

VALIDITY OF THE GROUP-ADMINISTERED 24-HOUR DIET RECALL AS USED BY EFNEP

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WHITE PAPER

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Key words:

diet recall, 24-hr diet recall, 24HDR, validation, group administration, group setting

ABSTRACT

During the last ten years, over 2 million participant-recorded group-administered 24-hour dietary recalls [24HDRs] have been collected with EFNEP participants; yet uncertainty about the validity of this method is a concern for some EFNEP professionals. Using a systematic literature review method, our objectives were to identify the following: 1) History of the 24-hour dietary recall [24HDR] in the Expanded Food and Nutrition Education Program [EFNEP]; 2) Findings of a systematic literature review to identify validation studies and strategies using the participant-recorded group-administered 24HDR; 3) Analysis and interpretation of those findings; 4) Recommendations and strategies for meaningful evaluation and best practices to maximize data quality; and 5) Recommendations for future research.

Of the 1376 titles generated, 140 abstracts were reviewed. Two studies met the eligibility criteria, although they had limited application. No studies were identified to establish best practices for the group recall protocol, the educator script nor the participant data collection tool. The method for EFNEP 24HDR as collected in 1969 is compared to that employed in 2015. Four types of 24HDR protocols are identified from the literature. Based on the body of evidence from our current expanded review, we conclude that the scientific underpinnings of the participant-recorded group-administered 24-hour diet recall as used in EFNEP remains an unanswered question. Two categories of recommendations emerged from this review. First is the immediate and critical need for validation studies to support EFNEP's use of the participant-recorded group-administered version of the 24HDR at entry and repeated at exit. The second category is the critical need for a research base supporting best practices for this group recall's protocol, script and data collection form.

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EXECUTIVE SUMMARY

Purpose

This purpose of this report was to:

- 1) Compile the history of the 24-hour dietary recall [24HDR] in the Expanded Food and Nutrition Education Program [EFNEP];
- 2) Review the findings of a systematic literature review to identify validation studies and strategies using the participant-recorded group-administered 24HDR;
- 3) Analyze and interpret those findings;
- 4) Propose recommendations and strategies for meaningful evaluation and identify best practices to maximize data quality;
- 5) Offer recommendations for future research.

Background

The 24-hour dietary recall [24HDR] is used to assess program impacts for the Expanded Food and Nutrition Education Program [EFNEP] which is based at land-grant universities and institutions (U.S. Department of Agriculture EFNEP). EFNEP is conducted in 50 states and 6 territories and the 24HDR has been used since the program's inception in 1969. For many years, EFNEP was taught by one educator to one client, usually in the client's home. The EFNEP educator collected the 24HDR data from one client at a time. The educator asked probing questions and used food models to help the client recall foods and amounts eaten. At that time, the protocol might be labeled as a single pass approach. The educator recorded the client's responses and, later, hand-scored the recall for food groups consumed. In 1980, a U.S. General Accounting Office assessment of the EFNEP program recommended that the program evolve from the 'one educator/one client' model to a group education model that was seen as a more cost efficient delivery method (U.S. General Accounting Office, 1980). Millions of participant-recorded group-administered 24HDRs have been collected from EFNEP and SNAP-Ed participants; yet uncertainty about the validity of this method is a concern for some EFNEP professionals.

Methods

This review focused on peer-reviewed studies of validation reports of the interviewer-recorded and the participant-recorded group-administered 24HDRs from 3 large databases. Because our goal was to summarize the existing research base and best practices for the EFNEP and SNAP-Ed version of the recall, this effort necessitated translation into three administrative practices: 1) the protocol for the multi-pass recall with 5 to 25 participants simultaneously; 2) the educator's script for handling data collection; and 3) the participant's data collection form for documenting all foods, specific food details and portion sizes.

The systematic literature review focused on published peer-reviewed articles, examining the use of the participant-recorded group-administered 24HDR. Multiple Medical Subject Headings [MeSH] terms were employed to search PubMed yielding 1194 citations. In Agricola, "24-hour diet recall" mapped to the term "diet recall." The term "diet recall" was exploded to include all the terms it is used for, including the different amalgamations of

“24-hour diet recall”. Because most of the 1194 citations were nutrient intake studies for populations, the term “valid*” was added to “exp diet recall” to better target papers focusing on administration methods. In FOODnetBase, search terms yielded 80 results including 63 book chapters for a total of 1376 potential citations identified for title review. These titles were screened with most citations [n=1236] being removed based on duplication and title content.

In the end, only two papers were found to be applicable for review regarding the participant-recorded group-administered 24HDR, with only one for the adult program. No studies were identified examining best practices for procedures for the group recall, the educator’s script or participant’s data collection form.

Evaluation of a Group Administered 24-hour Recall Method for Dietary Assessment by Scott et al. (2007) used meal observations for group and individual adult recalls comparing the effectiveness of the two methods. Researchers observed female food service workers eating lunch in nine University campus cafeterias where they were employed. The following day, 23 of the women participated in a participant-recorded group-administered 24HDR. The remaining 19 workers completed a traditional recall with one researcher collecting and writing down the data from one participant at a time. Scott and colleagues conclude that the group recall is as effective as the individual version. However, the researchers failed to generate power calculations to drive the number of participants needed to detect a statistically significant difference, if one existed. The small number of subjects may have made it nearly impossible for statistical tests to detect existing differences between the two methods. However, Scott’s study took an important step toward laying the initial groundwork for a research base for a group 24HDR in an EFNEP environment.

In *Validation of a Group-administered Pictorial Dietary Recall with 9-to 11-year-old Children* by Wallen et al. 2008, 125 low-income 9-11 old children completed the Day in the Life Questionnaire-Colorado (DILQ-CO) dietary assessment in their classrooms. One researcher read the prompt questions and led the class through the completion of a worksheet while an unknown number of researchers and possibly the teacher were available to help students individually. The researcher administering the recall, as part of the protocol, wrote the items served for school lunch on the board removing the need for participants to remember the foods eaten. Instead, they concentrated on the quantity or ‘how much’ eaten. Validity was assessed by comparing reported school lunch items and portion size estimations on DILQ-CO to plate waste. However, major design issues in the administration of the recall in this study nullify its results for use by EFNEP adults or youth.

Conclusions

Based on the body of evidence from our current expanded review, we conclude that the scientific underpinnings of the participant-recorded group-administered 24-hour diet recall as used in EFNEP remains an unanswered question. Two categories of recommendations emerged from this review. First is the immediate and critical need for validation studies to support EFNEP’s use of the participant-recorded group-administered version of the 24HDR at entry and repeated at exit. Second is the critical need for a research base indicating best practices for this group recalls’ protocol, script and data collection form. Seventeen research suggestions to address unanswered questions are offered.

The results of this review have implications for program mandates as they pertain to EFNEP. With EFNEP participants receiving lessons via the group delivery model, there is an immediate and critical need for validation studies to support the EFNEP preference for the participant-recorded group-administered version of the 24HDR collected at program entry and repeated at exit. These studies should consider a research design comparing the group recall to a gold standard recall, the researcher-administered AMPM computer-assisted protocol for 24 hours or observation for one meal with sample sizes driven by power analyses. A firm platform for a research base would consist of 5 to 10 studies using the participant-recorded group-administered 24HDR in situations similar to EFNEP as well as a research base supporting best practices for this group recalls’ protocol, script and data collection form in the peer-reviewed journal literature.

REPORT

BACKGROUND

Introduction

The 24-hour dietary recall [24HDR] is used to assess impacts for a USDA program in 50 states and 6 territories: the Expanded Food and Nutrition Education Program [EFNEP] (U.S. Department of Agriculture EFNEP). During the last ten years, over 2,000,000 participant-recorded group 24HDRs have been collected with EFNEP participants (U.S. Department of Agriculture [USDA], Expanded Food and Nutrition Education Program [EFNEP]). Available under: <https://nifa.usda.gov/program/expanded-food-and-nutrition-education-program-efnep> . Accessed 4.22.16); yet uncertainty about the validity of this method is a concern for some EFNEP professionals. Given the large number of recalls collected annually via this method and the 40 plus years of its use, further inquiry is warranted.

Description of EFNEP

EFNEP is a federal nutrition education program for low-income families, administered by the land-grant university in each state and 6 territories (U.S. Department of Agriculture EFNEP; U.S. Department of Agriculture EFNEP Policies). The paraprofessional educator, also called promotora, visited the participant's home to individually work with the homemaker to improve the family's nutrition (Chipman and Kendall 1989).

History of the individual 24-hour dietary recall [INDIVIDUAL 24HDR]/how/why developed

In 1993, a consensus workshop on dietary assessment, led by the National Center for Health Statistics, concluded that conducting several 24-hour dietary recalls on non-consecutive days is the best method for estimating nutrient intake for individuals (Wright et al. 1993). The report also stated that "...no one method suits all purposes". Since the workshop report, researchers have used individual 24 hour dietary recalls as a "standard" when judging reliability and validity of new methods for measuring self-reported dietary intake (Thompson and Byers 1994; Dodd et al. 2006). However, given that this "standard" is self-report, it is fraught with limitations relevant to that type of data collection. In addition, the individual 24HDR requires a well-trained interviewer to administer. With one-on-one administration, the method relies on memory; consequently, the problems with over- and under-reporting the amounts of food consumed are concerns (Buzzard, 1998). In addition, inclusion of foods not eaten is a concern (Baranowski et al 2012). Each individual 24HDR is limited to one day and does not readily provide information of long-term or seasonal changes in intake (Thompson and Byers 1994). The style and format of the recall form is not relevant for the client, because the form is completed entirely by the trained interviewer.

Description of the individual 24-hour dietary recall [INDIVIDUAL 24HDR] method and how administered

The individual 24HDR is one of the most widely used dietary assessment instruments in clinical and research settings (Wright et al. 1993). This method uses a trained interviewer, often a registered dietitian, who prompts a respondent to recall and describe all foods and beverages the person consumed over the previous 24 hours (Dodds, aka M. Wilson, and Silverstein 1997). With the 3-, 4- and 5-step multi-pass versions of the recall protocol, interviewers are trained to use probing questions to identify "forgotten" foods and beverages (Moshfegh et al.

2008). They are skilled at not leading the respondent to specific answers. Props such as food models and shapes, measuring cups, spoons, cups, glasses, and other serving size tools used to help the respondent determine portion sizes.

Strengths and weaknesses of INDIVIDUAL 24HDR with general audiences

The individual 24HDR is relatively versatile and moderately inexpensive for the trained interviewer, making it one of the few useful tools for determining food intake (Dodds, aka M.Wilson, and Silverstein 1997). This method requires effort on the part of the respondent in a one-on-one interview with an experienced, well-trained, nonjudgmental interviewer is essential for administration. The 24-hour recall has been the most popular method employed in large-scale studies but its validity has been limited to group interpretations (Dodds, aka M.Wilson, and Silverstein 1997). For a list of recent validation studies supporting individual 24HDR, see [Table 6](#).

