JOHNS HOPKINS
INSTITUTE *for* CLINICAL & TRANSLATIONAL RESEARCH

Human Performance Measures

Implementing Physiologic Measures in Clinical Studies

A little history

1990’s to early 2020’s: Exercise Physiology Core, Director Kerry Stewart

- Supported initially by NCRR General Clinical Research Center grant award
- Then a NCATS Clinical and Translational Science Award
- Transition to Service Center

Survival of Service Centers is contingent on a broad user base

- Economies of scale

Is there a demand for a Human Performance Laboratory Core?

Human Performance

Measuring an individual's ability to efficiently respond to homeostatic stressors,

- Physical: exercise, physical activity, ADLs, injury, etc.
- Chemical: drugs, carcinogens, toxins, etc.
- Pathologic: infection, disease, etc.

At any biological level (subcellular, cellular, tissues, organ systems, organismal),

With three basic measurement categories

- Baseline phenotypic characterization
- Acute physiologic responses
- Chronic adaptations

Phenotypic Characterization

Static and Functional Phenotyping

Static: Body composition, resting metabolic rate, circulatory profiles

Functional: Walk tests, muscle strength, exercise capacity, vascular/pulmonary

Essential for cross-sectional, timecourse, and longitudinal study designs

Specific primary/secondary outcomes, exploratory aims

Providing appropriate physiologic and statistical controls

npj primary care respiratory medicine www.nature.com/npjpcrm

ARTICLE OPEN

Check for updates

One-minute sit-to-stand test as a quick functional test for people with COPD in general practice

J. G. Spence[1,2,3], J. Brincks[2], A. Løkke[4,5], L. Neustrup[6] and E. B. Østergaard[3]

Phenotypic Characterization

JOHNS HOPKINS
INSTITUTE *for* CLINICAL & TRANSLATIONAL RESEARCH

Static and Functional Phenotyping

- Static: Body composition, resting metabolic rate, circulatory profiles
- Functional: Walk tests, muscle strength, exercise capacity, vascular/pulmonary

Essential for cross-sectional, timecourse, and longitudinal study designs

- Specific primary/secondary outcomes, exploratory aims
- Providing appropriate physiologic and statistical controls

Article

Maternal Aerobic Exercise, but Not Blood Docosahexaenoic Acid and Eicosapentaenoic Acid Concentrations, during Pregnancy Influence Infant Body Composition

Acute Responses

Measuring an individual's ability to efficiently respond to homeostatic stress,

Physical: exercise, physical activity, ADLs, injury, etc.

Chemical: drugs, carcinogens, toxins, etc.

Pathologic: infection, disease, etc.

At any biological level (subcellular, cellular, tissues, organ systems, organismal).

