Image-assisted methods for dietary intake assessment

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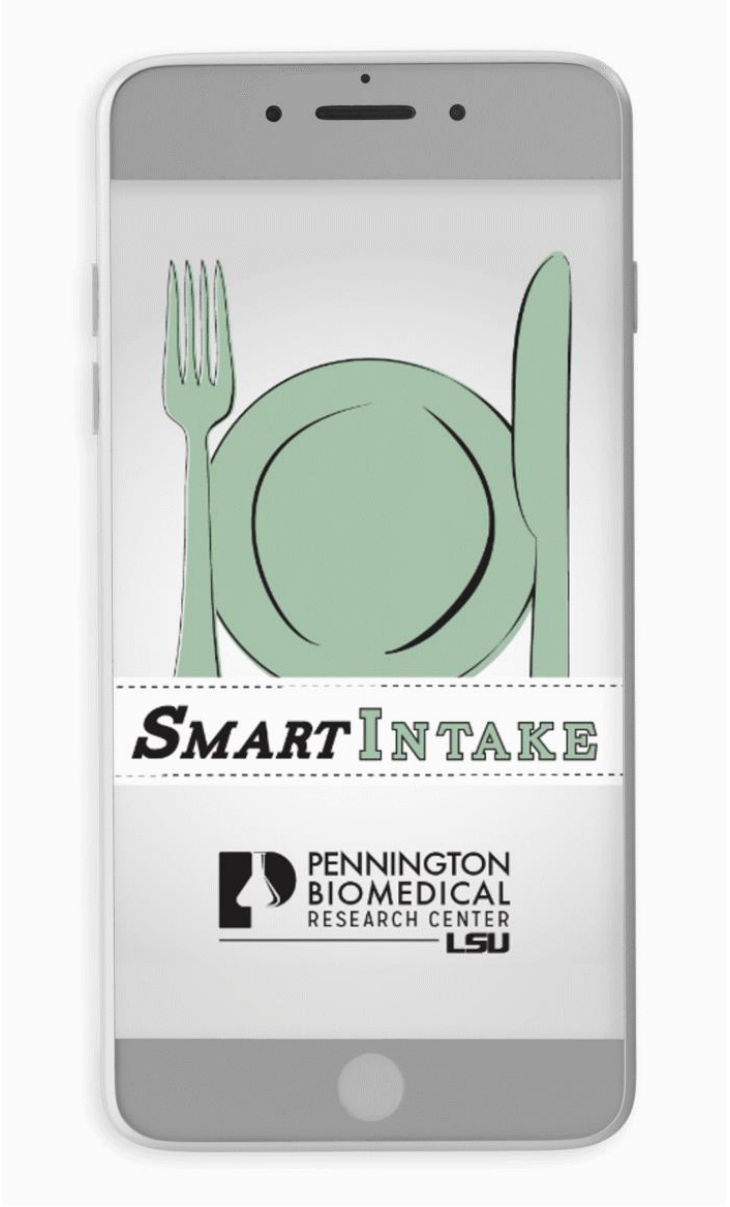
Presented to the National Academies of Sciences, Engineering, and Medicine

March 17, 2021

Disclosures

LSU/Pennington Biomedical has interest in the intellectual property (IP) surrounding the Remote Food Photography Method© (RFPM), SmartIntake® app, FoodImage™ app, PortionSize™ app, and eCigTracker™ app, and I am an inventor of these technologies.



Perspectives on the food intake assessment literature

All methods have their place in research and practice

- I use food records in weight loss studies, but not for the primary purpose of quantifying actual energy or nutrient intake
- I use Food Frequency Questionnaires to obtain reported frequency of consumption of different food groups, but not to estimate actual intake

Sponsors, researchers, and clinicians have failed to integrate more appropriate methods to assess food intake

- We all share blame
  - **Insanity** is doing the same thing over and over again and expecting a different result (A. Einstein)
- We need to stop expecting a method to do something that it cannot do
  - I do not think that AI, etc. will magically make bad data better. Why don't we just collect good data to start with?
  - Food intake is highly variable and missing data is missing data. Should we not stop using methods that have missing data or change the method to reduce missing data?
- There is wisdom in collecting more complete/valid data over a shorter time period
  - I have yet to see how collecting more bad data solves any problems; it seems to create problems and burdens everyone involved

