

JEAN MAYER
USDA
HUMAN
NUTRITION
RESEARCH
CENTER ON
AGING

HNRC



Current Technologies in Diet Assessment & Intervention in Older Adults

Sai Krupa Das, PhD, Tufts University

Overview

- **Aging and diet assessment in older adults**
- **Current diet assessment technology that may be feasible and applicable in older adults**
 - **A sample**
- **Diet intervention using technology**
- **Key takeaways**

No Disclosures (NIH R21 grant – Co-I 2013-15)

Diet Assessment in Older Adults

- The population worldwide is **aging. By 2030**
 - **55 countries** are expecting to see **20%** of their total population **65+**

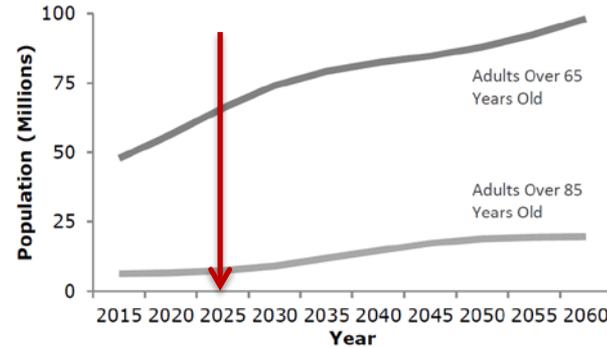
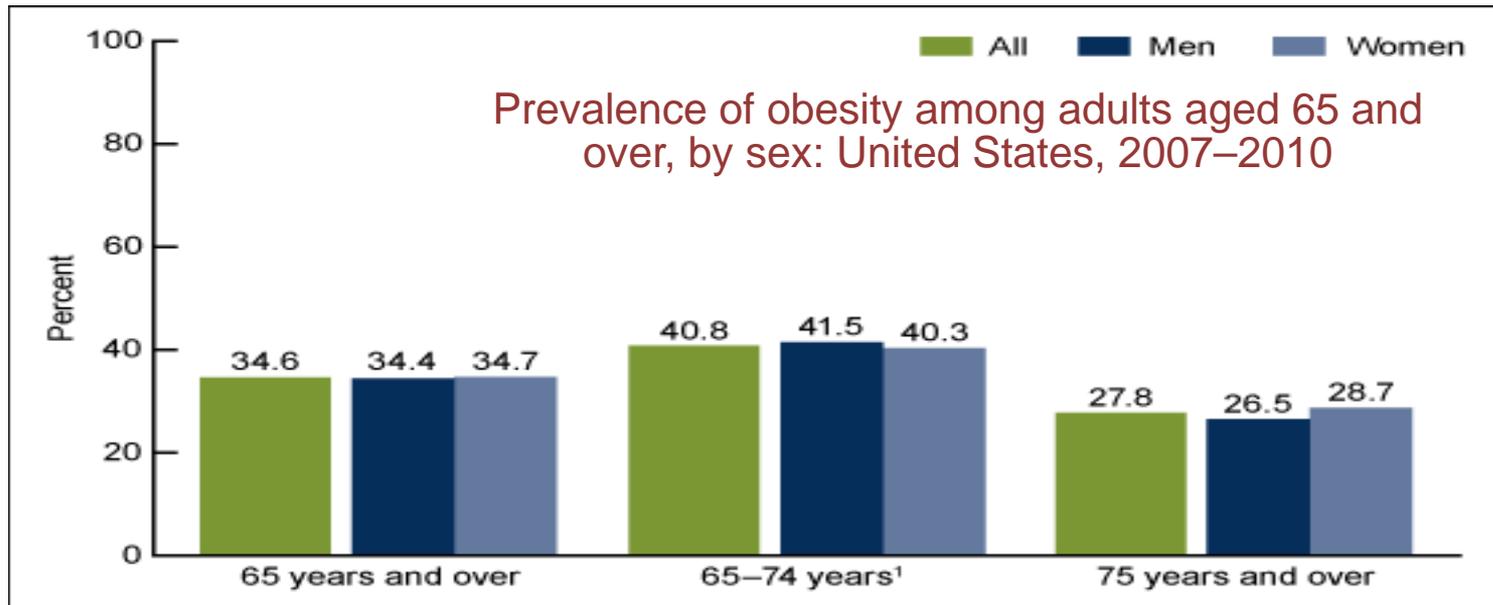