Blood-based analyses

Endothelial function

Systemic metabolic responses

Integrative cardiopulmonary measures

Assess maximal and submaximal physiologic responses to acute stress of interest

CellPress

Cell

JOHNS HOPKINS INSTITUTE *for* CLINICAL & TRANSLATIONAL RESEARCH

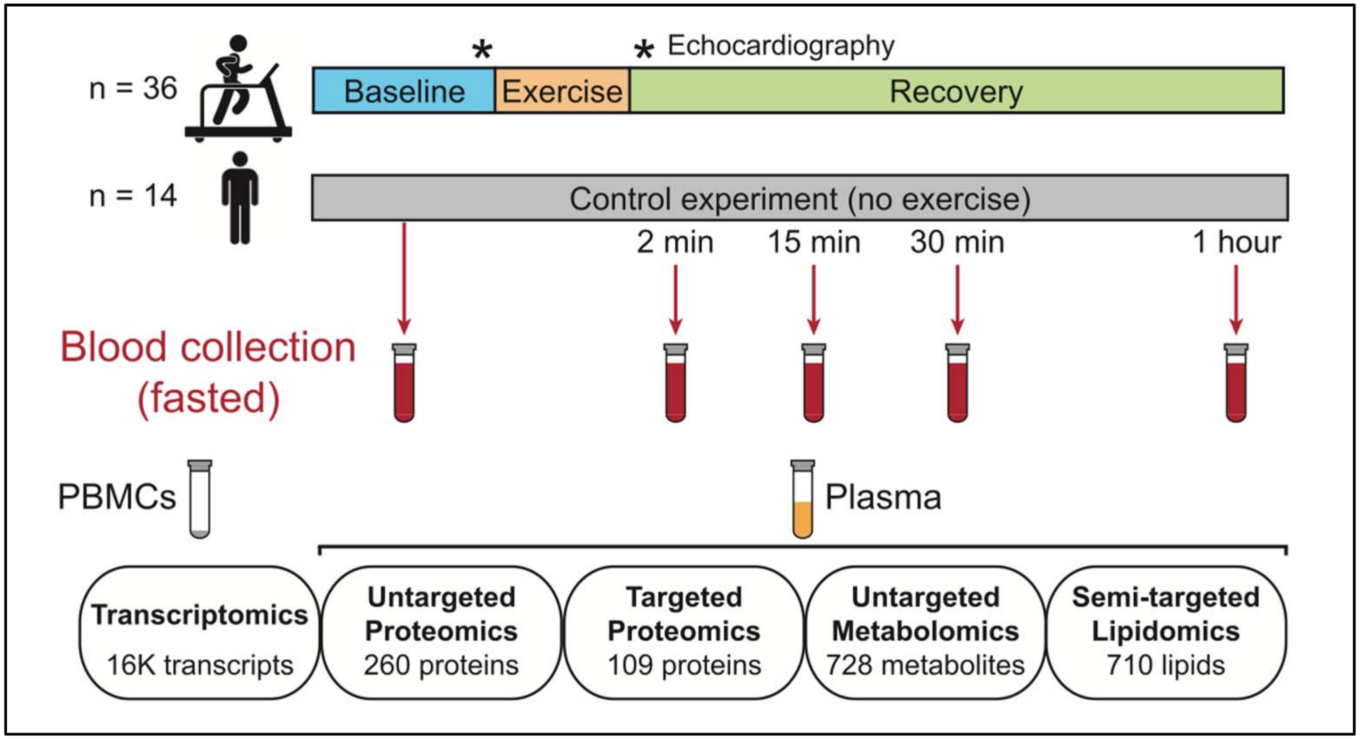
Article

Molecular Choreography of Acute Exercise

MoTrPAC

Molecular Transducers of Physical Activity Consortium

$170M NIH Common Fund



J Appl Physiol 129: 1477–1482, 2020.
First published October 1, 2020; doi:10.1152/japplphysiol.00512.2020.

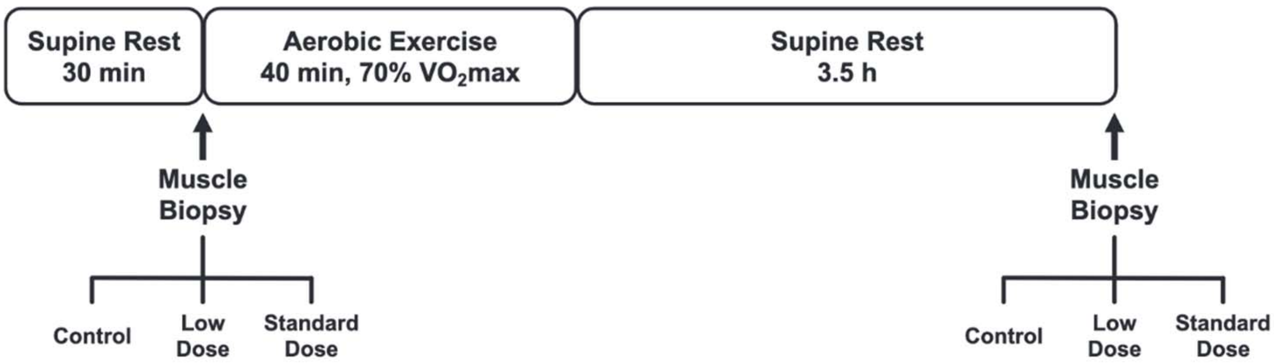
JOHNS HOPKINS
INSTITUTE *for* CLINICAL & TRANSLATIONAL RESEARCH

RESEARCH ARTICLE

Low-dose aspirin and COX inhibition in human skeletal muscle

William A. Fountain, Masatoshi Naruse, Alex Claiborne, Andrew M. Stroh, Kevin J. Gries, Andrew M. Jones, Kiril Minchev, Bridget E. Lester, Ulrika Raue, Scott Trappe, and Todd A. Trappe
Human Performance Laboratory, Ball State University, Muncie, Indiana

Does aspirin influence skeletal muscle inflammation before and after exercise?