Strengths and weaknesses of INDIVIDUAL 24HDR with limited resource audiences such as EFNEP

The individual 24HDR as a dietary instrument is relatively inexpensive to administer in a hospital or clinical setting taking 20 minutes or more for a trained interviewer (Townsend et al 2003). However, in a community setting with one EFNEP client, cost becomes more of an issue. Data entry requires a knowledgeable person familiar with the Web-Based Nutrition Education Evaluation and Reporting System, known as WebNEERS, to enter foods with precision and accuracy and is costly in terms of staff time for this data entry process. WebNEERS is a secure system designed, hosted, and maintained by Clemson University. It was launched in October 2012 as an update to the legacy system, the Nutrition Education Evaluation and Reporting System [NEERS] (Retrieved from <https://nifa.usda.gov/tool/webneers>). When reviewing the validation studies using the 24HDR with audiences similar in demographics to EFNEP participants, the majority of the studies have either conducted 24-hour recalls one-on-one by telephone or one-on-one in person with a trained interviewer, usually a dietitian. There are few studies that use the 24HDR in community settings, such as EFNEP. Blackburn et al (2006) compared total serum carotenoids with the fruit and vegetable intakes and other nutrient intakes captured through the University of California Food Behavior Checklist and three 24HDRs administered by a trained educator with one participant at a time. They concluded that compared to the 24HDRs, the Food Behavior Checklist was a more valid and reliable indicator of diet quality as well as less time consuming to administer and analyze than the 24HDR (Townsend et al. 2003). For this validation study, the lessons [i.e. intervention] and the UC food behavior checklist were collected with groups of EFNEP participants. The dietary recall [INDIVIDUAL 24HDR] was collected from the individual participant by a trained educator (Murphy et al. 2001; Townsend et al. 2003).

Cultural foods. Another potential advantage of using the 24HDR with the EFNEP audience was the ability to include foods eaten by minority cultures such as Hmong, Cambodian, Vietnamese, Peruvian and Salvadoran, all which are EFNEP participants in California. With the previous NEERS food database, it could be expanded to accommodate cultural foods and the corresponding nutrient content. However, the WebNEERS food database does not currently have the capability for EFNEP professionals to add recipes or expand the underlying FNDDS [Food and Nutrient Database for Dietary Studies] database. The current version of FNDDS, v5.0, contains 7400 food and beverage items [see [Table 1](#)] (U.S. Department of Agriculture EFNEP). The FNDDS database with existing foods and the inability to add and use recipes is appropriate for Middle America with typical American diets, i.e. NHANES .); but is not appropriate for cultures that are not mainstream (per M. Townsend conversation with Alanna Moshfegh, Research Leader of the USDA Food Surveys Research Group, USDA Beltsville Diet Assessment

Lab, MD, February 2014). Director Moshfegh stated that her lab is limited by funding to add more than a few foods each year to the database.

Table 1.

24-hour dietary recall before and after WebNEERS: analysis method, data entry, diet quality, & food detail

	NEERS or WebNEERS	
	Before [Estimate 1970-2010]	After [Estimate 2010-current]
Analysis method	Focus on food groups via hand score method	Focus on nutrients using a computerized nutrient analysis method
Data entry	None	WebNEERS* using USDA's FNDDS foods database
Diet quality determination	Food groups only	WebNEERS 2015 incorporates the Healthy Eating Index [HEI], version 2005, with calculations using added sugars, saturated fat, alcohol, etc.[The HEI-2005 and -2010 do not include total fat]
Food detail requirement	Hand score method does <u>not</u> require qualitative food details such as type of milk, type of spread on toast, milk/cream/sugar added to coffee, etc.	WebNEERS and HEI require substantial quantitative and qualitative details about each food item plus additions to each.
Protocol	A simplified protocol with no attention paid to type and additions to food items. Protocol was based on a 1-step 1-pass recall.	Nutrient analysis requires substantial details in the data collection. Current protocol** is the 5-step Multi-Pass Dietary Recall (Conway et al, 2003; Conway et al 2004; Moshfegh et al, 2008)

*WebNEERS is the Nutrition Education Evaluation and Reporting System, web-based version.

**Protocol includes recall support materials e.g. portion size charts, measuring kit items, MINI [food description guide], & projector.

EFNEP adopts the individual 24-hour dietary recall [INDIVIDUAL 24HDR] method in 1969

At the time EFNEP was established in 1969, the recall was selected as the assessment method of choice (Blackburn et al 2006). The educator would visit the participant's home and work with the homemaker individually to improve the family's nutrition, quality of life, and health. To assess program effectiveness, the educator collected a 24HDR at program entry for needs assessment and again at exit for evaluation (U.S. Department of Agriculture EFNEP Policies; Chipman and Kendall 1989).

The 24HDR was used to document participant improvements in diet quality, the definition of which was based on existing dietary guidance (U.S. Department of Agriculture EFNEP; U.S. Department of Agriculture EFNEP Policies; Chipman and Kendall 1989). It was administered by the EFNEP paraprofessional educator to one client, usually in her home. The EFNEP educator used probes and models and the client could share the food items from her kitchen. This was an enormous advantage in favor of recall accuracy. If not sure of a food name, the homemaker/participant could retrieve the item from her cupboard or refrigerator to share with the educator.

USDA Policy change in 1980 impacts the EFNEP 24HDR

A 1980 U.S. General Accounting Office assessment of the EFNEP program recommended a change in delivery method to a group protocol in a community setting (U.S. Department of Agriculture EFNEP Policies; Chipman and Kendall 1989; U.S. General Accounting Office 1980). In the years following the policy recommendation, group delivery was gradually implemented in states as the National EFNEP office encouraged a more cost efficient delivery method. Meanwhile, as the program grew, issues regarding educator safety and travelling to and visiting individual participant homes became apparent which further encouraged group delivery in a community setting. The risk became too great associated with a female educator travelling alone while visiting a participant's home. Today, 90% of participants nationwide are receiving lessons in group settings (U.S. Department of Agriculture EFNEP, 2015. Retrieved from <https://nifa.usda.gov/sites/default/files/resource/2015%20National%20Data%20Reports%20%28detailed%29%20v2.pdf>). In reality, these changes meant conducting the lessons in a community setting rather than 1:1 in participants' homes. While the change in program delivery was dramatic, little thought was given to the implications of this change for evaluation. We could identify no discussion of such in policy documents or the peer-reviewed literature. The result was that the existing recall data collection form continued to be used unchanged, despite the dramatic change in how the recall was collected (U.S. Department of Agriculture EFNEP; U.S. Department of Agriculture WebNEERS, 2016).

EFNEP adopts the group-administered 24-hour dietary recall [GROUP 24HDR] method in the 1980's

In the ensuing 40 years, the EFNEP delivery model evolved into a group of 5 to 25 [or more] adults, mostly women, meeting at centrally located community sites. The ratio of educator to client shifted from 1:1 in 1969 to 1:5 or 1:25 [or more] today, making collection of accurate dietary evaluation data more difficult for the educator and participants. For group administration, the recall takes about 40 to 50 minutes to administer depending on the size of the group (Townsend et al 2003). The larger the group, the more time required to identify details of the individual foods in each person's food list (Sheik 2010). More descriptive terminology for this recall would be **participant-recorded group-administered** 24-hour diet recall. Going forward that more descriptive terminology will be used in reference to GROUP 24HDR.

Today, to analyze the effectiveness of the program, each participant completes her own 24HDR data collection form in class upon entering and leaving the program. Specifically, this means that the entry recall is collected during Lesson 1 or 2 and then at exit during Lesson 7 or 8. The data collection form needs to be appropriate for an adult reading at no more than the 4th grade level (Townsend et al 2014).

Description of the EFNEP group recall [GROUP 24HDR] method and how administered

While the research supports the individual 24-hour diet recall [INDIVIDUAL 24HDR] administered by a dietitian/trained expert as a "gold standard" in nutritional assessment, the NC1169 "EFNEP-related Research, Program Evaluation and Outreach", multi-state USDA research-extension project sought to examine research which supported the validity of the participant-recorded group-administered 24-hour diet recall [GROUP 24HDR] conducted by an EFNEP paraprofessional with low-income adults. Many questions needed to be answered such as how individual recall procedures translate to performing the recall in a group setting and how adequately the 24HDR data collection form can be completed by untrained, often low-literate participants. Details are provided

in [Table 2](#) and discussed further in this report. For group administration, the recall takes about 45 to 60 minutes to administer depending on the group size (Wallen et al 2011; Subar et al 2012; Townsend et al 2013).

Table 2.

Comparison of participant, environmental and analytical characteristics of the EFNEP 24-hour diet recall in 1969 and 2013.

	Factors: protocol, script, data collection form. *	1969 Data collection	2015 Data collection
Environmental	Setting	Participant's home often at the kitchen table	Community classroom usually at an agency site
	Participants [n]	1	5 to 30
Participant	Reading requirement	Interviewer reads, client listens & responds	Client reads
	Writing requirement	Interviewer writes	Client writes
	Literacy level	Not important	Critical
Analytical	Data collection form	1-page, black and white photo copied form completed by the educator	Same form in most states but completed by the participant.
	Data analysis	Tally each of 4 food groups using the hand scoring method.	Nutrient analysis and food groups analyzed by software on WebNEERS.
	Food details gathered during step 4 of the 5-step Multi-Pass protocol	Not required	Essential

Strengths and weaknesses of GROUP 24HDR when used with limited resource audiences such as EFNEP

In a group setting with one educator/interviewer and 5 to 30 interviewees, the situation for data collection of the 24HDR is dramatically different than one-on-one interviews. The responsibility of the interviewee becomes major to the process. In a group setting, specific probing by an interviewer is not feasible for each individual in the group, therefore, underreporting is likely common. Underreporting is more common among overweight women (Blackburn et al 2006), so the use of this method may be especially problematic in low-income groups with a high

prevalence of overweight and obesity (McClelland et al 2001). [Table 2](#) provides clarity about the meaning and application of these statements.

Literacy.

To be clear, EFNEP is not a literacy program. However, the literacy level of participants has an impact on the participant cognitive load during lesson content and data collection for evaluation (Townsend et al. 2014). A further impact on the EFNEP program is the decline in participant literacy (Johns & Townsend, 2010). Many EFNEP clients are part of the 40 million Americans lacking basic reading and writing skills (Townsend 2011). In 2003, literacy rates were lowest for adults who did not complete high school and these adults accounted for the largest group with below basic prose and document literacy. With the interviewer-recorded individual 24HDR in the home of the EFNEP client, the client was not required to read and complete a 24HDR data collection form. With the participant-recorded group 24HDR, the client must be able to read and write with considerable accuracy. In addition, participants are expected to read and write in a language many of them marginally know as adults. Consequently, the participant cognitive load for the participant-recorded group 24HDR is substantially elevated compared to the traditional individual 24HDR (Townsend 2011; Townsend et al 2013).