Overview of the Martin Lab

1

Assessment of eating behaviors

Assess food selection, plate waste, and intake in laboratory and free-living conditions

2

Mechanistic Studies

Identify causes and consequences of energy imbalance/weight change

3

Intervention development and evaluation

Most interventions target diet and activity and at rely on mobile health technology/remote delivery

Ingestive Behavior

There was a "fundamental flaw" in obesity research in the early 2000's

- We could not accurately measure how much people eat in free-living conditions

- Food photography, but not traditional dietary assessments, have largely overcome this limitation

Winkler JT, BJN, 2007

Food Intake Assessment

Self-report (SR) methods (e.g., food records) incur:

- Time and cost to the researcher/clinician
- Burden to the participant/patient

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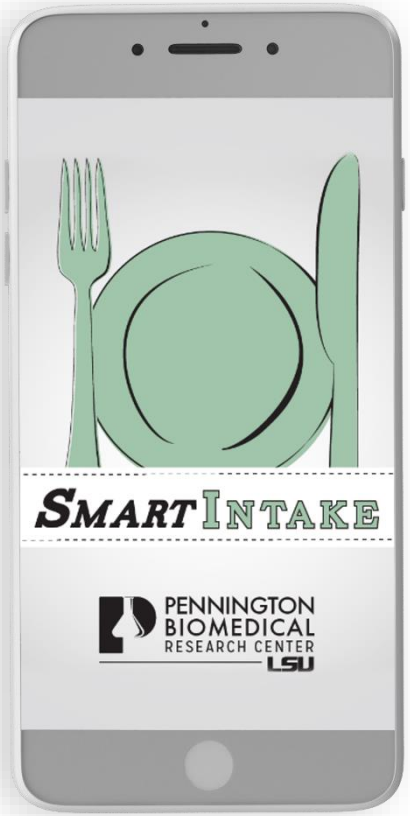
We found it very difficult to meaningfully improve peoples' portion size estimates

	Baseline	Weeks 22-24	p-value
	Mean	Mean	Δ over time
Portion Size Accuracy Score (0=perfect estimation)	30	19	<.05

The Remote Food Photography Method© (RFPM) and the SmartIntake® App



Martin et al., BJN, 2009; IEEE, 2009; Obesity, 2012; Dibiano, et al., 2013

R21 AG032231, R01 DK089051

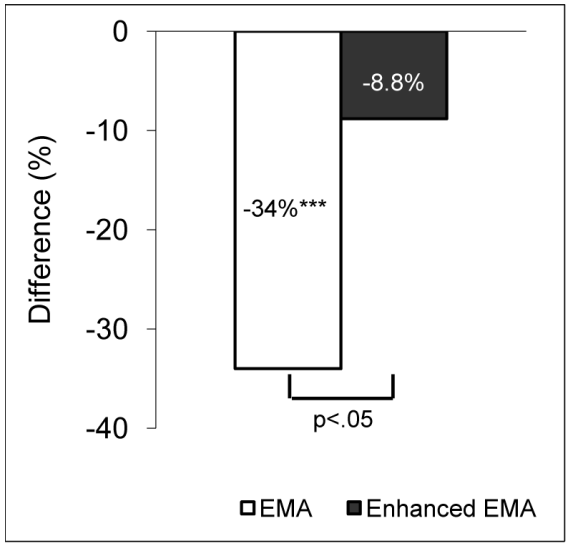
Ecological Momentary Assessment (EMA)

Good EMA methods (reminders to capture images) are needed to promote complete and accurate 24-h food intake data