Figure 1. Projections of the number of U.S. older adults.³

- **Nutrition** is an important lifestyle factor that **contributes to health and functioning (Double Burden – Obesity and Malnutrition)**
- There is a great **heterogeneity** of both **health and diet** in older adults
- A **tailored approach** to accommodate these differences would be a requirement of diet assessment technology

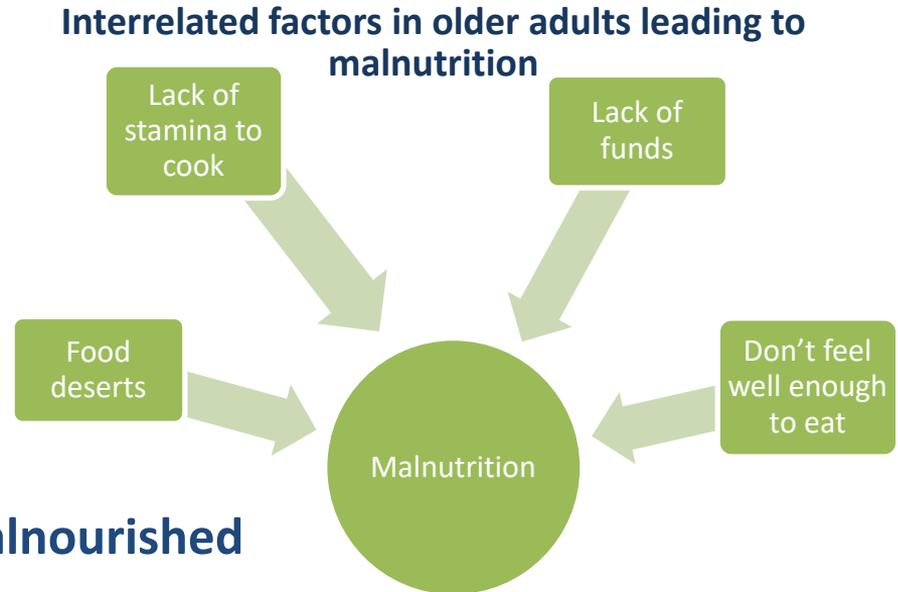
Obesity in older adults

- **Obesity is a worsening problem among older adults**
 - More than 33% of 65 + are obese 2007-2010



Malnutrition: hiding in plain sight

- However, **senior malnutrition** may not be getting the attention it deserves
- Malnutrition affects both overweight and underweight individuals
- Generally occurs over time
- **50 percent of older Americans are malnourished**
- Cannot always suspect malnutrition from just looking at someone
 - That is why malnutrition *hides in plain sight*

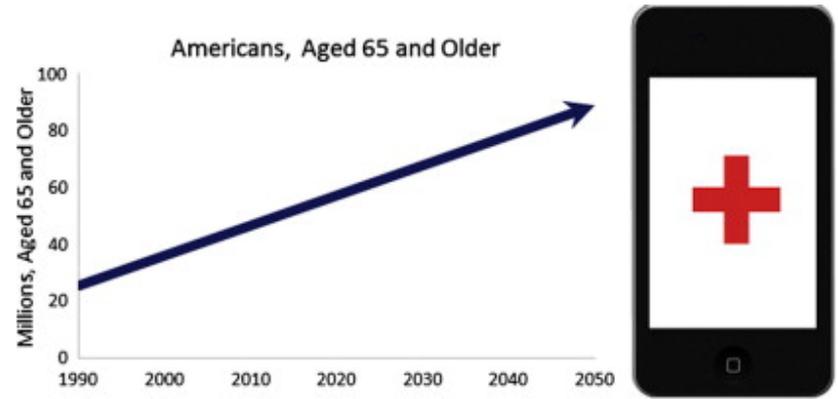


Diet Assessment in Older Adults

- Challenges to collecting accurate dietary intake in older adults:
 - Changes related to aging – diminishing smell and taste, diminished functionality and cognitive decline –all alter eating
 - Memory
 - May not prepare their own food - Eating out
 - Health conditions
 - Dietary supplement use
 - Change in living conditions: residents in care facilities or nursing homes, independent, with family
- The challenge with effective dietary assessment in older adults is in distinguishing between those who can accurately report their own intake and those who require observational data.

How can technology help?

- Health technologies are proliferating
 - 14% of apps released this past year were focused on nutrition
- Nutrition applications & calorie counters help track consumption
 - can be used just as effectively by healthy and active older adults (font enhancements, haptic aids etc. do help)
- For the others, less intensive input tools and observational data may be necessary
 - Voice recording
 - Pictures from wearables



“Despite the stereotypes, seniors are increasingly among the tech-savvy”

Dr. David Lindeman, Director of the Center for Technology and Aging at the Public Health Institute USA)

Our Approach- Food Talk !

