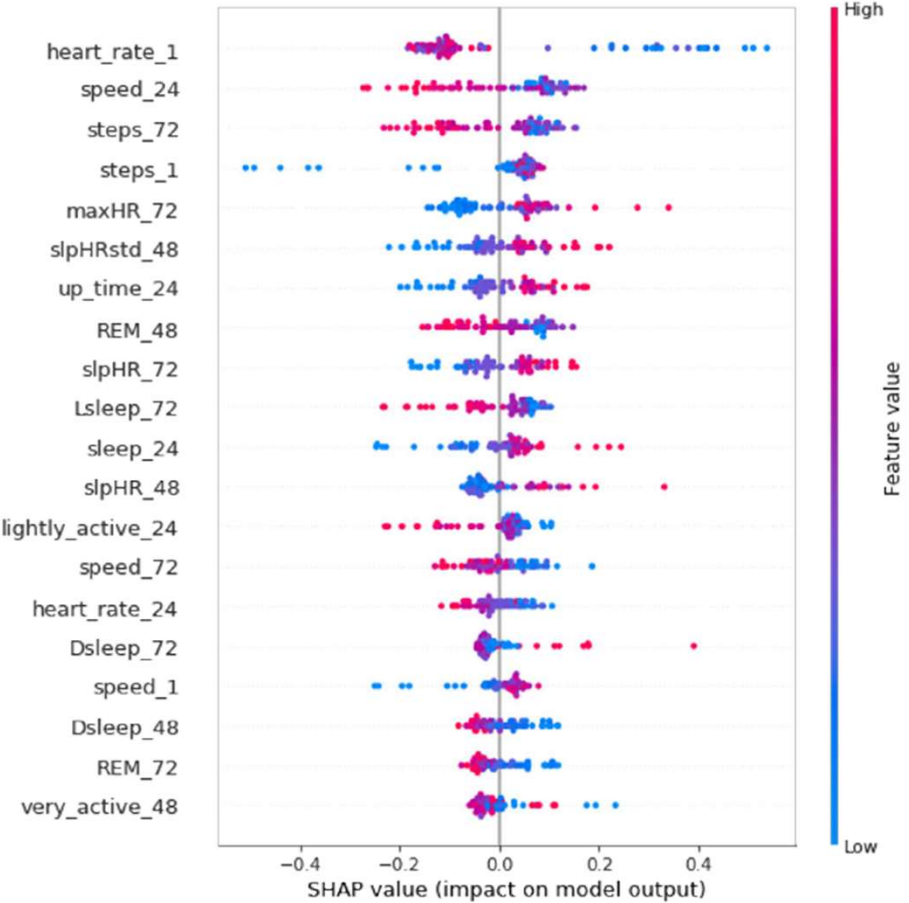
average 125/80  
 lowest 94/57  
 highest 159/96

Based on your blood pressure and lifestyle data, our analysis shows your blood pressure has the greatest correlation with the following:

- Daily average walking/running speed; increasing walking/running speed may positively influence (reduce) your future BP

The following graph(s) depict your daily blood pressure as compared to the following variable(s):

- Average walking/running speed





# Wearable Data at Point of Care?



- Many difficult clinical informatics challenges remain.
  - “Most doctors have little time for, or interest in, using wellness data collected by wearable devices. They don’t want to spend money on additional (and unproven clinical systems), and most of all, they don’t want to worry about keeping the data private.”
  - “Doctors would love to be excited about wearables — they’re gadget guys at heart — but their day-to-day is spent battling 30-year-old fax machines to get your last lab report.” says Jeff Tangney, CEO of Doximity

<https://venturebeat.com/business/guess-what-doctors-dont-care-about-your-fitbit-data/>

- Some health systems are syncing data from Apple Health, Fitbit and other vendors:
  - <https://www.metrohealth.org/mychart/track-my-health>
  - <https://mychart.texashealth.org/mychart/DeviceSyncingInstructions-en-083017.pdf>

# Summary



- Use of wearables is generally unlikely to cause harm.
  - Some patients can experience frustration with the use of wearables and associated apps. Abandon rates are relatively high, especially in populations with low digital literacy.
- Some wearables in combination with physical activity counseling can increase physical activity and engagement in some populations.
- Personalized health behavior recommendations in combination with easy-to-use wearables and other behavioral intervention strategies can have important benefits in the prevention of cardiovascular disease.



Thank you!

Questions/Discussion