While the 24HDR is relatively simple to complete and inexpensive to administer in the clinical setting, the literacy level of the client being assessed appears to be a critical factor in determining the quality of the recall. Johnson et al (1998) assessed literacy levels in a study of 35 low-income women by means of the Wide Range Achievement Test [WRAT] which evaluates reading [word recognition] and spelling skills. Higher WRAT scores indicate a better ability to read and spell [higher literacy] in comparison with lower scores. Results suggested that percentage body fat and the ability to read and spell as measured by the WRAT were the best predictors of energy intake misreporting on the INDIVIDUAL 24HDR. Participants with fewer literacy skills had greater difficulty remembering foods eaten yesterday during food recall.

Table 3.

Terminology and definitions used in this report.

Terminology	Definition
INDIVIDUAL 24HDR	Individually-administered recall. This is the original and currently the primary version of the diet recall where one dietitian or trained professional collects dietary information from one client or patient and writes the information on a recall form.
GROUP 24HDR	Participant-recorded group-administered recall. This version of the recall was developed by EFNEP and used to collect recall data in group classes with one paraprofessional and 2 to 30 clients.
Group mean	Mean of group data, μ
Individual level analysis vs. group level analysis	<p>These terms are confusing and sometimes misused. The book chapters and some papers reviewed for this report, use the term ‘group’. They use the term ‘group’ accurately despite the fact that 100% of the 24HDRs collected or discussed in these books and papers were collected in an individual setting with one trained interviewer collecting food data from one participant. The term ‘group’ was not referring to the method in which the 24HDR was collected. Instead, the term ‘group’ was used in 100% of the cases to refer to the type of analysis. The authors attribute this confusion over the word ‘group’ to the false assumption by some professionals that the participant recorded group-administered 24HDR is valid.</p> <p>Group level analysis refers to the clumping of 24HDRs from a large population, often with one 24HDR per person. We know that one 24HDR does not provide estimates of ‘usual diet’ for the individual person. Yet collapsing results of single 24HDRs for a large population is considered acceptable for estimating ‘usual diet’ of this population. To estimate usual diet of the individual, multiple recalls are required. Three 24HDRs are often considered acceptable for estimating macronutrients, i.e., protein, carbohydrate and fat, of the individual. Micronutrients such as vitamin A are not necessarily consumed consistently. The variance from day to day is greater. More recalls are required to estimate usual intake of vitamin A. Analysis of these multiple recalls from one person is referred to as ‘individual level’ analysis.</p>
FNDDS	<p>The Food and Nutrient Database for Dietary Studies [FNDDS] is the foods database that supports WebNEERS (https://nifa.usda.gov/tool/webneers). It is used to code and analyze dietary intakes for the What We Eat In America, National Health and Nutrition Examination Survey (WWEIA, NHANES). To create FNDDS 5.0 for WWEIA, NHANES 2009-2010, data for over 7,200 foods were updated to incorporate changes in the marketplace and information reported by survey participants. This update is limited to the addition of 10 foods/year.</p> <p>The USDA National Nutrient Database for Standard Reference, Release 24 is the basis for the 65 nutrient values for each FNDDS food. FNDDS 5.0 is available at http://www.ars.usda.gov/ba/bhnrc/fsrg [ars.usda.gov]. EFNEP uses only a few of the available 65 nutrients for each food entry. When EFNEP shifted from the EFNEP food database used between 1994-2013 to the USDA-maintained FNDDS 2013-2016, two important deficits became obvious. First, foods cannot be added to the database locally or at the state level. As new foods enter the marketplace that are popular with EFNEP participants, the specific foods cannot be added. Second, the focus is on mainstream diets in America; the focus is not on diets of sub-groups in the U.S. Yet, the latter is the focus of EFNEP in many states as these sub-groups are often at the lowest income levels and the target of local EFNEP. However, the benefits of FNDDS outweighs the deficits. At the same time, we must recognize the systematic errors that are incorporated into the WebNEERS reports as a result.</p>

Automated Multiple Pass Method [AMPM]: What is it?

The most current version of the recall, called the 5-step multi-pass recall protocol, includes a trained interviewer using the Automated Multiple Pass Method, known as AMPM, software on a laptop to generate the probing questions on quality and quantity of each food item (Conway et al. 2003; Conway et al. 2004). AMPM is a computer-assisted method for collecting interview-administered 24HDR in person or by telephone. This method employs 5 steps to enhance the recall's accuracy. It represents the gold standard for the dietitian in-person interview recall. This method administered by a trained interviewer using AMPM software on a laptop is used by the National Nutrition Monitoring System for What We Eat in America, the dietary interview component of the National Health and Nutrition Examination Survey [NHANES], and other research studies. The AMPM 5-step multi-pass method has been adapted by some EFNEP professionals for use with EFNEP participants in the group setting and subsequently adopted by many states (Sheik et al. 2010; Townsend et al. 2011; Donohue & Townsend, 2014; Townsend et al. 2013). This adaptation focuses on the 5-step multi-pass method without use of the accompanying software on the laptop.

PURPOSE

NC1169 and 2169

Given significant societal and programmatic changes over many years to EFNEP, NC1169 was created. EFNEP professionals and researches proposed to examine current data collection methods, the research base in support of such methods, and alternate approaches to evaluating EFNEP's program effectiveness.

Literature Review

The purpose of this report was to review the research base for the validity of the participant-recorded group-administered 24HDR in evaluating EFNEP.

This Report

As part of the NC1169 work described above, this report reviews published peer-reviewed literature examining the appropriateness of the use of the 24HDR for EFNEP evaluation after the transition to group program delivery in the 1980s, necessitating the participant-recorded group-administered 24HDR.

The purpose of this report was to compile the history of the 24HDR recall in EFNEP, review the findings of a systematic literature review to identify validation studies, analyze and interpret those findings, propose recommendations and strategies for meaningful evaluation and best practices to maximize data quality, and offer recommendations for future research questions.

LITERATURE SEARCH METHODS

Search team

The research team was composed of four people. The two authors have subject matter expertise pertaining to EFNEP, the 24HDR and the group 24HDR and some systematic search experience [MT, MW]. One undergraduate student [KA] did the library work under the direction of the senior author [MT] and a research librarian with systematic review methods expertise. Decisions on search strategy, appraisal, synthesis, and evaluation schema were made by the senior author [MT] and the UC Davis research librarian.

Overall search strategy

The searches were conducted for validation studies on the 24HDR protocols for individual- and group-administered 24HDR data collection with any income-level audience. While the ultimate goal of this review was to locate studies using the participant-recorded group-administered 24HDR, special attention was given to locate studies involving lower literacy, low-income participants similar to those who qualify for EFNEP. In addition, to improve the quality of the data collected using the participant-recorded group-administered 24HDR, we sought evidence of best practices in conducting a participant-recorded group-administered 24HDR including a protocol, educator scripts, and participant data collection forms.

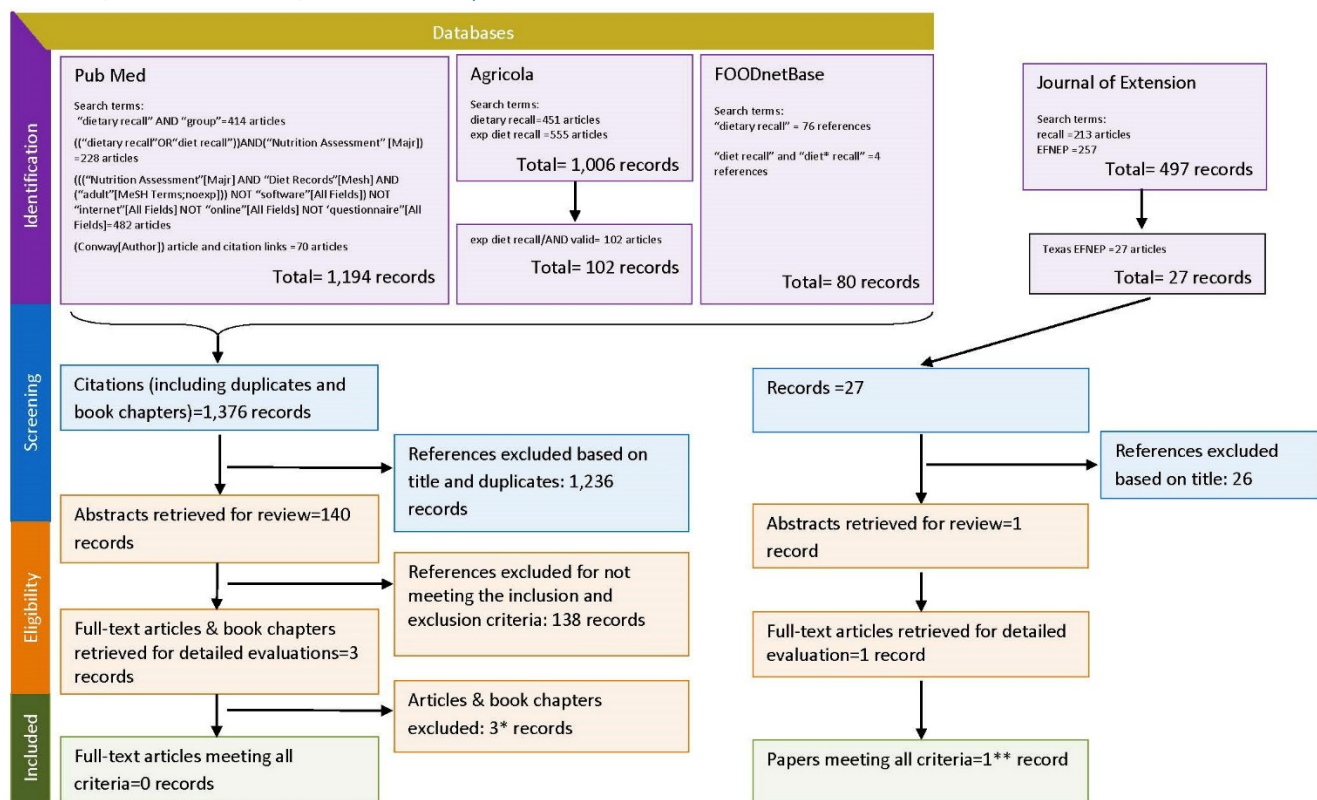
Data Sources

Building on a previously published review by McClelland et al in 2001, searches of databases were conducted from October 1998 through 2013. The databases searched included PubMed, Agricola and FOODnetBase. For each database the proper search term was first defined using Medical Subject Headings [MeSH] terms in PubMed and subject heading mapping in Agricola. MeSH terms are used by the U.S. National Library of Medicine for controlled vocabulary. The controlled vocabulary allows for indexing and cataloging of biomedical literature and is updated annually (PubMed 2005). Subject headings in Agricola are very similar except Agricola is on Ovid. FOODnetBase does not have this feature.