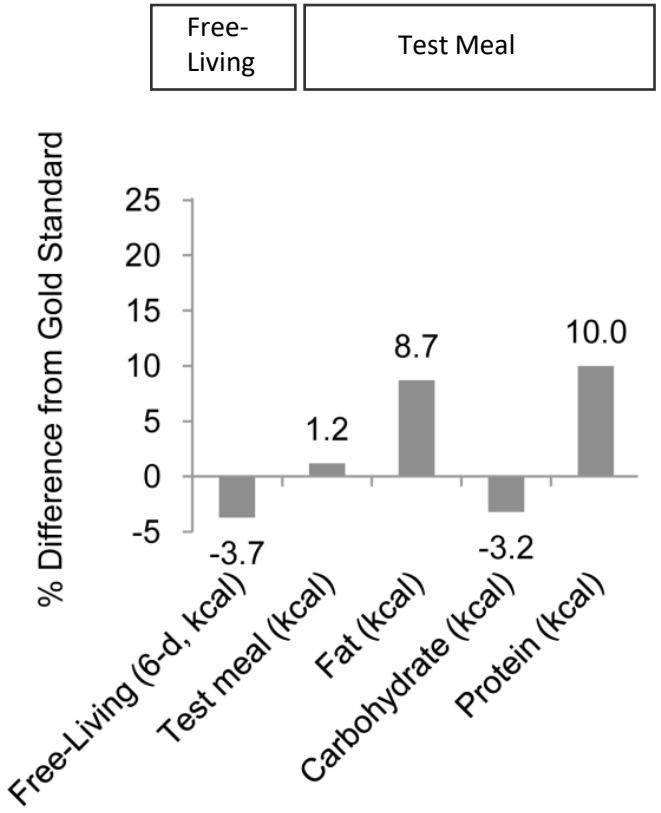
- This helps address ~50% of the error from traditional food intake assessment methods
- The other 50% is addressed via our procedures to estimate portion size during image analysis

Ecological Momentary Assessment (EMA)

Accuracy of the RFPM compared to doubly labeled water over 7-days in free-living conditions using Enhanced vs. Standard EMA methods.



* Asterisks indicate if error differed sig. (***p<.001) from zero within EMA group. Brackets denote differences between groups.



The RFPM overcomes limitations associated with self-report methods

Bias was consistent over levels of energy intake, nutrient intake, body weight, and age

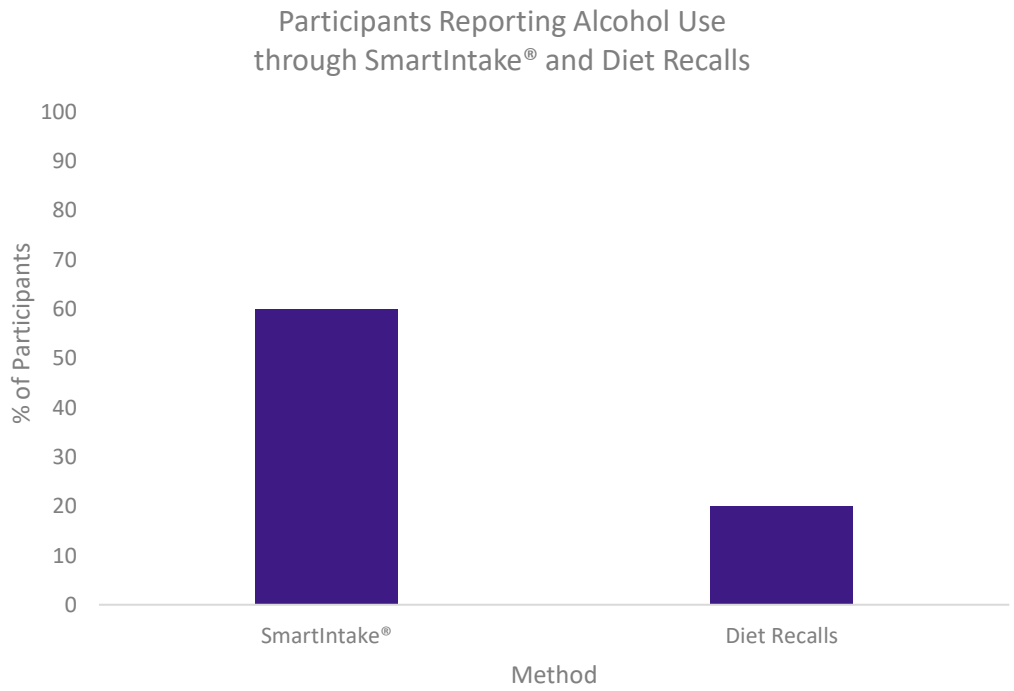
The RFPM does not affect energy intake (neither reactivity nor undereating were detected)

