What's trending in Image-Assisted Dietary Assessment (IADA) Technology?

Mary Cluskey, PhD, RD
Erica Howes, MS
Carol Boushey, PhD, RD
Dietary Assessments

- Standard tool for the evaluation of individual intake in the practice of nutrition and dietetics

- Nutrition research dependent upon dietary intake data for clinical trials

- Basis from which we form our understanding of population based intake studies (NHANES) and ultimately policy
Traditional methods and steps of DA

• Intake recording/measurement procedures
  ◦ Dietary record—the gold standard in traditional
  ◦ 24 hr. recall aka diet history
  ◦ FFQ or other survey
• Specifically recall/record foods for amount and type, including ingredient variations
• Transcribe those into a dietary data base, either by RDNs, trained analyst or subjects themselves
Limitations of DA

• All traditional DA methods have been shown to reveal inaccuracies in intake.

• Subjects ability to remember and/or report intentional bias into recall contributes to misreporting and error

• Expensive and incredibly time consuming and challenging to transfer information into databases.

• Other subject related limitations include the inconvenience, forgetting, lack of familiarity with foods and inherent ingredients, and with portions, and delays between consumption and the act of recalling/recording intakes
Developments in capturing images

- PDA, mobile phone apps, interactive software, camera and tape recorder, scan and sensor based technologies allowing for real time recording of food intake

- Other forms of /additions to imaging capturing,
  - Intake can be voice to text recording, photographing food label or bar codes
  - Reference item for color/size adjustment inserted into photo
  - Subject to separate items on plate for taking images
  - Text reminders to alert to send images
  - Confirmation back to subject of correct entry
  - Subject voice records food item detail
Active methods of image capture

- Challenges associated with capturing images
  - Require before and after photo
  - Poor color or light, unclear photo
  - Need to stand and take food images at a 45° angle
  - Difficult to get all foods into a photo
  - Fail to capture quick meals

- Challenges with interpreting the photos
  - Inability to discern hidden foods or ingredients
  - Amorphous shapes and foods with similar appearance are difficult to interpret serving size
  - Foods can look alike in images
  - Screens used for viewing images impact quality
Passive methods of image capture

- Wearable camera
- Takes image every 20 seconds (2,000/day)
- Compensates for forgetfulness
- Records non-food information
- Privacy and awkwardness concerns
- Newer: Worn on ear and turns on with chewing

Laboratory for Computational Neuroscience, Bioengineering, University of Pittsburgh, Pittsburgh, PA)
Research on image capture: Pilot testing

- Pilot studies have explored technology challenges and user friendliness of image capture

- Improved ease for subjects in recording intakes
  - Images easier transfer of data to databases
  - Intake collection error may be less than that resulting from asking subjects to recall and report

- Limited work to determine the level of improved accuracy of subjects’ actual intakes

- Early evidence that under-reporting with children is improved
TADA: Technology assisted dietary assessment

1. User captures image of eating occasion
2. Image + Metadata sent to server
3. Automated image analysis identifies foods & beverages
4. User confirmation or correction
5. Volume estimation
6. - FNDDS indexing
   - Nutrient analysis
7. Images & data stored for research or clinical use
OSU Research: Can dietitians (dietetics students) interpret food images

- Study conducted to explore skills needed, and identification and quantification ability of nutrition and dietetics students
- N~110, juniors/seniors/interns at 4 universities (US and Australia)
- Identification foods in images with a mean accuracy of 79.4% (66-97% range)
- With the exception of one food, the caloric difference by error represented +/- 4 kcal difference
- Quantification of foods represented a mean accuracy of 35.3% with a wider range and greater kcal differences
Associations between skills and image interpretation ability?

- Training and experiences that facilitate ability:
  - Hands-on food training improves serving size estimation
  - Calculations and food unit conversions
  - Measuring and preparing food and using recipes
  - Use of recipe/menu software programs and USDA FNDDS

- Limitations in interpretation:
  - Need greater familiarity with foods not typical in cultural group
  - Standardizing portion terminology in FNDDS database
Conclusions

**Image Assisted Dietary Assessment (IADA)**

- Unclear if IADA improves accuracy of nutrient intakes
- Easier for client in keeping food intake information; this may result in greater compliance and less error
- Random coding errors with TADA will be less likely to result in errors from biased misrepresenting of dietary intake
- Subjects prefer technology based methods, especially younger subjects—make is simple and uncomplicated
- Learning to interpret IADA will mean hands-on training with foods and preparation for dietitian/nutritionists
• Try the survey
References