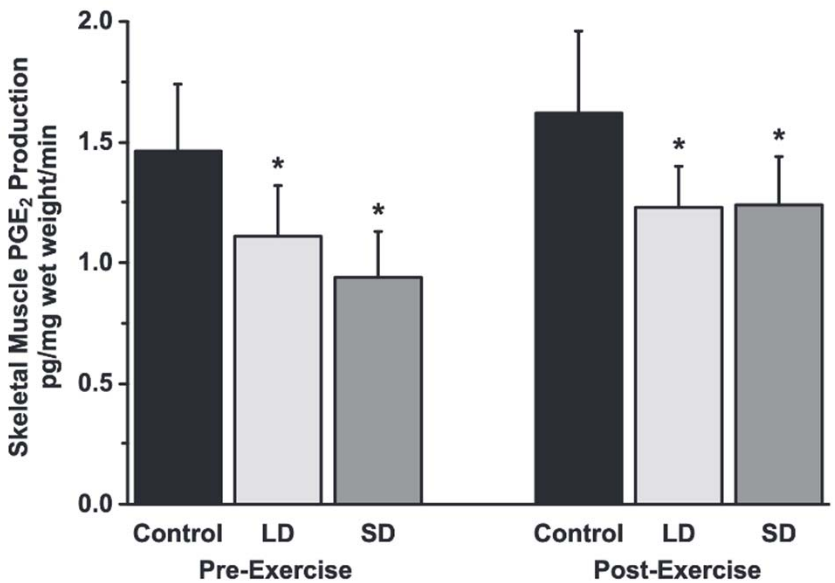


J Appl Physiol 129: 1477–1482, 2020.
First published October 1, 2020; doi:10.1152/japplphysiol.00512.2020.

RESEARCH ARTICLE

Low-dose aspirin and COX inhibition in human skeletal muscle

William A. Fountain, Masatoshi Naruse, Alex Claiborne, Andrew M. Stroh, Kevin J. Gries, Andrew M. Jones, Kiril Minchev, Bridget E. Lester, Ulrika Raue, Scott Trappe, and Todd A. Trappe
Human Performance Laboratory, Ball State University, Muncie, Indiana



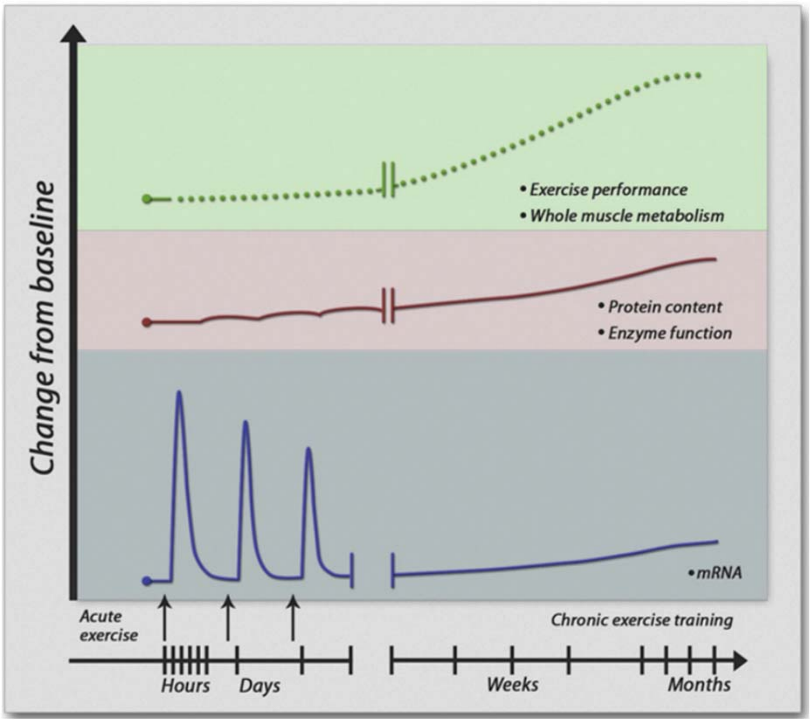
1. Basal characterization
2. Basal dose-response

3. Stimulated characterization
4. Stimulated dose-response

Exercise Metabolism and the Molecular Regulation of Skeletal Muscle Adaptation

Johns Hopkins Institute for Clinical & Translational Research

Brendan Egan[1,2] and Juleen R. Zierath[2,3,4,*]



How might this apply to your research?