Back-up methods were critical in promoting data completeness and validity

- Back-up methods constituted 9.7% of total energy intake estimates

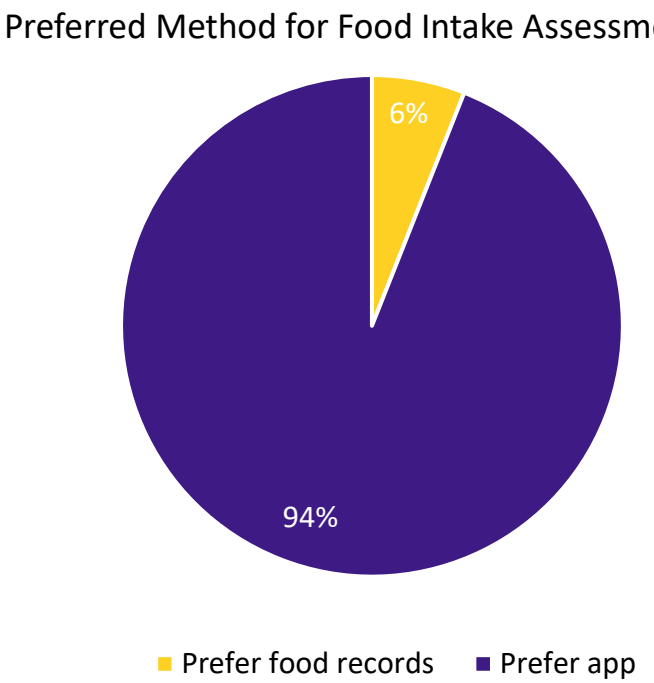
SmartIntake and food photography is adaptable and robust

SmartIntake has successfully assessed alcohol intake in heavy drinking college students

