

Development and Application of Novel Methodologies to Improve and Expand Research in Kinesiology and Nutrition

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Outline

- Introduction
- Contributions to Energy Balance Assessment
- Emerging Focus on Sleep & 24-hour Epidemiology
- Next Steps & Potential Collaborations
- Wrap-Up
- Q&A



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INTRODUCTION



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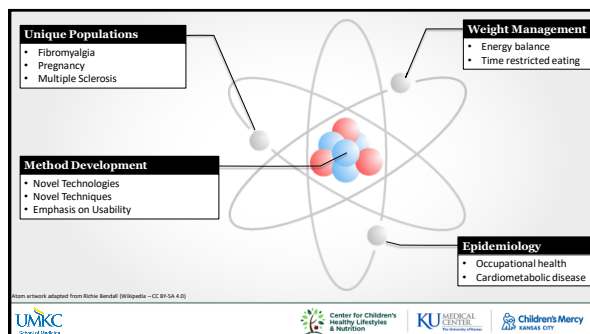
Academic & Scientific Background



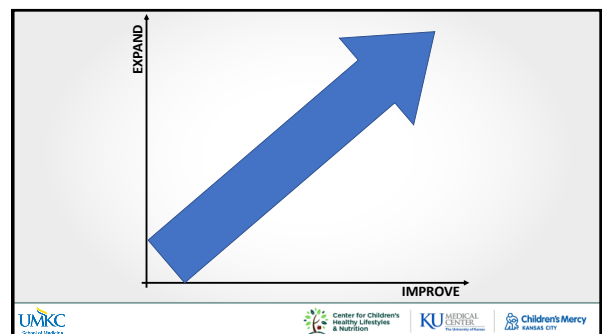
- Iowa State: B.S. (2014), M.S. (2016)
- University of Tennessee, Knoxville: Ph.D. (2020)
- Wearable Devices Methodologist
 - Physical activity and energy expenditure
 - Youth and adults
- Postdoctoral Emphases
 - Sleep/24-hr epidemiology
 - Energy balance (weight management/nutrition)



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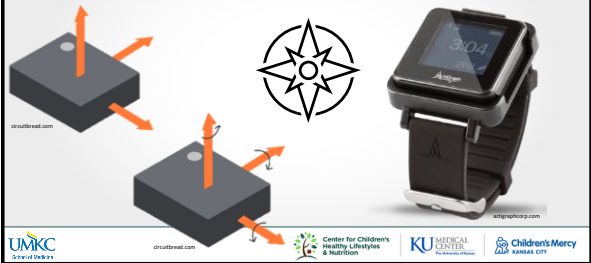
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CONTRIBUTIONS TO ENERGY BALANCE ASSESSMENT



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Multi-Sensor Models for Predicting Energy Expenditure



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Study Design

Time →



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Study Design



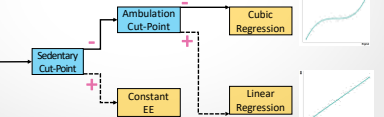
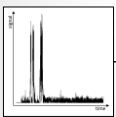
Coronel (Wikipedia - CC BY-SA 3.0)



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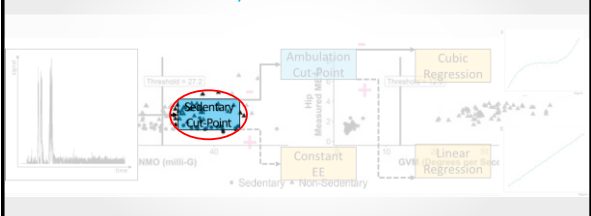
Two-Regression Models

	Hip	Left Wrist	Right Wrist	Left Ankle	Right Ankle
Acc	←	←	←	←	←
Acc + Gyro	←	←	←	←	←
Acc + Gyro + Mag	←	←	←	←	←



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Results: Sedentary Classification



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Results: Hip Models

	RMSE (METs)	MAPE (%)
Acc	1.14	20.32
Acc + Gyro	1.00	14.35
Acc + Gyro + Mag	1.00	14.52



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Takeaways

- Gyroscope excellent for sedentary classification
- Gyroscope helpful for modeling
- Magnetometer not useful
- Models are available in R package TwoRegression
- Models can be deployed for a variety of applications

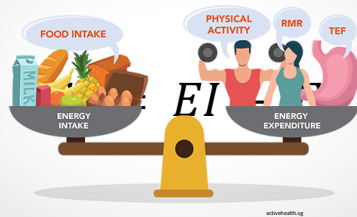
Hibbing PR, LaMonte SR, Kaplan AS, & Crouter SE. (2018) Estimating energy expenditure with ActiGraph GT9X inertial measurement unit. *Medicine and Science in Sports and Exercise*. 50(5), 1093-1102. doi: 10.1249/MSS.0000000000001532.