Transcript → Protein → Phenotype → Outcomes

Consider the following interventions:

Exercise	Therapeutics
Pharmaceuticals	Inactivity
Surgery	Injury
Medical Devices	Lifestyle Modification

Big Picture: JH Potential?

MAYO CLINIC

BRIEF REPORT

Reference Standards for Cardiorespiratory Fitness Measured With Cardiopulmonary Exercise Testing Using Cycle Ergometry: Data From the Fitness Registry and the Importance of Exercise National Database (FRIEND) Registry

Leonard A. Kaminsky, PhD; Mary T. Imboden, MS; Ross Arena, PhD; and Jonathan Myers, PhD

Can we create a longitudinal database of functional outcome standards for various patient populations?

JOHNS HOPKINS INSTITUTE *for* CLINICAL & TRANSLATIONAL RESEARCH

What Can We Do For You?

Anthropometrics
Body composition

Vascular Function
- Pulse wave velocity
- Augmentation index

Muscle Strength Testing

Metabolic Testing
- Resting, Exercise, etc.

Exercise Stress Testing
- Treadmill, Cycle

Vital Responses (HR, BP, etc.)
Blood Collection

More to come… we need your input!

Human Performance Core Lab

Johns Hopkins Institute for Clinical & Translational Research

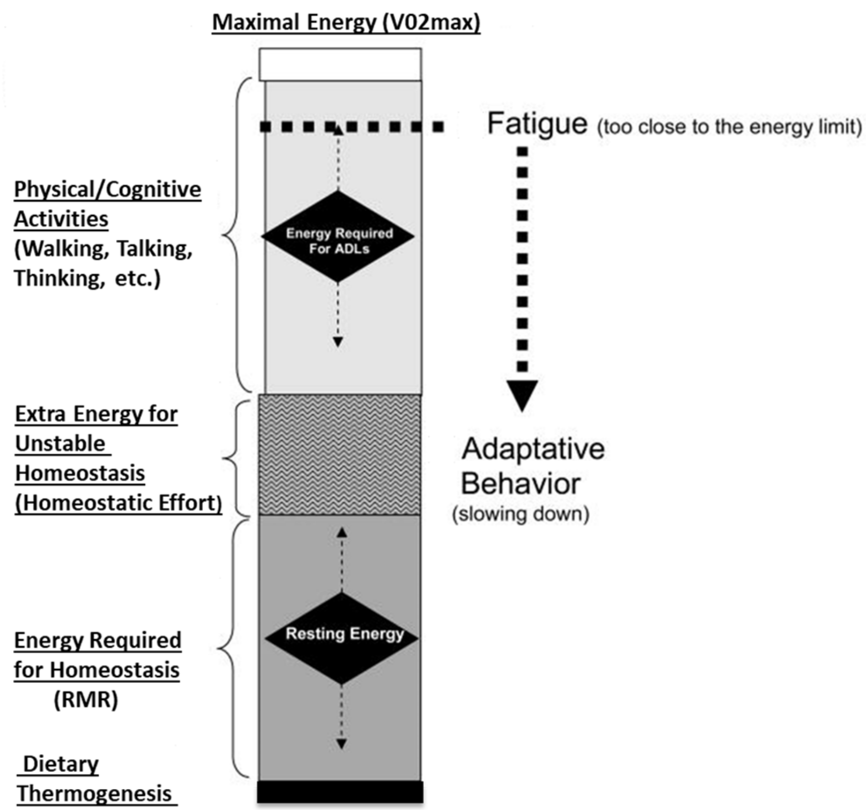
<u>Currently planning to restructure</u>

- Offer several portable services
  - Blood draw, handgrip, walk test, etc.
- Potential satellite locations (i.e. thinking beyond Bayview)
- Gauging interest to tailor the core to best suit your needs