Record a nutrition log!



I had **a bowl** of **oatmeal** and **a glass** of **milk**

Quantity Food Quantity Food

Food	Quantity	USDA Hits
 <p>Oatmeal</p>	Quantity: <input type="text" value="1"/> <input type="button" value="cup"/>	Cereals, oats, regular and quick, not fortified, dry, Calories: 307 <small>Source: USDA</small> <ul style="list-style-type: none"> • See more options
 <p>Milk</p>	Quantity: <input type="text" value="1"/> <input type="button" value="cup"/>	Milk, whole, 3.25% milkfat, with added vitamin D, Calories: 149 <small>Source: USDA</small> <ul style="list-style-type: none"> • See more options

Approach: Semantic Tagging



I drink

a glass

Quantity

of

Tropicana

Brand

orange

Description

juice

Food

Tropicana

orange

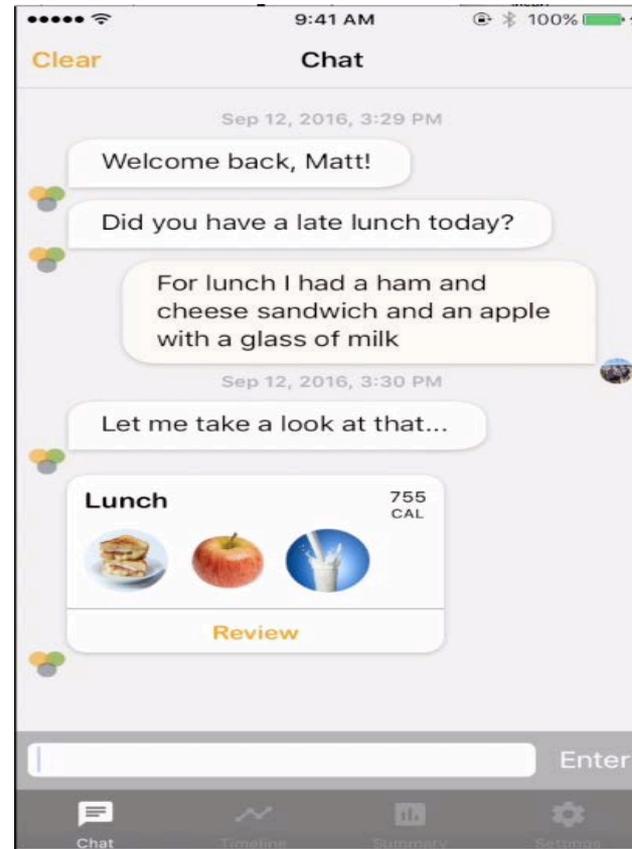
juice



09206	Orange juice, raw
09207	Orange juice, canned, unsweetened
42270	Beverages, Orange juice drink
09209	Orange juice, chilled, includes from concentrate