Search Terms

For the systematic literature review, numerous searches were conducted to define search terms within each database mentioned above. The initial search term to be defined was “24-hour diet recall” in all databases. Key words were also mined from research that fit inclusion criteria. After search terms were defined, combinations of search terms were used until no new papers appeared in the search. Only five of the combinations yielded promising results based on review of article titles and then abstracts. Some combinations of search terms also proved to be too restrictive, and did not yield any useful results after review of article titles and abstracts. See [Figure 1](#) for the specific search terms for the searches of three databases plus the Journal of Extension. The potentially useful results and the number of papers/records are shown. It should be noted that book chapters were included in the search methodology because they often reflect a summary of the literature and they could possibly identify an overlooked study.

Figure 1. Flow chart for the search process including databases, search terms, numbers of selected titles, abstracts, full text articles, and book chapters.



* Wallen V, Cunningham-Sabo L, Auld G, Romaniello C. Validation of a group-administered pictorial dietary recall with 9- to 11-year-old children. *J Nutr Educ Behav*. 2011 Jan-Feb;43(1):50-4. doi:10.1016/j.jneb.2009.12.008.
 Farris RP, Frank GC, Webber LS, Berenson GS. A group method for obtaining dietary recalls of children. *J Am Diet Assoc*. 1985 Oct;85(10):1315-20.
 Neuhouser ML, Patterson RE. Methods and Tools for dietary intake assessment in Individuals vs. Groups. in: *Handbook of Nutrition and Food*, 2nd edition. Taylor & Francis Group/ CRC Press. 2008. pp 529-541.

** Scott AR, Reed DB, Kubena KS, McIntosh WA. Evaluation of a group administered 24-hour recall method for dietary assessment. *J Extension*. 2007;45(1). <http://www.joe.org/joe/2007february/index.php>. Accessed May 30, 2009.

Key words used included a '24 hour recall', 'low income', and 'limited resource'. Numerous searches were initially conducted to define search terms within PubMed, Agricola, and FOODnetBase. With terms defined, combinations of search terms were used until no new records/studies appeared in the search.

In PubMed, "24 hour diet recall" did not yield any results in MeSH terms and neither did any common amalgamations, nor "diet recall". Finally, all MeSH terms containing the word "diet" and found "diet surveys," were searched. The latter really pertains to data collection on the group level, i.e. for a population, but was listed

under “nutrition assessment.” Nutrition assessment pertains to dietary data collection on the individual level, i.e. for one person, so this became the basis for the search in PubMed. “Diet records” was also a term that was searched along with “nutrition assessment” though a review of key words in the paper, “Group-administered Pictorial Dietary Recall with 9-to 11-year old Children” by Wallen et al, which fit inclusion criteria. See [Table 4](#) for specific search terms and their results.

Table 4. Data source and description of search terms.

Data Source	Search Term
PubMed	((("dietary recall") OR "diet recall")) AND ("Nutrition Assessment"[Majr])
	((("Nutrition Assessment"[Majr] AND "Diet Records"[Mesh] AND ("adult"[MeSH Terms] OR "young adult"[MeSH Terms] OR "adult"[MeSH Terms:noexp])) NOT "software"[All Fields]) NOT "internet"[All Fields]) NOT "automation"[All Fields] NOT "online"[All Fields] NOT "questionnaire"[All Fields])
Agricola	exp diet recall
	exp diet recall/ AND valid*
FOODnetBase	"dietary recall"
Journal of Extension	Texas EFNEP

In Agricola, “24-hour diet recall” mapped to the term, “diet recall.” The term “diet recall” was *exploded* to include all terms, including the different amalgamations of “24-hour diet recall.” This search was too broad with 465 results and so the term “valid*” was added in order to narrow the results to papers that were more focused on administration methods, not nutrient intake studies for populations. Adding “valid*” resulted in 102 papers which were then reviewed by title and abstract for inclusion in the review. Searching this term with “diet recall” yielded one useful paper by Wallen et al (2008) that had already been identified through a search of the PubMed database.

Dr. Townsend knew there was a study conducted by EFNEP in Texas; however, it had not appeared in searches of the three databases [\[Figure1\]](#). She suggested searching the Journal of Extension directly. Searching “Texas EFNEP” on the Journal’s website found one paper. The title of the paper did not include the word “valid” nor was the term mentioned in the abstract. This is probably the reason this paper was not appearing in any of the searches. Subsequently, the paper was located in Agricola indexed under “agricultural education, extension education, dietary surveys, diet recall, Expanded Food and Nutrition Education Program, food intake, females, Texas.”

In FOODnetBase, the term “dietary recall” after “24-hour diet recall” did not produce any results. Searching “diet recall” and “diet* recall” yielded four results, none of which were applicable. “Dietary recall” produced 63 book chapters. Reading the chapter titles, two looked promising. “Methods and Tools for Dietary Intake Assessment in Individuals vs. Groups” by Marian Neuhouser in *Handbook of Nutrition and Food*, Second Edition, actually used “groups” to refer to proper nutrition assessment tools for entire demographic groups, not the administration of a group recall (Neuhouser & Patterson 2008). The other chapter “Dietary Intake Assessment: Methods for Adults”

in *Handbook of Nutrition and Food*, Second Edition also looked promising because of the title and introduction, but again “groups” referred to demographic groups not group-administered recall (Smiciklas-Wright et al. 2007).

Inclusion Criteria

Validation of the 24HDR was the primary inclusion criteria. Secondly, validation studies were sought with low-income, limited resource adult audiences and/or with EFNEP clientele. Studies were sought using a group-administered recall. To identify studies relevant to EFNEP’s group administered recall, abstracts were reviewed with these criteria:

- ◆ published in English in peer-viewed scientific journals or as book chapters, and
- ◆ containing content about ‘group’ or similar terminology to determine method of recall administration.

Exclusion Criteria

Exclusion criteria included studies from countries not similar to the US [e.g. Brazil, Korea]. Adults, youth, and children were the subjects of this literature review. Food frequency questionnaires were also excluded as this literature review focuses on the 24-hour diet recall. Food frequency questionnaires do not capture the same information as 24HDR and are not used by EFNEP. Abstracts were excluded if studies were:

- ◆ from countries not similar to the US;
- ◆ about ‘group’ referring to mean nutrient intakes;
- ◆ of validation of food frequency questionnaires, diet records, diet histories, checklists and other short assessment questionnaires; and/or
- ◆ about conference proceedings, book reviews and dissertations.

Data extraction and appraisal

Using an evidence analysis approach (Myers et al 2001), each selected study was analyzed for 11 characteristics of the diet recall protocol, data collection form and overall study. These characteristics included description of study participants, how intake data were collected, number of researchers collecting data, sample size estimates and statistical measures used for analysis along with others identified in [Table 10](#). These characteristics were based on authors’ assessment of relevant information for the group 24HDR:

- ◆ a protocol accommodating 5 to 25 EFNEP participants at the same time;
- ◆ a script aimed at capturing all foods, specific food details, and portion sizes; and,
- ◆ a data collection form appropriate for participants with minimal literacy skills for reading and writing (Townsend et al 2011).

The original plan was to examine the quality, quantity, consistency and generalizability of the body of evidence. Because of the lack of findings from the literature searches for the participant-recorded group-administered 24HDR, this plan was not executed.

“Methods and Tools for Dietary Intake Assessment in Individual vs. Groups” is an excellent example of how this book chapter on analysis approaches can be confused with a comparison of administration methods. In the title the words “Individual vs. Groups” is clear for the researcher analyzing recall data, but not others less familiar with

this diet assessment area of expertise. All the recalls discussed in this book chapter are individually collected by a trained dietitian. The term “group” refers to how the data from the recalls is analyzed and applied, not how the data is collected. [Table 3](#) provides definitions and examples. Some research shows that three recalls per person is considered the minimum necessary for valid macronutrient assessment given their consistency in the individual’s diet from one day to the next. However, a quantity of 9-12 recalls is considered necessary to garner evidence about usual intake of micronutrient results for one person given the variability micronutrient intake from one day to the next (Basiotis et al, 1987). Because NHANES collects only one or two recalls per individual, the analysis is only considered reliable for populations.

McClelland et al. (JNEB 2001) erroneously reports the EFNEP Group-administered Diet Recall to be valid

In their 2001 review titled “Review of Evaluation Tools Used to Assess the Impact of Nutrition Education on Dietary Intake and Quality, Weight Management Practices, and Physical Activity of Low-Income Audiences”, the authors, including several from Cooperative Extension and EFNEP, identified two citations as documentation of validation for the participant-recorded group-administered 24HDR. This effort was the basis for subsequent misreporting of the validity of the EFNEP group-administered 24HDR. A number of post 2001 published EFNEP studies using the participant-recorded group-administered 24HDR cite the McClelland review as evidence of the validity of the EFNEP participant-recorded group-administered recall. However, there were several flaws in the authors’ analysis and interpretation of the two citations they cite for evidence.

The first paper titled “Evaluation of validity of items for a food behavior checklist” was authored by Murphy SP, Kaiser LL, Townsend MS, Allen LH and published in JNE in 2001. The literature review identified this study as a validation study of the group 24HDR with EFNEP participants. However, examination of Murphy et al. report to Food and Nutrition Service, the funder of the study, and its subsequently published papers (Murphy et al. 2001; Townsend et al. 2003; Townsend & Kaiser 2005;

Townsend & Kaiser 2007) reveals the data was collected for the 24HDR by individual interview by a trained researcher with one participant. In other words, the 24HDR was not participant-recorded and not group-administered. The food behavior checklist was collected in a group. The other extensive data for this study, including six 24HDRs and two blood samples, were collected via individual interviews by a trained EFNEP educator with one study participant at a time.

The second citation titled “Dietary Assessment Resource Manual” by Thompson and Byers was published as a supplement in the Journal of Nutrition in 1994, referenced a specific section on the validity of the 24HDR. Thompson and Byers discussed the term ‘group’ with reference to the traditional 24HDR. However, the authors used the term in reference to ‘group means’ for a population as an analysis procedure, not in reference to the administration method for the recall. For further explanation see Table 3.

McClelland et al. authors erroneously identified these two references as providing validation support for the group-administered recall. In fact, there was no mention of the group method for collecting dietary recall data in either citation. In summary, McClelland et al. found no studies supporting the participant-recorded group-administered 24HDR such as that used in EFNEP and SNAP-Ed.

RESULTS

Search Term Results

Overview. Multiple MESH terms were employed to search PubMed yielding 1194 citations. In Agricola, “24-hour diet recall” mapped to the term, “diet recall.” The term “diet recall” was exploded to include all the terms it is used for, including the different amalgamations of “24-hour diet recall” [Figure 1]. Because most of the 1194 citations were nutrient intake studies for populations, the term “valid*” was added to “exp diet recall” to better target papers focusing on administration methods. In FOODnetBase, search terms yielded 80 results including 63 book chapters for a total of 1376 potential citations identified for title review [Figure 1]. These titles were screened with most citations [n=1236] being removed based on duplication and title content. In the end, only two unique papers were found to be applicable for review [Table 5].