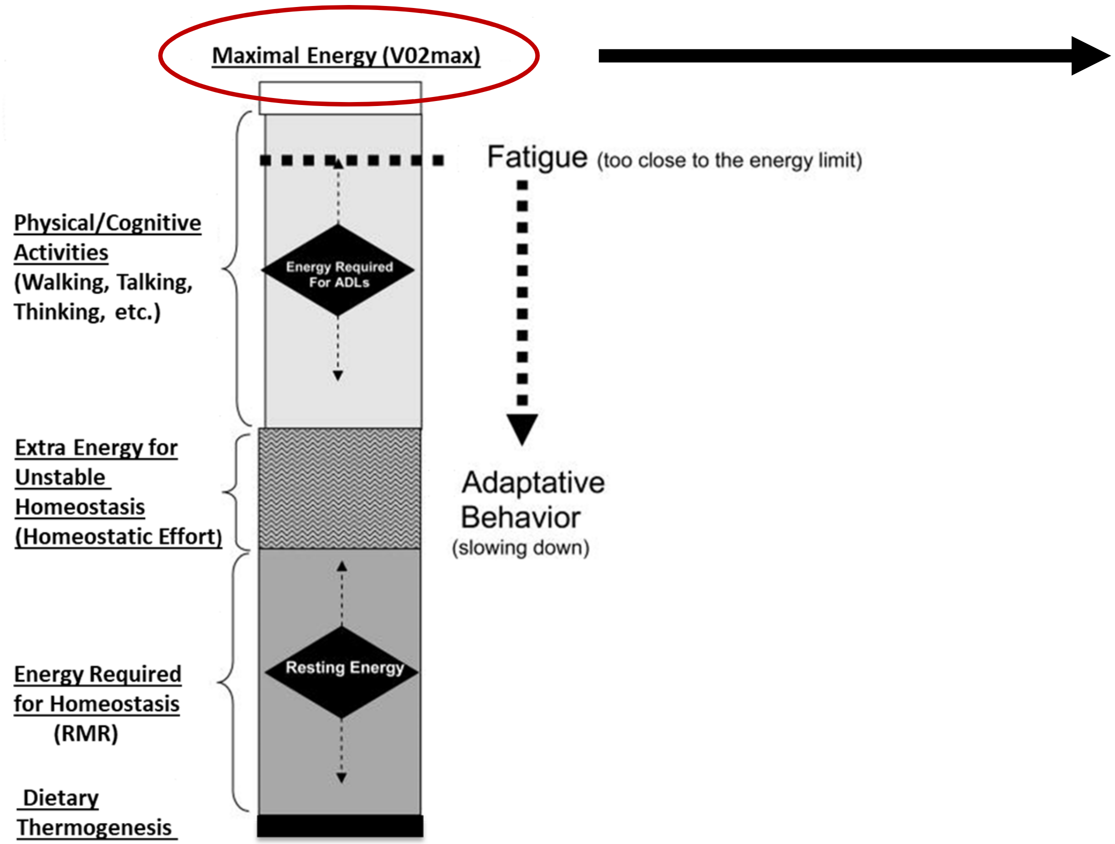
Case Studies

Clinical applications of human performance measures

Energy Expenditure (VO2)