Ongoing and Future Research

- Personalized nutrition advice to provide intervention support



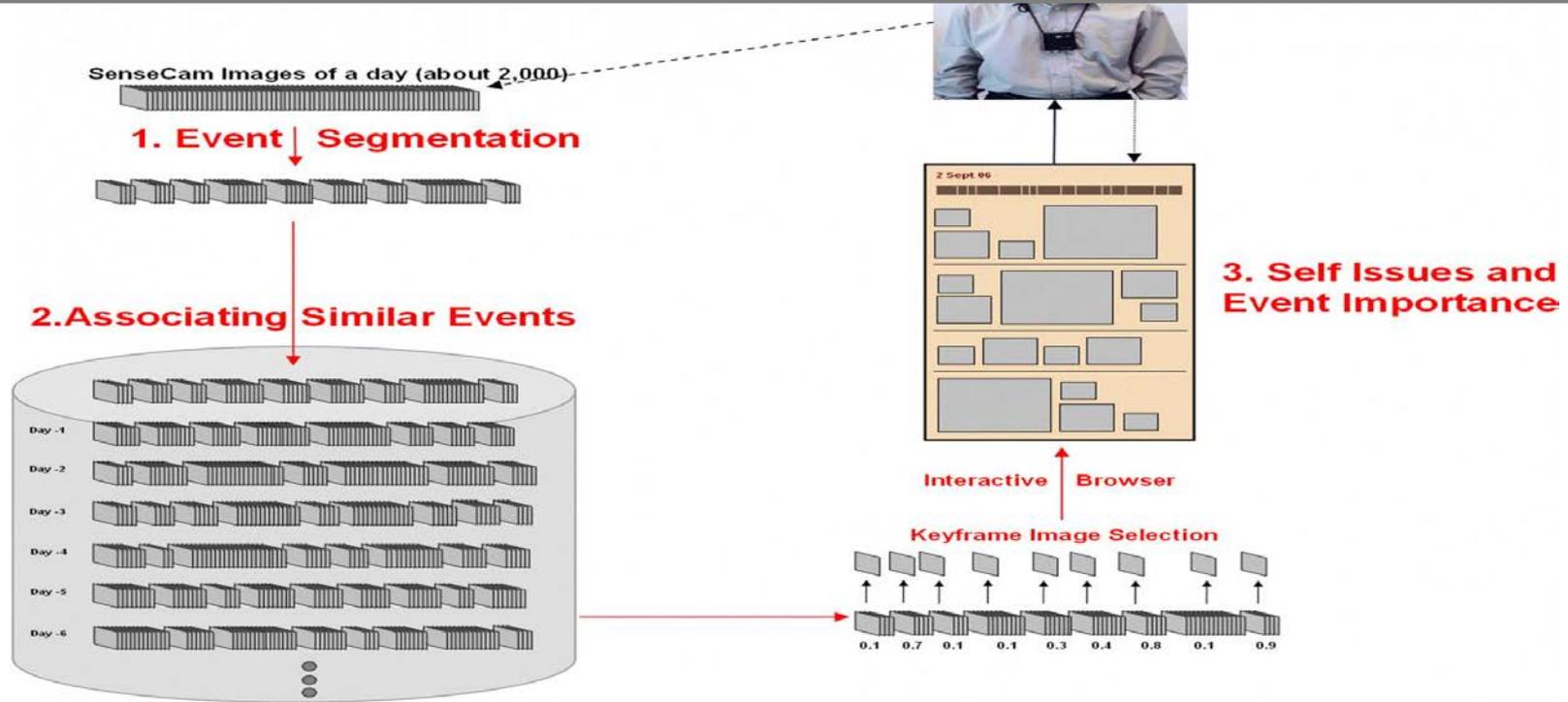
SenseCam

- SenseCam is a wearable camera that takes photos automatically
- Device is now available to buy as the Vicon Revue
- Older adults don't mind wearing the SenseCam
 - Collected data on over 100 older adults (Dr. Kerr)



(2.55 x 2.75 x 0.66-inch), 94g (3.31oz) device

SenseCam



Model of automatically structuring SenseCam images.

SenseCam

- Images from the SenseCam can detect:

- dietary intake patterns
- portion size
- forgotten foods
- leftovers
- brand names



- Revealed significant

under-reporting of calorie intake, which is a

prevalent and critical error of food diaries and self-reporting

SenseCam

- Wearable camera technology can benefit many populations, particularly older adults
 - Ability to distinguish between different types of eating
 - Can see multiple behaviors at once e.g. TV and eating.
 - Can use the data to validate whether GIS data are accurate on food outlets
 - Can validate if wrist worn devices can pick up eating behaviors



Nutrient Specific Intervention

Using mobile technology to support lower-salt food choices for people with cardiovascular disease: protocol for the SaltSwitch randomized controlled trial

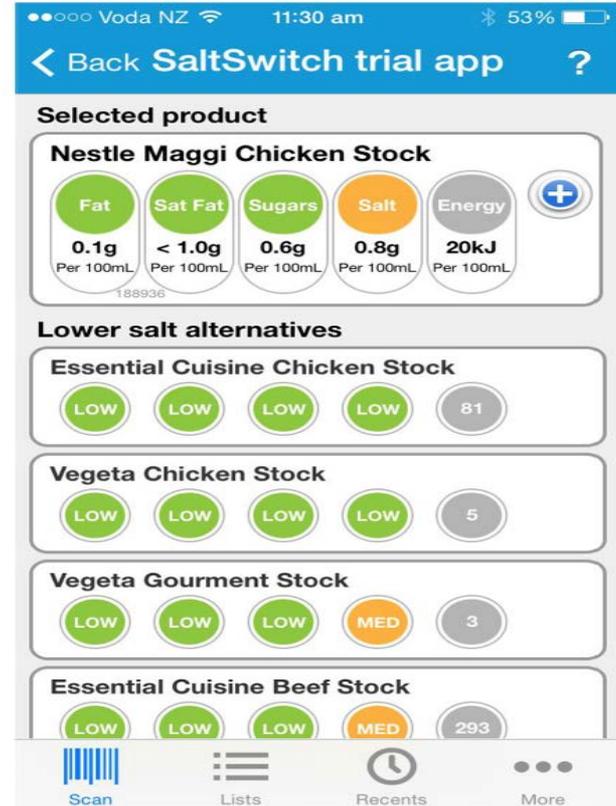
Helen Eyles, Rebecca McLean, Bruce Neal, Robert N Doughty, Yannan Jiang, and Cliona Ni Mhurchu
Bio-Med Central –Public Health, 2014