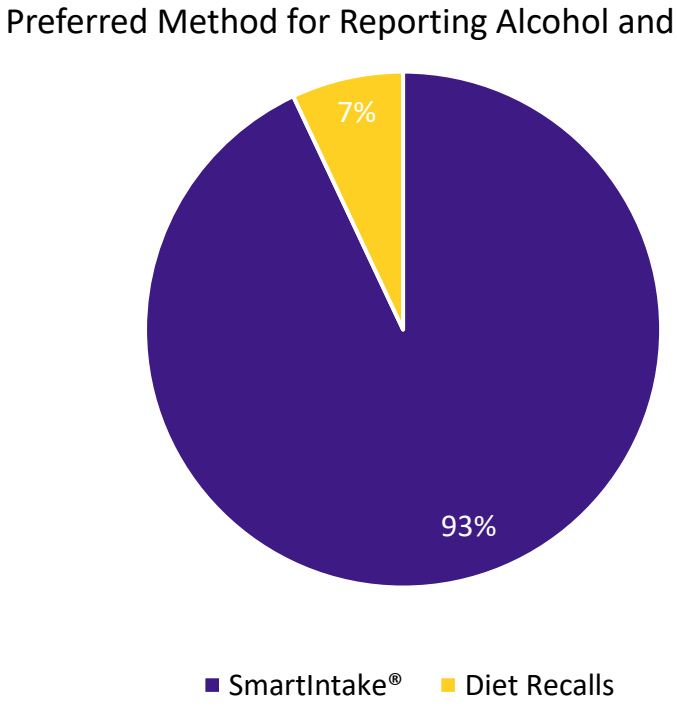


Fazzino, T L et al. 2018, JMIR Mhealth Uhealth

Participant prefer food photography and SmartIntake

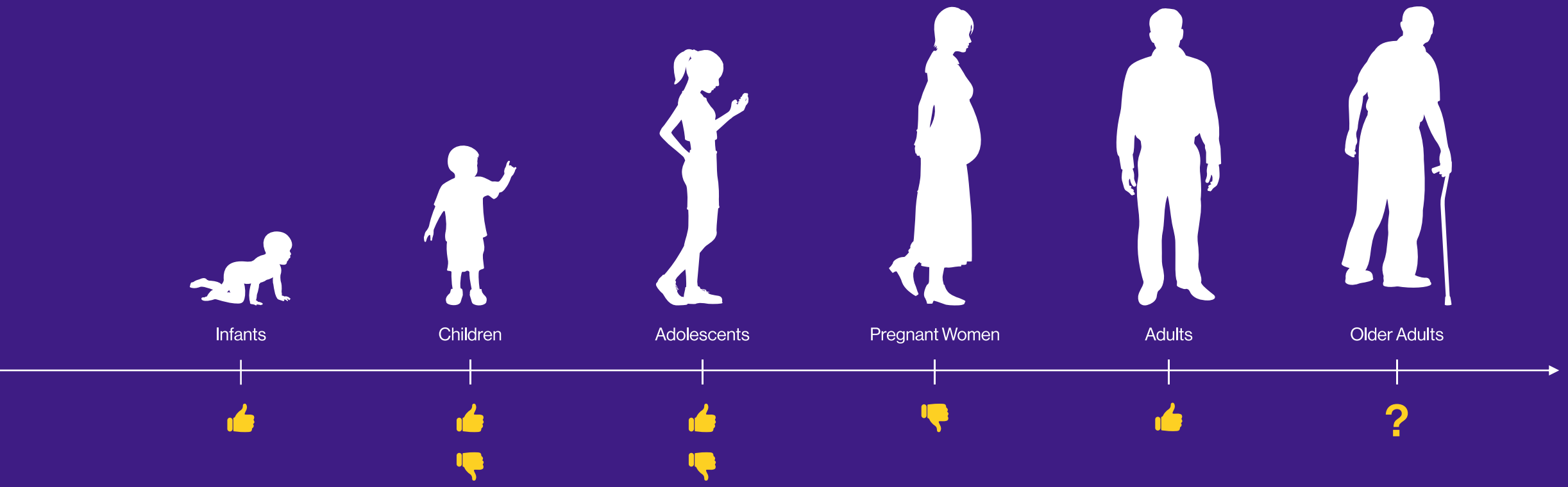


Martin, CK et al., 2012, Obesity



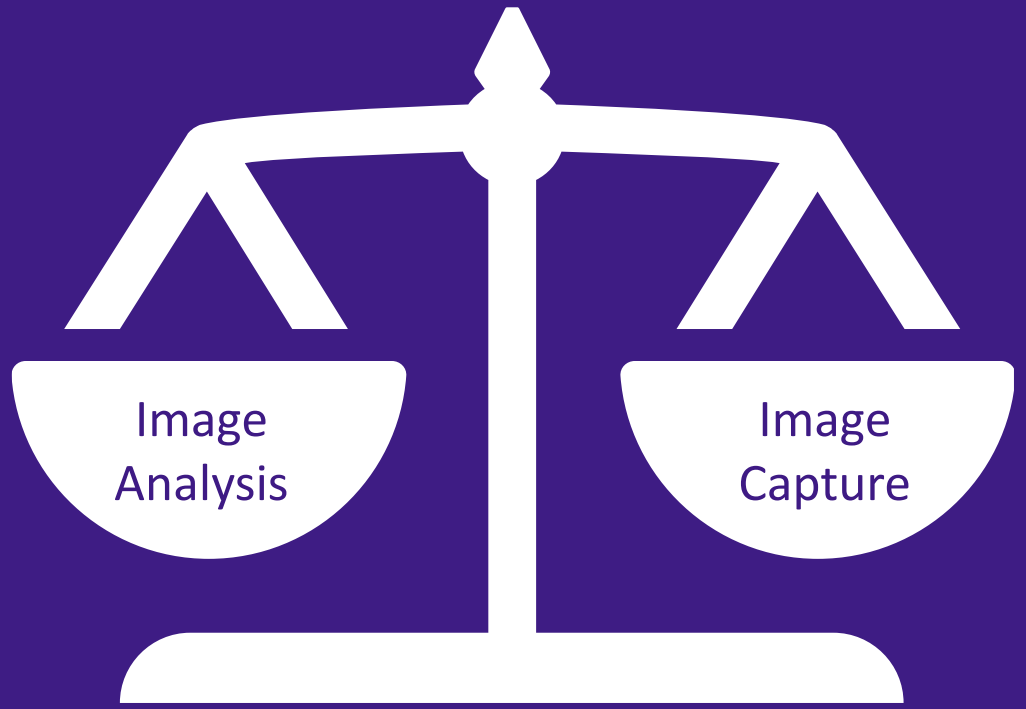
Fazzino, T L et al. 2018, JMIR Mhealth Uhealth