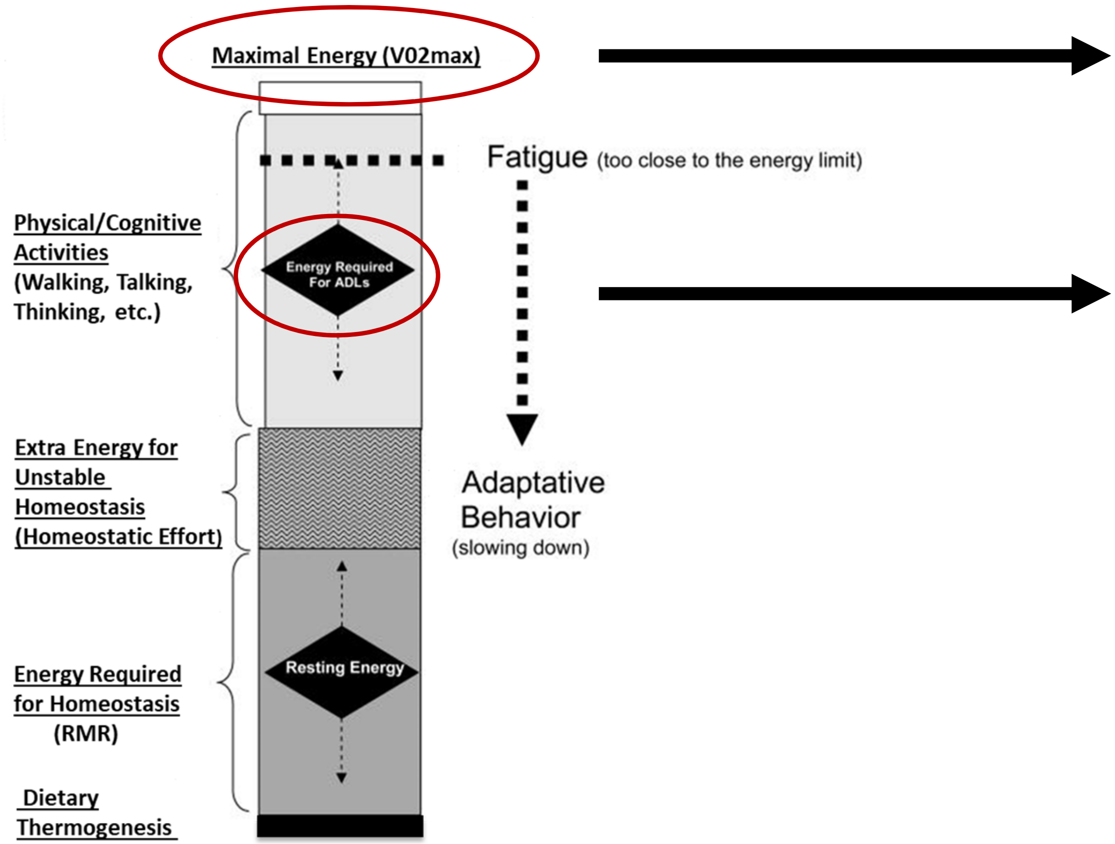


Energy Expenditure (VO2)



Strong predictor of:
Physical function
Cardiovascular disease
All-cause mortality

Energy Expenditure (VO2)



Strong predictor of:
Physical function
Cardiovascular disease
All-cause mortality

Predictor of:
Physical function

Aerobic capacity measurement

Maximal Graded Exercise Test

- Modified Balke Protocol
    - Constant speed
    - Incremental grade

Measure of Cardiorespiratory fitness

- VO_{2peak} (ml/kg/min)

Energetic cost of walking measurement

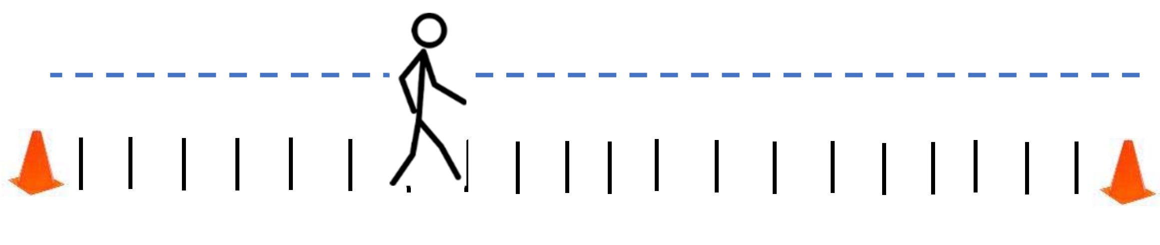
Overground customary-paced walking test

- 2.5-minutes of walking at “usual comfortable pace”
- Oxygen consumption (VO_2) via a portable indirect calorimeter (ml/kg/min)

