Evaluation of new technology-based tools for dietary intake assessment

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On behalf of the ILSI Europe Expert Group
“Evaluation of new methods for dietary intake assessment”
Development of dietary intake assessment tools 1900-2000

- US Food Balance Sheets 1909-13
- Global systematic comparison of food consumption across countries 1936
- US Individual-level intake surveys: one 24-hr recall + 2d records 1977-78
- Block and Willett FFQs 1985
- 1st Intl. Conf on Dietary Assessment Methods 1994
- UK Dietary and Nutritional Survey (Adults) 7-d weighted food records 1986-7
- Automated Multiple Pass Method 2002
- UK National Diet & Nutrition Survey 4-d food records 2008-9
Development of dietary intake assessment tools 2000-2018

PDA

Web-based ASA 24

On-line FFQ

myfood24

E-button

TADA

Scanner app
Wearable Device Trackers Still Increasing

CCS Insight: Wearables Market to Be Worth $25 Billion by 2019

Statista 2018
We are crossing the technology divide, but we aren’t there yet...

- AMPM 24-hr recall
- Validated FFQs
- Weighed food records

- Digital images
- Passive data collection
- Sensor technology

Higher burden, higher cost, higher quality

Lower burden, lower cost, increased access, but quality?
Aim

• Characterize and evaluate technology-based dietary assessment tools in order to develop general quality standards for future applications
Approach: Comprehensive lit review

4695 Articles Identified

• Articles identified from PubMed, PLOS, BioMed, Science Direct, OVID

800 Articles Screened

• Removed duplicates and irrelevant articles (n=3895)

85 Tools Identified

• Exclusions (n=42)

43 Tools Evaluated

Keyword searches from Jan 2011-Sept 2017; English language articles
We identified three types of tools

15 Smartphone apps

2 Wearables

26 PC or web-based tools
Tools rated on 25 features & functions

Data Entry
- Input (text, voice, photo, bar-code) and by whom (user, interviewer or coder)
- Health characteristics, physical activity

Identification and Quantification of Foods
- Automated or manual
- Characteristics of the food composition database; geographical reach
- Portion estimation (weights, household measures, estimation from photo)

Customization
- Ability to add missing foods, custom recipes, dietary supplements
- Learning system to adapt food list

Output
- Energy, macronutrients, food groups
- Time and name of meal occasion
- Automated report generation

Other attributes: Time to complete, user feedback, validation
Tool Features: Data Entry

- 79% of tools relied on self-report, self-entry
- 91% used text entry & 33% used digital images to help identify foods
- Integrated tools for diet and health still lacking
Data entry innovation

- Digital images may ease respondent burden for reporting, but most still use text
- May improve recall, reduce missing items
  …if people remember to take the images!
Tool Features: Food description

• Nearly all (91%) relied on manual identification of foods
• Only 65% had integrated databases for estimating energy or nutrients
Food description innovation

- Food image identification technologies are improving, as are quantity estimations
- Improvement needed in integrating comprehensive food comp databases

Images of Snap-n-eat, Princeton Univ.
e-Button, Univ. of Pittsburgh
Tool Features: Output

- Most reported energy (65%) and macronutrients (70%), but fewer reported micronutrients (53%) and food groups (67%)
- Only 53% generated automatic reports
Output innovations

- Web-based tools more likely to incorporate full complement of nutrients (exceptions MMM, mFR)

- Tools for research may need to capture time and name of meal, and generate user-friendly reports

My Meal Mate, Univ. of Leeds
ASA 24, National Cancer Institute
Tool Features: Customization

- Less than half reported any features of customization, like missing foods, recipes or use of dietary supplements.

![Bar chart showing customization features]

- Ability to add missing foods
- Ability to add custom recipes
- Records dietary supplements
- Learning system adapts list
Customization innovations

• Flexibility to add foods and recipes increases accuracy
• Ability to add dietary supplements improves nutrient intake estimations
• Learning systems help reduce respondent burden
Tool Features: Usability / Validity

• Most tools reported on usability (77%) or compared their tool with another assessment method (72%)
• Time to complete reported for 40% of tools
Usability / Validity innovations

• Improvement needed in validation methods and reporting: only 6 studies compared intakes to DLW or biomarkers
• Timing influences compliance; time to complete varies widely depending on purpose of tool
Summary

• Dietary assessment methods that utilize technology provide rapid feedback to users and offer potential cost-savings for researchers

• There remain gaps in many of these tools before they will be ready to replace more traditional interview-based methods for research purposes
Innovation needed

• Digital image technologies are promising, but many lack a link to comprehensive food composition databases

• Most tools still require validity testing

• Publications often lack comprehensive reporting of features and characteristics of the tools, especially related to completeness and source of food composition data and details on how the foods are identified and quantified

• Some popular apps have no publications at all
ILSI Dietary Intake and Exposure Task Force
EG: Evaluation of new methods for dietary intake assessment

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Thank you