Leading To: R01DK129428 (MPs Crouter and Ding)



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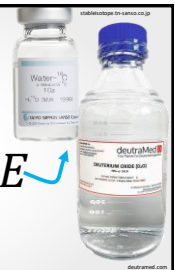
Accelerometry for Intake-Balance



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Accelerometry for Intake-Balance

$$EI = \Delta ES + EE$$



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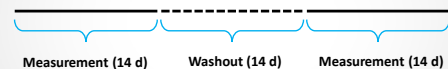
Accelerometry for Intake-Balance

$$EI = \Delta ES + EE$$

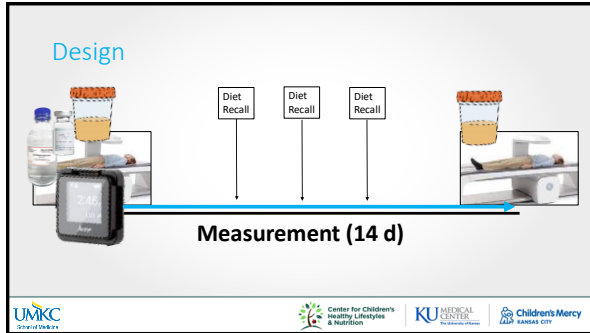


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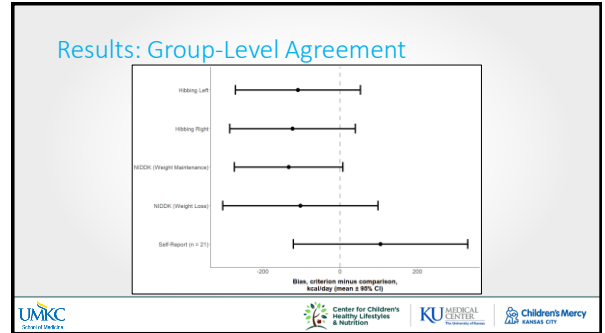
Design



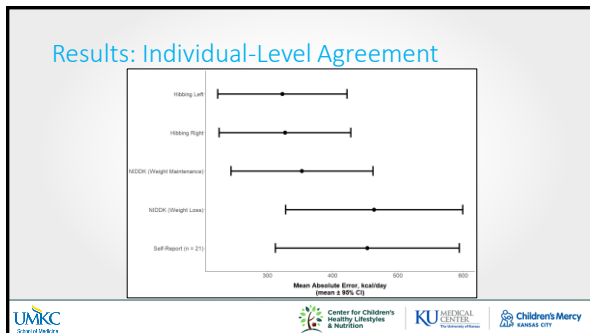
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Takeaways

- Comparable with other methods at group level
- Notable individual-level gains
- Handedness not a strong factor in accuracy
- Utility may be context dependent
- Manuscript/R package under development

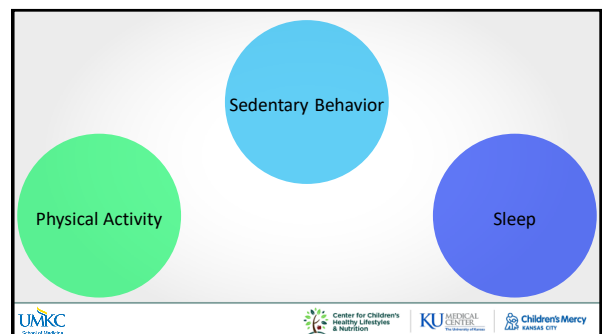
Logos: UMKC, Center for Children's Healthy Lifestyles & Nutrition, KU Medical Center, Children's Mercy Kansas City

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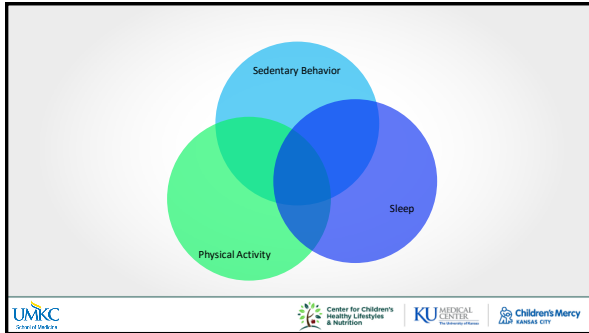
EMERGING FOCUS ON SLEEP & 24-HOUR EPIDEMIOLOGY