The Remote Food Photography Method (RFPM) and SmartIntake (Version 2) app



Automated or semi-automated image analysis is not yet a reality

Höchsmann, C. & Martin, C. K., IJO, 2020

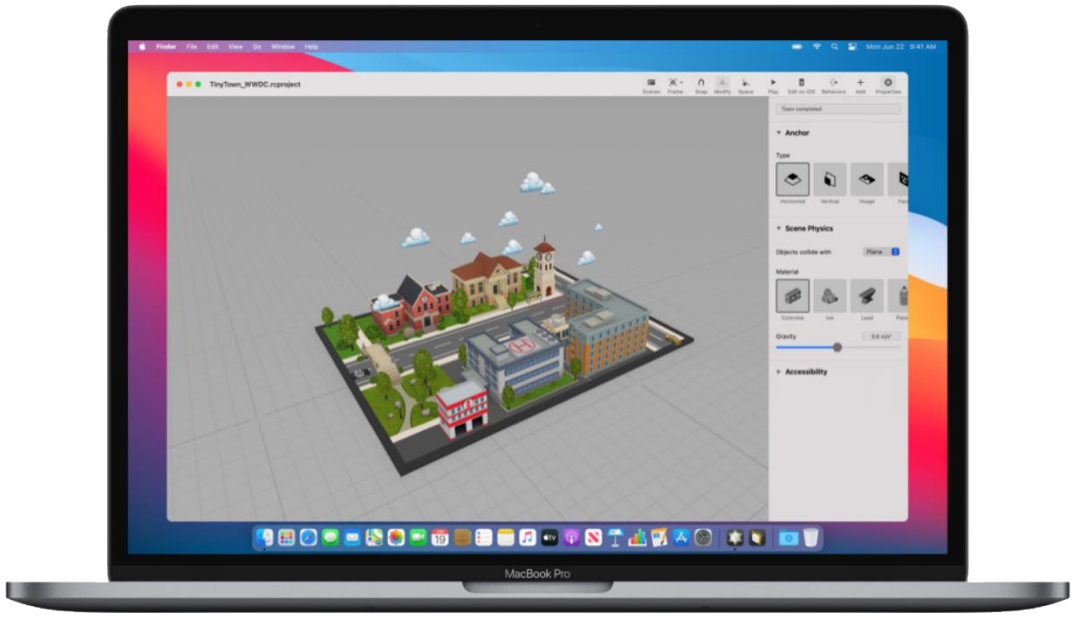


Automated or semi-automated image analysis is not yet a reality

We seem to be trying to address automated (and semi-automated) image analysis within two silos

Academia

Industry/private companies



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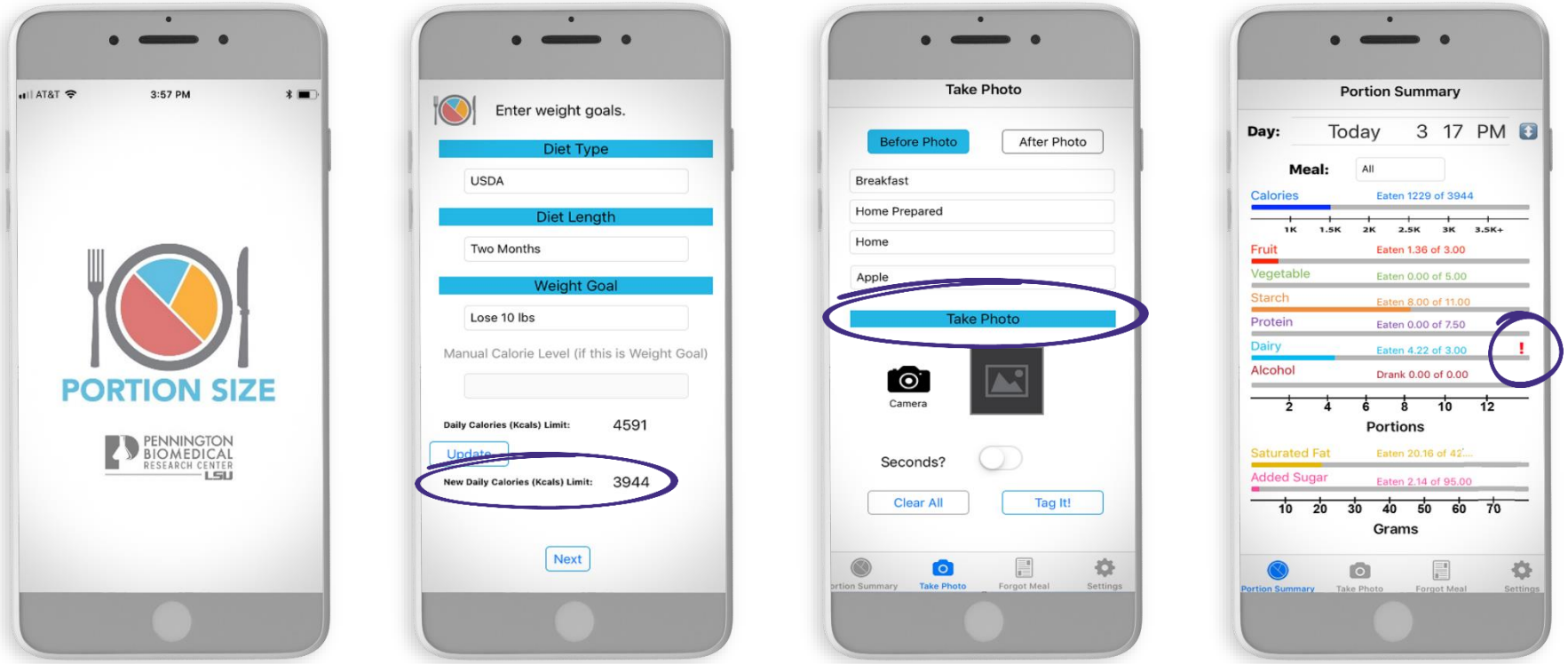
Build unparalleled augmented reality experiences for hundreds of millions of users on iOS and iPadOS, the biggest AR platforms in the world. With powerful frameworks like ARKit and RealityKit, and creative tools like Reality Composer and Reality Converter, it’s never been easier to bring your ideas to life in AR.