Table 5. Data source, search terms, results and number included in review to reflect inclusion and exclusion criteria

Data Source	Search Term	Number of Results	Number Included in Full Review
PubMed	((("dietary recall") OR "diet recall")) AND ("Nutrition Assessment"[Majr])	219	1
	((("Nutrition Assessment"[Majr] AND "Diet Records"[Mesh] AND ("adult"[MeSH Terms] OR "young adult"[MeSH Terms] OR "adult"[MeSH Terms:noexp])) NOT "software"[All Fields]) NOT "internet"[All Fields]) NOT "automation"[All Fields] NOT "online"[All Fields] NOT "questionnaire"[All Fields])	195	0
Agricola	exp diet recall	465	1
	exp diet recall/ AND valid*	102	1
FOODnetBase	"dietary recall"	63	0
Journal of Extension	Texas EFNEP	28	1

Study inclusion. Five combinations of search terms yielded promising results based on review of article titles and then abstracts. Articles were screened for additional relevant citations.

Eligibility and selection. Abstracts from the preliminary screening were reviewed for relevancy. Full-text articles and chapters of relevant studies were retrieved for further review.

Hand search. The authors were aware of a relevant paper by Scott et al. 2007 that did not appear during any of the above searches. Consequently, the journal for this publication, Journal of Extension, was searched post hoc [Figure 1].

Screening of Abstracts. After defining the search terms, papers were screened based on title and then abstract. Many of the titles/abstracts focused on development of computer-based 24-hour diet recall administration, also

known as ASA24. While this technology puts reporting in the hands of the participant, this research was excluded from the final results because the protocol for administering a computer-based recall is different from the participant-recorded group-administered 24HDR (Diep et al., 2015; Kirkpatrick et al., 2015; Baranowski et al., 2012; Frankenfeld et al., 2012; Subar et al., 2007; Zoellner et al., 2005) currently used in EFNEP. A computer-based delivery method is not currently possible for all EFNEP states [e.g., requires internet connectivity which can be limited in some areas, issues such as freezing with the platform itself, some EFNEP participants found the ASA24 confusing at times and reported difficulty locating food items, once the recall has been closed it cannot be modified, etc.] (Pilot study conducted by NC1169 in 2009), although the approach was tested successfully in some states.

As mentioned before, many studies used diet recall to research specific nutrient intakes, such as zinc or fiber. These studies were excluded during the review of titles and abstracts, because they did not pertain to validation of the recall.

Data Synthesis

The flow chart for the article selection process, search term strategies employed, and search results is shown [Figure 1].

Two articles and one book chapter were obtained in full-text. All of the citations listed in [Appendix A](#) were also retrieved in full-text and read, not because they were identified for the review, but for their value as background studies on the 24HDR. The Journal of Extension search yielded the one anticipated adult-focused research paper appropriate for this review.

A fourth citation from 1985 was also retrieved although it predates the McClelland et al. 2001 literature review (Farris et al. 1985). The Farris paper is included in this discussion due to the minimal number of papers found through the searches. Two citations about the group 24HDR targeted children (Wallen et al 2011; Farris et al. 1985). Two citations targeted adults, with the second being a book chapter (Scott et al. 2007; Neuhouser and Patterson 2008).

The four citations were first grouped by subject's age. The Wallen and Farris studies focused on children (Wallen et al., 2011; Farris et al., 1985) while the EFNEP Texas study and book chapter focused on adults (Scott et al. 2007; Neuhouser and Patterson 2008). From here, the two research papers were analyzed for the setting in which the study was conducted, how intake data were collected, how portions were determined by researchers, number of researchers collecting data and administering recall, type of recall method used, number of subjects in the group, if researchers were available to answer questions/assist during recall, how food portions were reported by participants, and statistical significance measures used for analysis. These points are all important in evaluating the validity and applicability of the study protocols and procedures to new research. See [Table 10](#) for a summary of the data collected from the two studies.

Adult [n=31] and youth [11] validation studies in the peer-reviewed literature targeted during the search for reading of abstract or full paper are shown in [Table 6](#). Four studies validate the current 5-step multipass recall protocol with one trained professional collecting data from one client. Two studies target low-income groups. Nineteen studies use the paper data collection form with the interviewer doing the writing with an adult client. Six adult and 3 youth studies incorporate the computer-assisted methodology by the interviewer. Eleven studies test a participant-recorded computer-assisted protocol. One adult and one youth study used the participant-recorded group-administered protocol as seen in EFNEP.

Table 6. 24-hour diet recall literature review table

Author & title of articles	5-Step	U.S. Low-Income	Administration Method				Group *
			Individual				
			Interviewer-recorded		Participant-recorded		
			Written on paper	Computer Assist	Computer Assist		
* Group is defined as participant-recorded group-administered 24HDR							
ADULT STUDIES							
Arab L, Wesseling-Perry K, Jardack P, Henry J, Winter A. <i>Eight self-administered 24-hour dietary recalls using the Internet are feasible in African Americans and Whites: the energetics study.</i>					X		
Beer-Borst S, Amadò R. <i>Validation of a self-administered 24-hour recall questionnaire used in a large-scale dietary survey.</i>					X		
Brustad M, Skeie G, Braaten T, Slimani N, Lund E. <i>Comparison of telephone vs face-to-face interviews in the assessment of dietary intake by the 24 h recall EPIC SOFT program--the Norwegian calibration study.</i>			X				
Casey PH, Goolsby SL, Lensing SY, Perloff BP, Bogle ML. <i>The use of telephone interview methodology to obtain 24-hour dietary recalls.</i>			X				
Conway JM, Ingwersen LA, Moshfegh AJ. <i>Accuracy of dietary recall using the USDA five-step multiple-pass method in men: an observational validation study.</i> J Amer Diet Assoc. Apr 2004; 104(4):595-603.	X			X			
Conway JM, Ingwersen LA, Vinyard BT, Moshfegh AJ. <i>Effectiveness of the US Department of Agriculture 5-step multiple-pass method in assessing food intake in obese and nonobese women.</i> Am J Clin Nutr. May 2003; 77(5): 1171-1178.	X			X			
Ferguson EL, Gadowsky SL, Huddle JM, Cullinan TR, Lehrfeld J, Gibson RS. <i>An interactive 24-h recall technique for assessing the adequacy of trace mineral intakes of rural Malawian women; its advantages and limitations.</i>			X				
Fox TA, Heimendinger J, Block G. <i>Telephone surveys as a method for obtaining dietary information: a review.</i> J Amer Diet Assoc. Jun 1992; 92(6):729-732.			X				
Frankenfeld CL, Poudrier JK, Waters NM, Gillevet PM, Xu Y. <i>Dietary intake measured from a self-administered, online 24-hour recall system compared with 4-day diet records in an adult US population.</i> J Acad Nutr Diet. Oct 2012; 112(10): 1642-1647.	X				X		
Galasso R, Panico S, Celentano E, Del Pezzo M. <i>Relative validity of multiple telephone versus face-to-face 24-hour dietary recalls.</i> Ann Epidemiol. Jul 1994; 4(4): 332-336.			X				
Gersovitz M, Madden JP, Smiciklas-Wright H. <i>Validity of the 24-hr. dietary recall and seven-day record for group comparisons.</i> J Amer Diet Assoc. Jul 1978: 73(1): 45-55.			X				
Graham GG. <i>Validity of 24-hr dietary recall.</i> Amer J Clin Nutr. Dec 1977: 30(12): 1939-1941.			X				
Hulshof PJ, Burema J, van Staveren WA. <i>Validity of food intake measurement of adult Turkish immigrants in The Netherlands.</i> Eur J Clin Nutr. Jan 1995: 49(1): 17-25.			X				

Author & title of articles	5-Step	U.S. Low-Income	Administration Method			
			Individual			Group*
			Interviewer-recorded		Participant-recorded	
			Written on paper	Computer Assist	Computer Assist	
* Group is defined as participant-recorded group-administered 24HDR						
Kahn HA, Whelton PK, Appel LJ, Kumanyika SK, Meneses JL, Hébert PR, Woods M. <i>Validity of 24-hour dietary recall interviews conducted among volunteers in an adult working community.</i> AnnEpidemiol. Nov 1995; 5(6): 484-489.			X			
Kirkpatrick SI, Subar AF, Douglass D, Zimmerman TP, Thompson FE, Kahle LL, George SM, Dodd KW, Potischman N. Performance of the Automated Self-Administered 24-hour Recall relative to a measure of true intakes and to an interviewer-administered 24-h recall. Am J Clinl Nutr. 2014;100(1):233-40.	X		X		X	
Krantzler NJ, Mullen BJ, Schutz HG, Grivetti LE, Holden CA, Meiselman HL. <i>Validity of telephoned diet recalls and records for assessment of individual food intake.</i> Am J Clin Nutr. Dec 1982; 36(6): 1234-1242.			X			
Kretsch MJ, Fong AK. <i>Validation of a new computerized technique for quantitating individual dietary intake: the Nutrition Evaluation Scale System (NESSy) vs the weighed food record.</i> Am J Clin Nutr. Mar 1990; 51(3): 477-484.			X			
Levine JA, Madden AM, Morgan MY. <i>Validation of a computer based system for assessing dietary intake.</i> Brit Med J. Aug 1987; 295(6594): 369-372.				X		
Liu B, Young H, Crowe FL, Benson VS, Spencer EA, Key TJ, Appleby PN, Beral V. <i>Development and evaluation of the Oxford WebQ, a low-cost, web-based method for assessment of previous 24 h dietary intakes in large-scale prospective studies.</i> Public Health Nutrition. Nov 2011; 14(11): 1998-2005.				X		
Madden JP, Goodman SJ, Guthrie HA. <i>Validity of the 24-hr. recall. Analysis of data obtained from elderly subjects.</i> J Am Diet Assoc. Feb 1976; 68(2): 143-147.			X			
Margetts BM, Thompson RL. <i>Validation of dietary intake estimation.</i> Eur J Clin Nutr. Dec 1995; 49(12):934.			X			
Posner BM, Borman CL, Morgan JL, Borden WS, Ohls JC. <i>The validity of a telephone-administered 24-hour dietary recall methodology.</i> Am J Clin Nutr. Sep 1982; 36(3): 546-553.		X	X			
Scott A, Reed D, Kubena K, McIntosh W. <i>Evaluation of a Group Administered 24-Hour Recall Method for Dietary Assessment.</i> J Extension. 2007; 45:1.		X	X			X
Slimani N, Casagrande C, Nicolas G, Freisling H, Huybrechts I, Ocké MC, Niekerk EM, van Rossum C, Bellemans M, De Maeyer M, Lafay L, Krems C, Amiano P, Trolle E, Geelen A, de Vries JH, de Boer EJ; EFCOVAL Consortium. <i>The standardized computerized 24-h dietary recall method EPIC-Soft adapted for pan-European dietary monitoring.</i> Eur J Clin Nutr. Jul 2011; 65 Supplement 1: S5-15.				X		
Slimani N, Ferrari P, Ocké M, Welch A, Boeing H, Liere M, Pala V, Amiano P, Lagiou A, Mattisson I, Stripp C, Engeset D, Charrondière R, Buzzard M, Staveren W, Riboli E. <i>Standardization of the 24-hour diet recall calibration method used in the European prospective investigation into cancer and nutrition (EPIC): general concepts and preliminary results.</i> Eur J Clin Nutr. Dec 2000; 54(12): 900-917.			X	X		
Subar AF, Kirkpatrick SI, Mittl B, Zimmerman TP, Thompson FE, Bingley C, Willis G, Islam NG, Baranowski T, McNutt S, Potischman N. <i>The Automated Self-Administered 24-hour dietary recall (ASA24): a resource for researchers, clinicians, and educators from the National Cancer Institute.</i> J Acad of Nutr and Diet. Aug 2012; 112(8): 1134-1137.	X				X	
Subar AF, Thompson FE, Potischman N, Forsyth BH, Buday R, Richards D, McNutt S, Hull SG, Guenther PM, Schatzkin A, Baranowski T. <i>Formative research of a quick list for an automated self-administered 24-hour dietary recall.</i> J Am Diet Assoc. Jun 2007; 107(6): 1002-1007.					X	
Sun Y, Roth DL, Ritchie CS, Burgio KL, Locher JL. <i>Reliability and predictive validity of energy intake measures from the 24-hour dietary recalls of homebound older adults.</i> J Am Diet Assoc. May 2010; 110(5): 773-778.			X			
Touvier M, Kesse-Guyot E, Méjean C, Pollet C, Malon A, Castetbon K, Hercberg S. <i>Comparison between an interactive web-based self-administered</i>					X	