Logos: UMKC, Center for Children's Healthy Lifestyles & Nutrition, KU Medical Center, Children's Mercy Kansas City

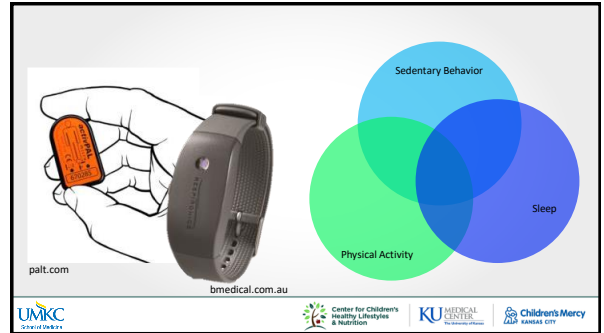
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Projects

- Field Validation (Convergent Validity)
- Ground Truth Validation
- In addition:
 - Summer mentorship
 - Movement disorders
 - Future NIH grant submission (likely R01)

A photograph of a young child lying in a hospital bed, wearing a medical device on their chest. To the left of the child is a blue sign that reads 'Children's Mercy Kansas City 225 Years and Growing Sleep Clinic' and 'BEST CHILDREN'S HOSPITALS'.

Logos at the bottom: UMKC, Center for Children's Healthy Lifestyles & Nutrition, KU Medical Center, Children's Mercy Kansas City.

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Applications: Occupational Health

- Algorithm implications in shift workers
- Differential implications of the physical activity paradox

A line graph with 'Hours/Week' on the y-axis (ranging from 0.5 to 1.5) and 'Realization between MHR and remaining behaviors (minutes/week)' on the x-axis (ranging from -20 to 20). Two lines are plotted: a blue line labeled 'Work' and an orange line labeled 'Leisure'. The 'Work' line starts at approximately 0.8 at x=-20 and rises to approximately 1.2 at x=20. The 'Leisure' line starts at approximately 1.2 at x=-20 and falls to approximately 0.8 at x=20. They intersect at x=0, y=1.0.

An illustration of a person standing on a ladder, working on a large clock face. The clock face has numbers 1 through 12.

Logos at the bottom: UMKC, Center for Children's Healthy Lifestyles & Nutrition, KU Medical Center, Children's Mercy Kansas City.

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NEXT STEPS & POTENTIAL COLLABORATIONS

Logos at the bottom: UMKC, Center for Children's Healthy Lifestyles & Nutrition, KU Medical Center, Children's Mercy Kansas City.

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Notice of Special Interest (NOSI): Dietary, Physical Activity, Sedentary Behavior and Sleep Assessment Methodologies Among Infants and Young Children (Birth to 5 years) through Adults

Notice Number: NOT-CA-21-108

Key Dates

Release Date: October 4, 2021

First Available Due Date: February 05, 2022

Expiration Date: May 08, 2023

Related Announcements

PA-20-180 - NIH Research Project Grant (Parent R01 Clinical Trial Not Allowed)

Issued by

National Cancer Institute (NCI)
National Heart, Lung, and Blood Institute (NHLBI)
Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD)

Logos at the bottom: UMKC, Center for Children's Healthy Lifestyles & Nutrition, KU Medical Center, Children's Mercy Kansas City.

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First Study

- **Potential Departmental Collaborators:** Drs. Motl, Foucher
- **Additional Resources/Collaborators:**
 - Center for Biostatistical Development (Public Health)
 - Dr. Wei Tang (Computer Science)
 - Center for Sleep and Health Research
 - Sleep Science Center



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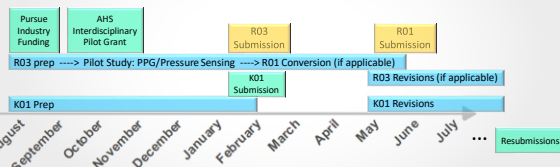
An Alternative Path Through Career Development

- NIH K01: "intensive, supervised career development experience"
- **Rationale**
 - Exceptional institution, department, and faculty
 - Strong applicant
 - Opportunity to expand research footprint in nutrition & interventional research
- **Content**
 - Interaction of diet and exercise timing
 - Research/Professional mentors: Drs. Varady & Clifford



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1-Year Funding/Project Plan



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Further Potential Collaborations

- **Occupational Health:**
 - Dr. Vanessa Oddo
 - Hispanic Community Health Study/Study of Latinos (HCHS/SOL)
- **Activity Measurement:**
 - Application in Integrative Physiology Lab studies
 - Development studies with Dr. Motl (possibly an NIH P-award down the road)



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WRAP-UP



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Why does it matter?



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