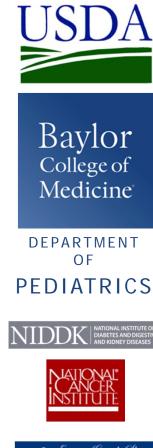
Small devices – Big potentials Halborg University, Copenhagen, Denmark Friday, August 28, 2015 - 9:30 am









Automated dietary intake assessment Overview of technology-based methods

Tom Baranowski, PhD Professor of Pediatrics, Baylor College of Medicine Editor-in-Chief, Games for Health Journal Editor-in-Chief, Childhood Obesity

Most common methods of dietary assessment

- Food frequency questionnaire (FFQ)
- Food record (FR)
- 24 hour dietary recall (24hdr)
- Nutritional biomarkers

(FE Thompson et al. J Acad Nutr Diet 2010; 110:48-51)









Common FFQ Methods

- Time interval of assessment: last year, month, week?
- Data collection instrument: list of foods, food groups
- Variables assessed: frequency of intake, usual portion size
- Conversion data: nutrients per average portion size for each food/group
- Output: average daily frequency of food group intake, average daily nutrient

$$\sum_{j=1}^{x} \sum_{i=1}^{y} freq \ xi \cdot portion \ xi \cdot nutrient \ ij$$









FFQ Strengths

- Simple, easy, covers long time interval (usual/habitual intake)
- Minimal participant burden
- Minimal staff time, professional dietary competence & training
- Correlated 0.3 to 0.8 with other measures of same constructs (is that good or not?)









FFQ Weaknesses

- Limitation of memory over time interval
- Influences of seasonality in off season
- Requires averaging/estimate of central tendency
- Doesn't allow for variability in portion
- Assumes no intentional change in diet (e.g. dieting, illness, price)
- Variability in intake across foods in a category
- Variability in nutrients in foods within a category
- Cannot obtain info on meals









FFQ Technology Changes Over Time

- Use bubble forms/scannable
- Respond directly to computer
- Internet based with touch screen picture responses
- FIVVR images + voice record

Most of the technology innovations do nothing to mitigate the likely sources of error.









Common FR Methods

- Food diary: record all foods & portions consumed on a selected day or over sequential days
 - Weighed FR: weigh foods before & after









FR Strengths

- If done as specified, minimizes errors of memory & attention
- If weighed: no error in portion size estimation









FR Weaknesses (1)

- FR often completed at end of day or end of week
 - Becomes a set of 24hdrs?
- Self selection bias in response to response burden
- Requires high levels of literacy, numeracy & motivation
- Problems of not knowing ingredients in foods
- Consecutive days: correlated errors









FR Weaknesses (2)

- Reactivity: may change behavior when confronted with record
 - Eat simply to avoid recording
 - Social desirability
- Costs of sophisticated staff to process the data









FR Technology Changes Over Time (1)

- Audio recording reports
- Use smartphone to take images before and after meals
- Electronic diary
- Linking a kitchen scale to a computer & identifying foods within categories









FR Technology Changes Over Time (2)

- Food bar code reader and an electronic scale & modem to transmit data by telephone
- Bar code reader with booklet of bar codes for 187 food items, type of meal, and amount eaten
- New apps for recording diet
 - Little validation research









Common 24hdr Methods

- Randomly selected nonconsecutive day: no warning
- Interviewer conducted
- Use dietary interview software: guides
- Previous day or previous 24h









24hdr Strengths

- Random days/no prior notice minimizes reactivity
- Interviewer minimizes literacy concerns
- Nonconsecutive days minimizes correlated errors









24hdr Weaknesses (1)

- Errors due to inattentiveness & memory
 - Intrusions, omissions (usual vs. yesterday)
- Errors increase with time since intake
 - Memory decay
- Portion size errors
 - Numeracy
- Only one day not usual/habitual
 - Need multiple days increased burden & costs









24hdr Weaknesses (2)

- If consecutive days: correlated errors
- Costs of automated systems
- Costs of training in use of system
- Cost of sophisticated staff & their time needed to collect the data (interviewing, coding, processing & quality control)









24hdr Processing Technology (1)

- Used to be all done by hand
- Compared manual processing with using software in processing
 - However, nutrient estimates vary substantially across software employed
- Automated the interview questions (enhance consistency of interview)
 - NDSR
 - USDA AMPM









2hhdr Processing Technology (2)

- Others combined FFQ + 24hdr + multiple pass
- Self administered 24hdr (for children) (FV)
 - ASA24 computer conducted 24hdr using AM-PM
- Use smartphone to take images before and after meals
 - Have dietitians identify foods & portion sizes
 - Add voice recognition to smartphones









Common Nutritional Biomarker Methods

- Obtain biological sample (e.g. blood, urine, biopsy, hair, toenail)
- Analyze in an appropriate lab (e.g. flame spectrophotometer)

Nutritional Biomarker Strengths

Biomarkers reflect dietary intake without errors of self report

New Biomarker Method

Metabolomics









Nutritional Biomarker Weaknesses

- Seldom direct relationship between biomarker and intake
- Biological influences on biomarker value (e.g. smoking, adiposity)
 - Some homeostatically controlled
- Fears for providing (shot)
- Costs for collection
- Costs for analyses
- Specific to a nutrient









Long history of technology in dietary assessment

• Current goal:

- Dietary assessment requiring no volitional effort in dietary assessment
 - One <u>ideal</u>: <u>tooth</u> implanted with sensors that identify foods during consumption
 - <u>Throat sensor</u> recording swallows to assess portion?
 - Second <u>ideal</u>: image systems that capture & record images at brief intervals throughout the day
 - Automatically
 - Identifies before & after images
 - Identifies foods
 - Identifies portion sizes









THANK YOU!

Dank u wel (Dutch) Dêkuji! (Czech)

DANKE! (German) **M GÒI!** (Chinese, Cantonese) **ARIGATO**! (Japanese) MERCI BEAUCOUP! (French) MUCHAS GRACIAS! (SPANISH) SERDECZNIE DZIĘKUJĘ! (Polish) SHUKRAN! (Arabic, Middle East) TACK SÅMYCKET! (Swedish) JAKK! (Marmegian) EFCHARISTO! (GREEK) Xie Xie! (Chinese, Mandarin) Khawp Khun maxh! (Thai) Grazie! (Italian)

teşekkür ederim (Turkish)

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