Author & title of articles	5-Step	U.S. Low-Income	Administration Method			
			Individual			Group*
			Interviewer-recorded		Participant-recorded	
			Written on paper	Computer Assist	Computer Assist	
* Group is defined as participant-recorded group-administered 24HDR						
24 h dietary record and an interview by a dietitian for large-scale epidemiological studies. Brit J Nutr. Apr 2001: 105(7): 1055-1064.						
Yanek LR, Moy TF, Becker DM. <i>Comparison of food frequency and dietary recall methods in African-American women.</i> J Am Diet Assoc. Nov 2001; 101(11): 1361-1364.			X			
Zimmerman TP, Hull SG, McNutt S, Mittl B, Islam N, Guenther PM, Thompson FE, Potischman NA, Subar AF. <i>Challenges in converting an interviewer-administered food probe database to self-administration in the National Cancer Institute Automated Self-administered 24-Hour Recall (ASA24).</i> Journal of Food Composition and Analysis. July 2009; 22S: S48-S51.					X	
Zoellner J, Anderson J, Gould SM. <i>Comparative validation of a bilingual interactive multimedia dietary assessment tool.</i> J Am Diet Assoc. Aug. 2015; 105(8): 1206-1214.			X			
YOUTH STUDIES						
Baranowski T, Islam N, Baranowski J, Martin S, Beltran A, Dadabhoy H, Adame SH, Watson KB, Thompson D, Cullen KW, Subar AF. <i>Comparison of a Web-based versus traditional diet recall among children.</i> J Acad Nutr Diet. Apr 2012; 112(4): 527-532.					X	
Baxter SD, Smith AF, Hardin JW, Nichols MD. <i>Conventional energy and macronutrient variables distort the accuracy of children's dietary reports: illustrative data from a validation study of effect of order prompts.</i>			X			
Baxter SD, Guinn CH, Royer JA, Hardin JW, Smith AF. <i>Shortening the retention interval of 24-hour dietary recalls increases fourth-grade children's accuracy for reporting energy and macronutrient intake at school meals.</i>			X			
Burrows TL, Martin RJ, Collins CE. <i>A systematic review of the validity of dietary assessment methods in children when compared with the method of doubly labeled water.</i> J Am Diet Assoc. Oct 2010; 110:1501-1510.			X			
Diep CS, Hingle M, Chen TA, Dadabhoy HR, Beltran A, Baranowski J, Subar AF, Baranowski T. The Automated Self-Administered 24-Hour Dietary Recall for Children, 2012 Version, for Youth Aged 9 to 11 Years: A Validation Study. J Acad Nutr Diet. 2015; 115(10):1591–1598.				X	X	
Eck LH, Klesges RC, Hanson CL. <i>Recall of a child's intake from one meal: are parents accurate?</i> J Am Diet Assoc. Jun 1989; 89(6): 784-789.			X			
Lytle LA, Nichaman MZ, Obarzanek E, Glovsky E, Montgomery D, Nicklas T, Zive M, Feldman H. <i>Validation of 24-hour recalls assisted by food records in third-grade children. The CATCH Collaborative Group.</i> J Am Diet Assoc. Dec 1993; 93(12): 1431-1436.			X	X		
Nicklas TA, Forcier JE, Webber LS, Berenson GS. <i>School lunch assessment to improve accuracy of 24-hour dietary recall for children.</i> J Am Diet Assoc. Jun 1991; 91(6): 711-713.		X	X			
Räsänen L. <i>Nutrition survey of Finnish rural children. VI. Methodological study comparing the 24-hour recall and the dietary history interview.</i> Am J Clinic Nutr. Dec 1979; 32(12): 2560-2567.			X			
Treiber FA, Leonard SB, Frank G, Musante L, Davis H, Strong WB, Levy M. <i>Dietary assessment instruments for preschool children: reliability of parental responses to the 24-hour recall and a food frequency questionnaire.</i> J Am Diet Assoc. Jun 1990; 90(6): 814-820.			X	X		
Vereecken CA, Covents M, Matthys C, Maes L. <i>Young adolescents' nutrition assessment on computer (YANA-C).</i> Eur J Clinic Nutr. May 20015: 53(5): 658-667.				X	X	
Wallen V, Cunningham-Sabo L, Auld G, Romaniello C. <i>Validation of a group-administered pictorial dietary recall with 9- to 11-year-old children.</i> J Nutr Educ Behav. Jan-Feb 2011; 43(1): 50-54.			X			X

Author & title of articles	5-Step	U.S. Low- Income	Administration Method				
			Individual			Group*	
			Interviewer-recorded		Participant -recorded		
			Written on paper	Computer Assist	Computer Assist		
* Group is defined as participant-recorded group-administered 24HDR							
	TOTAL						
	4	3	28	9	9	2	

Adults: Neuhouser and Patterson 2008

Of the 63 book chapter titles in FOODnetBase, two looked promising, “Methods and Tools for Dietary Intake Assessment in Individuals vs. Groups” in *Handbook of Nutrition and Food* and “Methods and Tools for Dietary Intake Assessment in Individuals vs. Groups: A group method for obtaining dietary recalls of children” (Neuhouser and Patterson 2008). However, the book authors used the term “groups” to refer to demographic groups and “group means” from data analysis, not group-administration of the recall. Diet assessment accuracy for one participant requires more recalls than for a group of participants (Baranowski et al 2012). No book chapter utilized the term “group” to refer to the administration method of the 24HDR.

Adults: Scott et al. 2007

In *Evaluation of a Group Administered 24-hour Recall Method for Dietary Assessment* by Scott et al. 2007, researchers observed female food service workers eating lunch in nine University campus cafeterias where they were employed. Plate waste was collected following the meal. On the second day, 23 of the women completed a participant-recorded group-administered 24HDR. The remaining 19 workers completed a traditional individual recall with one researcher. The purpose was to compare the accuracy of group and individually administered 24HDR methods with an observation of the university food service lunch (Posner et al 1982).

Both recalls used a three-step multi-pass method that consisted of making a 1) quick list of foods consumed in the previous 24 hours in any order; 2) detailed description including probing questions to gain specific information about portion size, brand etc. of the foods; and 3) a review (Posner et al 1982).

For each part of the study, there were two researchers: a registered dietitian and an undergraduate nutrition student. The researchers collecting meal data were not the same as the ones who conducted the 24HDR.

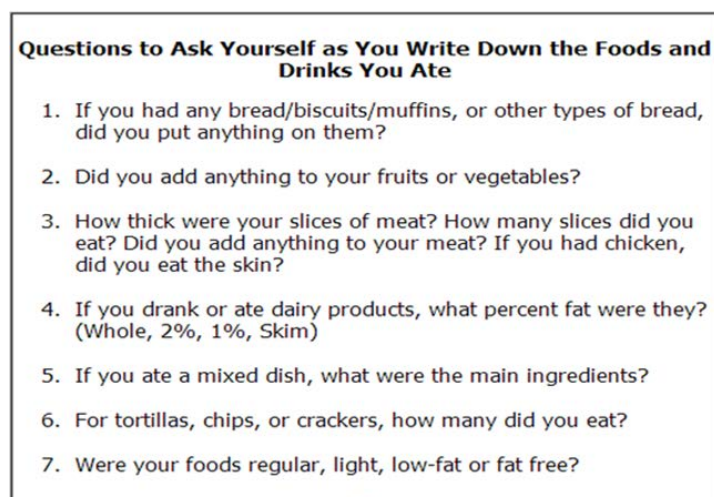
Researchers used the size of the serving utensil used in the service line to determine standard food portion sizes that the subjects were served. When reporting intake on either the individual or the group-administered recall, the subjects were encouraged to use food models and measuring utensils.

Both recalls used a three-step multi-pass method that consisted of making a quick list of foods consumed in the previous 24 hours in any order, detailed description including probing questions to gain specific information

about portion size, brand etc. of the foods and finally review. After each step, subjects were also prompted for any missing items.

For the group-administered recall, subjects were split into groups of five and completed the recall in this small group. In the group-administered recall, a poster with seven questions, which researchers read and displayed to the group, simulated probing questions (see [Figure 2](#)). During the participant-recorded group-administered 24HDR, both researchers were available to answer individual “questions, spot check recalls, and ensure subjects were completing recalls according to the instructions.” Researchers also assisted in reading or writing where necessary while subjects completed an individual form for the recall. The group completed each pass before moving on to the next step.

Figure 2. Questions read aloud and displayed to subjects during group-administered recalls.



Questions to Ask Yourself as You Write Down the Foods and Drinks You Ate

1. If you had any bread/biscuits/muffins, or other types of bread, did you put anything on them?
2. Did you add anything to your fruits or vegetables?
3. How thick were your slices of meat? How many slices did you eat? Did you add anything to your meat? If you had chicken, did you eat the skin?
4. If you drank or ate dairy products, what percent fat were they? (Whole, 2%, 1%, Skim)
5. If you ate a mixed dish, what were the main ingredients?
6. For tortillas, chips, or crackers, how many did you eat?
7. Were your foods regular, light, low-fat or fat free?