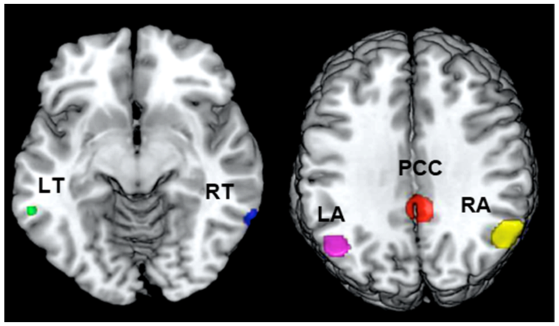
Measure of energy cost of walking

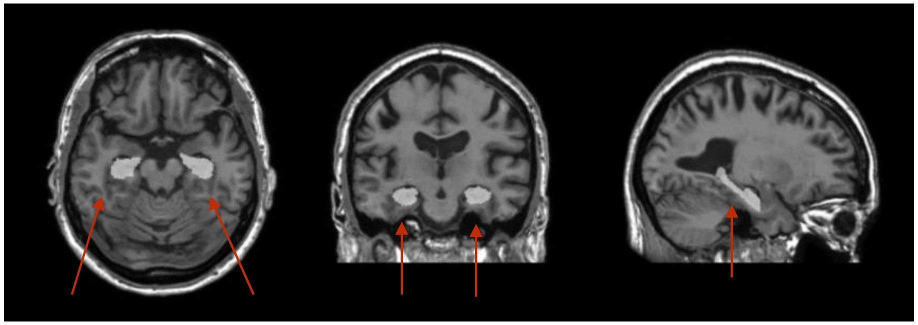
- VO_2 (ml/kg/m)

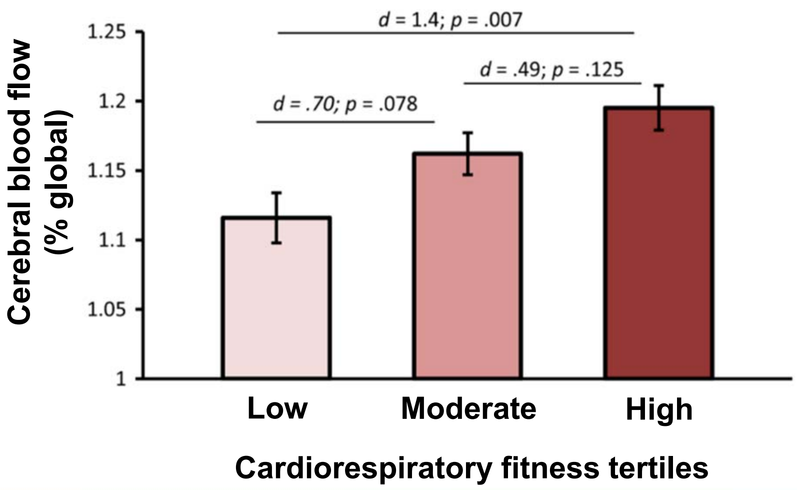
cosmed.com

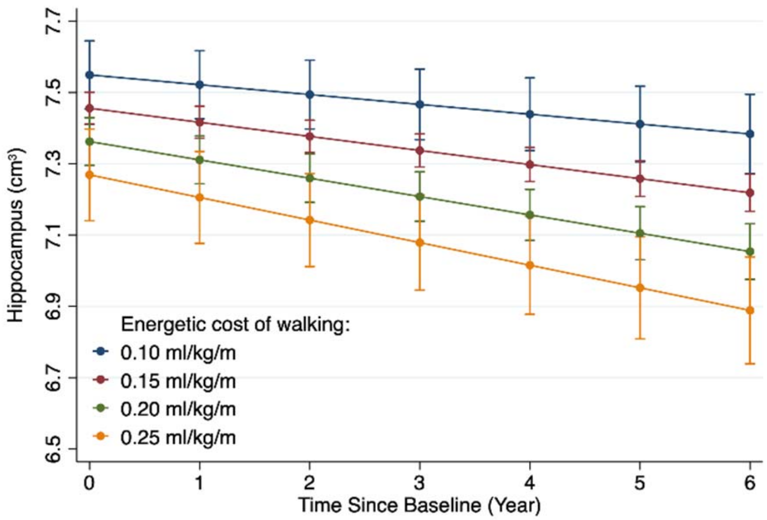


VO2 and brain health









Conclusion

Physiologic measures

- Can directly assess
  - Function
  - Functional capacity to respond to stressors

- Can be predictive of outcomes
  - Disease occurrence/progression
  - Response to treatment

JOHNS HOPKINS
INSTITUTE *for* CLINICAL & TRANSLATIONAL RESEARCH

Please complete a brief evaluation of this presentation
Scan the QR code below to link to a Qualtrics survey