PortionSize™

PortionSize aims to improve scalability and provide users and clinicians/researchers with real-time feedback on dietary intake and dietary adherence

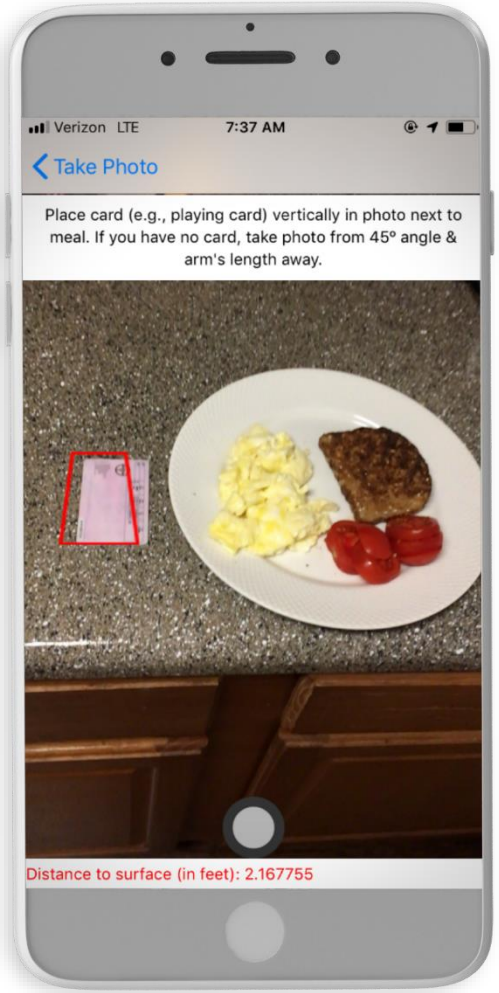
- The app's validity is being tested in the first of 3 studies during an R01