Using paired t-tests, researchers reported no statistically significant differences between observed intake and reported intake for energy, four macronutrients, and 16 micronutrients with the group recall. This result was interpreted by the authors as evidence for validity of the participant-recorded group-administered 24HDR. However, no mention of power calculations or effect size was noted in the paper. With insufficient power to detect differences between the recall and observed intakes, the ‘no difference’ results could be misinterpreted as a positive assessment of validity and not a sample size [i.e. statistical power] issue. In addition, with the participant-recorded group-administered 24HDR, the group should be the unit of analysis. Scott et al. (2007) report that the participant-recorded group-administered 24HDR was at least as good as the traditional recall when in fact no comparison analysis was conducted between the two 24HDR methods (Townsend et al. 2010). The 23 literate food service workers in five groups have minimal applicability to the low-literacy participants in many states making external validity limited. Our search goal was to validate the group 24HDR with 5-25 participants. Scott et al. is not generalizable to groups of 6-25 nor groups of 5 with one educator.

Texas EFNEP also reports no demographic differences between the two subject groups. And according to Scott, the subjects, female food service workers, approximately represent the target population for Texas EFNEP based on socioeconomic status, ethnicity and gender.

The Scott et al. (2007) paper is the only paper containing a validation study with adults as shown in [Table 6](#).

Youth: Wallen et al. 2011

In *Validation of a Group-administered Pictorial Dietary Recall with 9-to 11-year-old Children* by Wallen et al. 125 low-income nine-to-eleven-year old children completed the Day in the Life Questionnaire- Colorado [DILQ-CO] dietary assessment in their classrooms. The purpose of this study was to evaluate the sensitivity and validity of the DILQ-CO, which is adapted from Edmunds and Ziebland in the United Kingdom.

Two schools were selected for this study based on percentage of children receiving reduced-price school lunches. At each school, at least 50% of the children received reduced-price school lunches. In addition, one school served a morning snack of fruit to the students while the other did not. This was important because the researchers wanted to measure the sensitivity of the DILQ-CO to the inclusion of a morning snack.

The DILQ-CO assessed dietary intake by having the children fill out the questionnaire what they did the previous day, including their meals, in reverse-chronological order, starting with their most recent activities or meal. Reported intake on the worksheet was measured against plate waste data collected by the researchers during the same day's lunch. Portion sizes of school lunch items were determined by an average of 10 serving samples. Two dietitians weighed plate waste when the children were finished eating and determined how much each child ate by subtracting from the standardized portion size. Plate waste was then converted to the semi-quantitative scale for comparison with subject responses. On the DILQ-CO, the subjects used a semi-quantitative scale to report how much food they ate. Options for reporting how much they ate were: all, more than half, less than half and none; indicated by a symbol drawn through the name for the food item the subject wrote down on the form. No particular multi-pass method was reportedly used in the recall, although, based on the script obtained from the author of the study, a variation on the USDA 3-pass method was employed. First, students were asked if they ate lunch, where the food came from [school or home], what was included in the meal and finally how much of each food was eaten. The worksheet progresses to collect all foods eaten of the previous school day in this manner.

One researcher read the prompt questions and led the class through the entire worksheet while an unknown number of researchers and possibly the teacher were available to help students individually. The researcher administering the recall, as part of the protocol, wrote the items served for school lunch on the board. The protocol script also calls for extensive prompting to remind the children to include side items in their meal descriptions. The entire exercise took about 35 minutes to complete.

Wallen et al. found a high level of accuracy for reporting types of foods eaten at lunch and statistically significant reporting of quantity eaten compared to plate waste measures for six of the ten items served at lunch. The researchers also found the DILQ-CO was sensitive to inclusion of a morning fruit snack.

Youth: Farris et al. 1985

This study is reviewed here although it does not meet our criteria for inclusion dates for this review. It is a group-administered recall study for youth. It predates the beginning of this literature review [with the advent of McClelland et al.]

In this study, two versions of 24HDR collection are compared using data from 47 10-18 year olds. The first version of the recall was administered by a researcher to a group of these youth. The data was collected in groups of 5-8 youth. A 15-minute demonstration session instructed these youths about the information needed, how to complete the recall workbook form. A flip chart provided visual probes to assist in recalling foods eaten. The chart consisted of a series of large posters with photographs of food in 7 food groups and 5 posters outlining types of snacks. Additional visual aids were included to elicit qualifying information about food type, methods of preparation and condiments added. Each group was equipped with three standardized graduated food model sets which participants used to estimate portions. The day's total intake was divided in the workbooks into 7 eating periods, one per page. This workbook was edited with each child at the end of the session. The researcher probed to verify missing or incomplete responses. The workbook method was then compared to a second version of the 24HDR, this time the traditional dietitian-administered recall with an individual youth. The dietitian asked the questions and wrote the youth's responses on a traditional recall form. Two youth from each group session were randomly selected for the individual 24HDR interview using the same 24-hour recall period.

The two versions of the recall compare favorably for total energy up to the 70th percentile. Respondents reported energy intakes in range of 500-2600 kcals. For intakes above the 70th percentile or above 2600 kcals, intakes were significantly greater when assessed by the group workbook 24HDR method. This result indicates the tendency for some youth to report greater quantities of foods and beverages when completing a participant-recorded group-administered 24HDR compared a one-on-one interview with careful probes and quality controls.

ASA24

Much of the research not meeting the inclusion criteria focused on development of a computer-directed 24HDR, referred to as the Automated Self-Administered 24-hour Dietary Recall [ASA24] (Subar et al. 2012, Baranowski et al 2012). While this technology puts reporting in the hands of the participant, this research was excluded from the final selection of papers because the protocol for administering a computer-directed recall is dramatically different from the participant-recorded group-administered 24HDR protocol (Subar et al 2012). A computer-directed delivery method with its requirements for reading, spelling and computer proficiency as well as the availability of computer/tablet and internet access is not feasible for low-literate and limited resource clients such as EFNEP and SNAP-Ed participants at this time.

The computer-directed model ASA24 is being considered as a protocol for EFNEP with research conducted by the Multistate Project 2169 "EFNEP Research" (National EFNEP Coordinator's Website). A substantial hurdle to implementing the ASA24 within EFNEP is that the participant serves as her own interviewer with the demands of reading, spelling and computer proficiency, unlike the AMPM protocol (Conway et al 2004).

No studies were identified examining best practices for procedures for the group recall, the educator's script or participant's data collection form. Additional assessment of quality, quantity, consistency and generalizability for the preponderance of evidence was not feasible, given the study findings.

Categories of 24HDR protocols

After reading the full-text of the citations cited above plus abstracts or full text of those listed in [Appendix A](#), a schema was created as shown in [Table 7 and 8](#). The validation studies of the 24HDR from these searches could be classified into four categories based on characteristics of the 24HDR protocols.

- ◆ First is interviewer-administered individual 24HDR with the dietitian or other trained interviewer giving oral instructions and writing the information provided by the client or patient. This is the traditional, also called an individual, 24HDR. The dietitian/trained interviewer is available to reply to each client question as it arises. Consequently, the authors have labeled this method /protocol as client-centered evaluation.
- ◆ Second is the computer-assisted interviewer-administered individual 24HDR. The trained interviewer enters the client's list of foods into dietary software installed on a laptop. Probing questions to elicit food details and portion sizes are automatically generated, customized to the foods reported. An example is the U.S. Department of Agriculture's [USDA] automated multiple-pass method called AMPM and discussed further below.
- ◆ Third is the participant-recorded group-administered 24HDR, the focus of this systematic search. This recall is unique in that the client must be able to read and write. The trained EFNEP educator leads a group of clients through the recall protocol while clients read the form and write responses on it. It is described in more detail elsewhere in this report. The authors have labeled this 24HDR protocol as educator-driven. It is not client-centered. Essential for data quality is experienced educators, training, repeated consistently, a well-tested data collection form, a script tenaciously followed by educators and one protocol agreed upon by all states and territories [probably a 5-step multi-pass, but not necessarily].

Table 7. Validation studies of four 24-hour diet recall administration protocols for each of two recall analysis methods.

		RECALL ADMINISTRATION PROTOCOLS			
		For NHANES	For research studies	For EFNEP	For EFNEP
		Individually-administered recall [INDIVIDUAL 24HDR] by dietitian with laptop Example: AMPM*	Individually-administered recall [INDIVIDUAL 24HDR] by dietitian	Individually-administered recall [INDIVIDUAL 24HDR] by paraprofessional	Participant-recorded group administered recall [GROUP 24HDR] by paraprofessional
		1 recall	3 recalls	1 recall	1 recall
METHOD OF RECALL ANALYSIS	Individual Level	Not valid for individual	Valid for macronutrients for individual; may require more than 3 recalls for micronutrients	Weak evidence to support validity.	No evidence of validity.
	Group Level	Valid for group means [μ] for large sample [such as the nationally represented sample employed by NHANES]	Valid for group means for both macro and micronutrients. Applies to small samples.	Considered valid for group means although no study provides evidence.	No evidence of validity

*Automated multiple pass multi-step 24-hour Dietary Recall

DISCUSSION/ANALYSIS ISSUES

The results of the review indicate that the research base for the participant-recorded group-administered 24HDR with adults is one study of university food service employees recalling one meal. Scott et al (2007) used meal observations for group and individual recalls comparing the effectiveness of the two methods. The group method in the study employed two researchers collecting data from 5 food service employees at a time. The authors state that the study shows that the group recall is as effective as the individual version. However, research design and statistical issues exist. No power calculations with sample size estimates or effect sizes are reported. Results and conclusion are based on Pearson correlations calculated with a small sample. With small samples, correlational outcomes are based on sample size. The small number of subjects [23 women completing the participant-recorded group-administered 24-hour recall and 19 women completing the individual 24-hour recall], may have made it impossible for statistical tests to detect existing differences between the two methods. An alternative interpretation of the outcome for this study is that the sample size was insufficient to detect meaningful differences. Another issue with this study is that the food service employees knew they were being observed. According to Mertz (1992), observation of subjects who are unaware of being observed during their meals in a cafeteria-type setting is the preferred method.

Scott et al. (2007) study took an important step toward laying the groundwork for a research base for a participant-recorded group-administered 24HDR in an EFNEP environment. With 87% of EFNEP participants receiving lessons via the group model, a firm platform for a research base would consist of 5 to 10 studies of the group 24HDR in situations similar to EFNEP. These studies would be published in peer-reviewed nutrition journals such as American Journal of Clinical Nutrition, Journal of the Academy of Nutrition and Dietetics and Journal of Nutrition Education and Behavior. Study subjects would be low-income clients with literacy levels typical of our participants in groups of 5 – 25 for this research. Data collection staff would be paraprofessional educators.