Auckland- New Zealand

Mobile technology has been scientifically proven to support behavior modifications, but there is a demand for evidence-based smartphone interventions

SaltSwitch

- Smartphone app, created from FoodSwitch
 - Currently available in Australia and the UK
 - Uses algorithm to score food based on nutritional profile with additional criterion related to low-salt alternatives
 - Contains nutritional information for ~13,000 barcodes of packaged foods and beverages
 - Crowdsources data for food and beverages not in database
- Provides immediate feedback to consumers
 - Scans the barcode of packaged foods using smartphone camera
 - Rates nutrient profile and provides interpretation
 - Provides healthier lower-salt options to “switch” to



SaltSwitch: Intervention

- 6 week, two arm, parallel, randomized controlled trial
 - 2 week baseline, 4 week intervention
 - Intervention group: 150 participants receive SaltSwitch app for 4 weeks
 - Collection of receipts for all food and beverage purchases
 - Weekly survey regarding use of Saltswitch app
 - Control: 150 participants continue normal shopping habits for 4 weeks
 - Collection of receipts for all food and beverage purchases
- Outcomes
 - Salt content of household purchases at the end of the intervention (weeks 5 and 6)
 - Saturated fat and energy content of food purchases and food expenses at the end of intervention (weeks 5 and 6)
 - Use and acceptability of the SaltSwitch app
 - Systolic blood pressure, ambulatory blood pressure (subset of ~40), and urinary sodium of CVD participant taken at baseline (week 0) and end of study (week 6)
 - Subgroup of ~20 with CVD will repeat follow up measures for outcomes except ambulatory blood pressure (weeks 11 and 12)

SaltSwitch: Results

- The results of the SaltSwitch trial have the potential to:
 - Fulfill the need for strong evidence-based mobile health dietary interventions
 - Determine the effectiveness, use, and acceptability of a smartphone application to create positive behavior changes
 - Aid consumers in making lower-salt food and beverage choices as a secondary prevention of CVD

Preventing Senior Malnutrition with the NANA System

- **NANA**: Novel Assessment of Nutrition and Ageing.
 - Designed to look holistically at nutrition and health by taking measures of **diet, mood, cognition and physical function**.
 - It does all this using touchscreens and webcams.
 - Simple for older adults

“Users select food items from a visual interface on the computer, recording everything they eat, including snacks. They then take before and after pictures of their meals using a webcam. The information is then sent off to a nutritionist who can ascertain a person’s dietary intake.”

Novel Assessment of Nutrition and Ageing





- The researchers hope NANA will make it easier:
 - For caregivers to monitor seniors' food intake
 - To drastically reduce the incidence of malnutrition

“Being able to eat and drink properly is vital for keeping well and living a good life.

We have worked with older adults to make NANA something that people would want to have in their homes and use every day”

Dr. Arlene Astell, Senior Lecturer in the School of Psychology and Neuroscience at the University of St. Andrews

Key Takeaways – Gerontechnology

- Diet assessment technology should be sensitive or adapted to great heterogeneity of both health and diet in older adults
- Minimal burden inputs-automated images from wearable cameras, spoken language derived data are attractive design options
- Technology assisted diet monitoring and intervention is feasible in older adults, more research is needed
- Robotics, machine learning and artificial intelligence should be explored for making sense of the data and for wider reach and monitoring



Thanks!

ILSI North America

Dr. Simin Meydani (HNRCA-Tufts)

Dr. Susan Roberts (HNRCA-Tufts)

Dr. Cheryl Gilhooly (HNRCA-Tufts)

Dr. James Glass (MIT)

Dr. Mandy Korpusik (MIT)

Dr. Jacqueline Kerr & Dr. Todd Manini (Tech-Summit)

Drs. David Klurfield and Tamara Harris (Tech-Summit)

Jean Mayer USDA – Human Nutrition Center on Aging at Tufts University