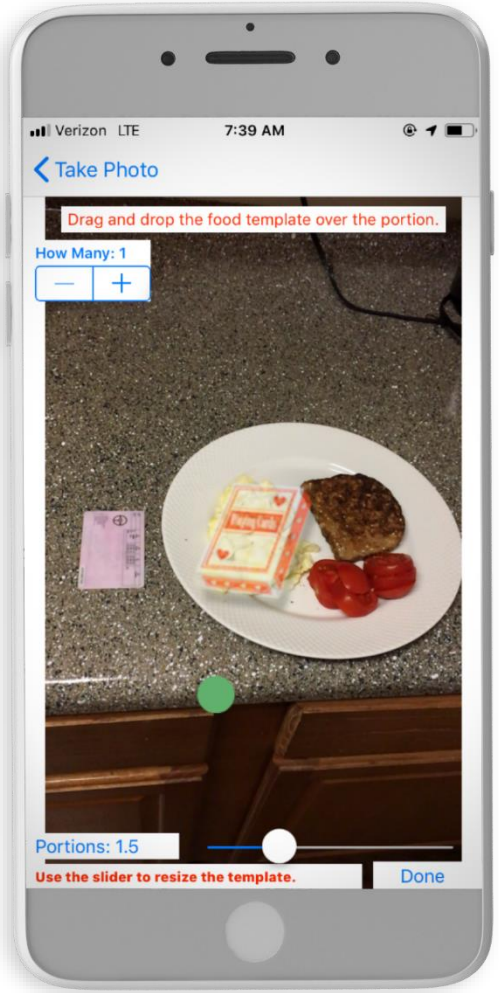


PortionSize™

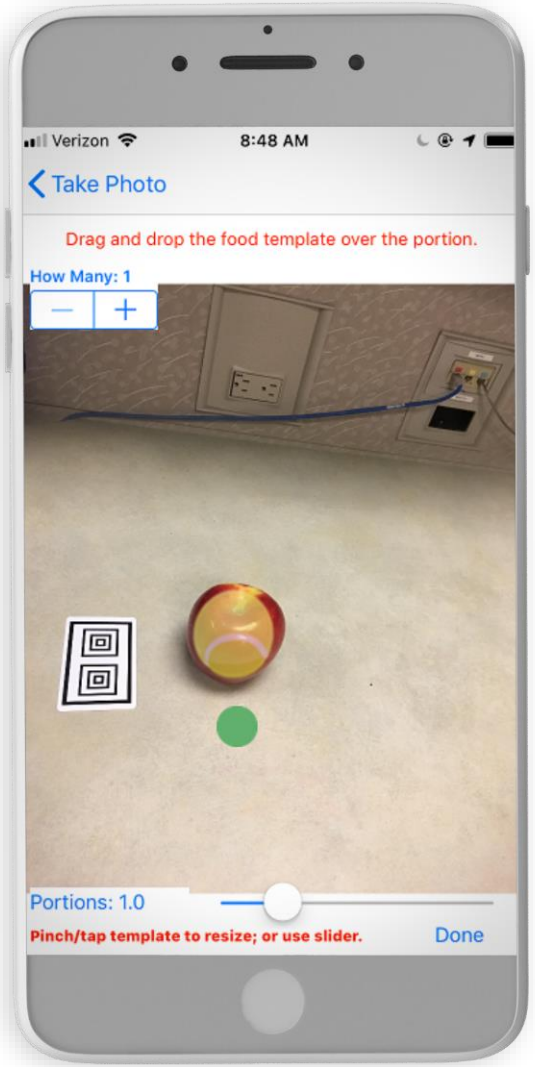
Image standardization and users' deployment of templates to accurately estimate portion size allows us to:

- Immediately and automatically calculate food intake
- Quantify dietary adherence





PortionSize™



PortionSize™

"A picture really is worth a thousand words",

particularly when delivered to you in real time

Food photography serves as a good "ground truth" to actual behavior and intake…

- But nothing replaces change in body weight over time as a measure of energy balance and relative energy intake

Acknowledgements

Grant Support:

R01 DK124558 (PortionSize, C. Martin; J. Apolzan)

R01 DK089051 (RFPM in Adolescents)

R21 AG032231 (RFPM)

R01 CA142919 (T. Nicklas)

U54 GM104940 (LA CaTS)

P30 DK072476 (NORC)

Louisiana LIFT Fund (C. Martin; J. Apolzan)

OSU INFAcT grant (B. Roe)

USDA 2017-67023-26268 (B. Roe; C. Martin; J. Apolzan)

USDA 20216702333820 (B. Roe; C. Martin; J. Apolzan)

PBRC:

Bill Johnson

Catherine Champagne

Daniel Hsia

Eric Ravussin

Intervention Resources

John Apolzan

Ray Allen

Robbie Beyl

Ohio State Univ.:

Brian Roe

Danyi Qi (now at LSU)

Univ. of Kansas:

Tera Fazzino

Baylor College of Medicine:

Theresa Nicklas and Team

Tom Baranowski

Martin Lab.:

Christoph Hoechsmann

Isabelle Schexnayder

James Dorling

Karissa Neubig

Kathryn Scruggs

Mary Catherine Halphen

Meredith Blackburn

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