Four Types of 24HDRs

Four general types of diet recalls based upon protocol employed were identified from the literature. The four types are shown in [Table 8](#) and discussed below. The reader could also consider this table as a summary overview of the 24HDR methods identified from the results of this review.

Table 8. Four types of 24HDR protocols and their characteristics identified from the literature: interviewer-recorded, computer-assisted interviewer-recorded, computer-assisted participant-recorded and group-administered participant-recorded.

	Type defined by protocol	Data collection environment	Leader	Protocol	Education Style	Data collection form	Client skill requirement	
							Reading	Spelling/ writing
INDIVIDUAL	Interviewer-recorded	Hospital EFNEP participant's home	Dietitian	Probes by dietitian are reactions to foods listed	Reactive Client-centered	Completed by interviewer	None	None
	Computer-assisted, interviewer-recorded	NHANES Mobile Lab	USDA's Web-based system with non-dietitian	Probes generated by computer			None	None
	Computer-assisted, participant-recorded	Web-based	Adaptation of Computer or web-based w/o interviewer.	Probes generated by computer	Reactive Client-centered	None	Required	Type list of foods
GROUP	Participant-recorded	Community agency	EFNEP educator	Scripted text with props.	Proactive	Completed by participant	Required	Required

The interviewer-recorded recall is the common protocol and what usually comes to mind when 'diet recall' is mentioned. It is often used in a clinical setting with a dietitian as the interviewer. There are two types of approaches for computer-assisted diet recall. The first is interviewer-recorded on the computer or laptop while the second is participant-recorded. The computer-assisted, interviewer-recorded recall is commonly known as AMPM for Automated Multiple-Pass Method. This protocol and software were developed for NHANES data collection. Most recent validation studies have used the new 5-step protocol, instead of the previous 3 (Moshfegh et al 2008; Conway et al. 2004; Conway et al. 2003). In discussion with EFNEP coordinators, the 3-step multiple-pass recall appears to be the most popular version used by states. A few states have adopted the 5-step multiple-pass recall and are training educators to use it. These include California, Nevada, Washington, and Oregon among others. The computer-assisted, participant-recorded recall was developed by National Cancer Institute for use by researchers. The name is ASA24 for Automated Self-administered 24 hour Dietary recall and an early version of it was pilot tested with EFNEP participants in six state EFNEP programs. This pilot study was to ascertain EFNEP

participants' perceptions regarding ease of use of the ASA24 as compared to the currently used participant-recorded group-administered 24HDR. Results found that participants gave considerably more favorable comments and support for use of the ASA24 with 74% reporting the ASA24 was easy to complete; 72% responded positively that the amount of time it took to complete the ASA24 was reasonable and 72% preferred the ASA24 over the participant-recorded group-administered 24HDR. The fourth and final recall type is participant-recorded group-administered 24HDR. This type is currently used to collect recall data from about 90% of EFNEP participants (U.S. Department of Agriculture EFNEP, 2015. Retrieved from <https://nifa.usda.gov/sites/default/files/resource/2015%20National%20Data%20Reports%20%28detailed%29%20v2.pdf>).

Sources of misunderstanding when interpreting the diet assessment literature

Sources of misunderstanding are subtle regarding interpretation of recall data [Table 9]. There are two categories of methods for the 24HDR: data collection and data analysis. Sometimes these are confused by the general professional reader as well as the researcher. The most valid type of 24HDR and the protocol found in the long list of papers in this review reflect a 24HDR collected by a trained dietitian or researcher from one individual using the USDA multi-pass multi-step procedures [refer to Table 6,7,8]. Data analysis is conducted for a group or population. The single diet recall does not make nutritional analysis for the individual valid; the individual's diet varies too much from day to day to make that possible. Macronutrients, i.e. protein, fat, carbohydrate, vary the least. With micronutrients, i.e. vitamins and minerals, vary considerably more from one day to the next, from one season to the next (Neuhouser & Patterson 2008). Researchers have estimated that 9-12 recalls would be necessary to capture vitamin A variance over time. One recall is simply not appropriate for capturing the diet of the individual. One recall [and two for a sub-sample] such as with NHANES is appropriate for capturing diet macronutrient means of the U.S. population. One recall pre and post is appropriate for evaluating interventions such as EFNEP.

Table 9. Comparison of 24HDR administrative protocols and analysis methods: group vs. individual

Protocols for data collection:	Protocols for data analysis:	Analysis of INDIVIDUAL 24HDR for individual person	Analysis of INDIVIDUAL 24HDR for group/population
Individual		3 recalls minimum for usual intake. Multiple 24HDRs required to support analysis for individual. 3 minimum for macronutrients. 12 recalls required for vitamin A. For other micronutrients, various.	1 recall for each person in the population. Most valid and common type. Employed by NHANES researchers.
Group		EFNEP analyzes usual intake for the individual with 1 recall [Regional/County level]	EFNEP reports group means based on single recall [Institutional and Federal levels]

The two studies on group-administered recall described above lay the groundwork for further research by EFNEP professionals. Some points that need to be addressed and reconciled follow. Our recommendations for research are found in the Conclusions section.

Two important studies using group-administered methods

Wallen et al. 2011 The Wallen et al. study was found applicable for review because of the unique approach of using a pictorial recall as well as the subject's age and cognitive level. Although EFNEP targets adults for the 24HDR, the education level of subjects may be as low as fourth or fifth grade. Therefore, the DILQ-CO shows promise for working with subjects of varying literacy levels. Pictures may also help with the language barrier. On the other hand, there was an unspecified amount of researchers available to assist the children in the recall; this is not likely an option for the EFNEP program. There are some protocol issues in the administration procedure for the DILQ-CO. Refer to [Table 10](#).

First, a list of foods served at school lunch were posted on the blackboard for all children to view. They were asked to report how much was eaten. They were not asked to recall foods eaten, so "diet recall" is a misnomer. A better name for this method might be, "Portion size study for a school lunch meal". Second, the study discusses performing the recall in reverse-chronological order, a method that is worth testing in more detail. Because there is no control for this in the study, it is unclear if this method improves the accuracy of the group-administered recall. Third, the recall was also administered within two to three hours after the meal the researchers were observing. This protocol and time frame is not representative of group recalls for EFNEP in California and Nevada.

While the pictorial, semi-quantitative scale described in the study is novel and seems to be a good idea to help report portion sizes when subjects are not good at knowing how much they ate, it is unclear how a semi-quantitative scale would be applicable with a free-living population. Furthermore, the study reports significantly different consumption results for six of the ten food items served at lunch. The researchers speculate this could either be due to inconsistent portions served to the children or because of variations in the ease of estimating portion sizes of different foods by the children. The researchers discuss how green beans, which were accurately reported, were served in a transparent plastic container, versus other foods that had lower quantitative intake reporting accuracy were served in paper bowls.

Wallen et al. (2011) conclude in their study that the DILQ-CO shows "substantial to almost perfect agreement" for children reporting quantities of what they consumed at lunch. Upon examination of the actual protocol used to administer the DILQ-CO in the classroom, it was discovered that the researchers provided the children a list of foods served at lunch on the blackboard. So this 'recall' was not actually recalling foods, but recalling portions eaten. It is not surprising then that they observed such a high degree of accuracy of the foods children ate at lunch, but less accuracy of how much using the semi-quantitative scale. The DILQ-CO pictorial group-administered 24-hour diet recall presents creative ideas and innovations to the topic; however, there are major design issues in the administration of the recall in this study, which nullify its results for use by adult EFNEP.

Table 10. Main points for evaluating 24HDR validation studies using a group-administered protocol

	Day in the Life Questionnaire DILQ-CO*	EFNEP Texas **
Subjects	low-income children 9-11 youth	food service workers, female
Setting	school/classroom	university dining centers
Intake data	plate waste and standard weights of lunch line items	meal observation
Portions determined by researchers	avg. weight of 10 samples	utensil size used in serving line used as a portion estimate
Number of researchers collecting intake data	2 dietitians did plate waste, unknown how many were there at lunch	2 meal observers
Number of researchers administering recall	unknown	2
Recall method	Researchers provided youth with lists of foods served. Youth were asked to report quantity or 'how much'. Modified 3-step multi-pass	3-step multi-pass
Number of subjects in group	125 total, 6 classrooms, 3 per school	23 GROUP 24HDR, 19 INDIVIDUAL 24HDR, 42 total
Researchers available to answer questions/assist during recall	yes	yes
Portion reporting by participants	semi-quantitatively, using symbols	Estimates with the food models & measuring utensils
Statistical Analysis	Mann-Whitney U for sensitivity to fruit snack inclusion. Validity assessed by spearman correl K coeff & % agreements	paired t-tests & Pearson's correlations

* Wallen V, Cunningham-Sabo L, Auld G, Romaniello C. Validation of a group pictorial dietary recall with 9- to 11-year-old children. *J Nutr Educ Behav.* 2011 Jan-Feb;43(1):50-4.

** Scott AR, Reed DB, Kubena KS, McIntosh WA. Evaluation of a group administered 24-hour recall method for dietary assessment. *J Extension.* 2007;45(1).

Scott et al. 2007 The study by Texas EFNEP is more representative of adult EFNEP's administration of the 24HDR, especially with respect to application to California and Nevada EFNEP. Only two researchers were required for the entire procedure, which is a more accessible number of staff for EFNEP. In addition, the poster with probing questions may also be a helpful tool in recall administration as it offers a visual aid for the participants. Posters are not expensive to print and can be printed in multiple languages. Refer to [Figure 2](#).

The areas for further study in the Texas EFNEP paper are the number of participants involved in the study and information on whether food service employees can estimate food portion sizes more accurately than the average EFNEP participant. Study subjects [n=42] are divided into two groups for the individual and group-administered protocols making each sample small. According to this report's first author in a personal communication with Scott, sample size estimates for the study were not calculated (Townsend 2012). Consequently, the Scott et al. "No difference" finding could mean the study is insufficiently powered to detect a difference between methods if one exists. There is no research on whether food service employees can better estimate portion sizes than the average person and so it is unclear whether the accuracy of the recalls reported is due to this bias.

Finally, neither study identified in this review used the five-step multi-pass method for 24-hour diet recalls validated by the USDA despite the fact that both studies were conducted after the publication and acceptance of the five-step method (Conway et al. 2004; Conway et al. 2003). It is not clear why Wallen et al. and Scott et al. chose to use the 3-step multi-pass method.

Literacy

The literacy level of participants is a critical factor for the quality of the recall (Johnson et al 1998). Johnson et al. (1998) report that percent body fat and the ability to read and spell are the best predictors of energy intake misreporting. Consequently, we recommend the subjects' literacy levels be documented in validation studies, and that low-literacy skills be an inclusion criterion as our earlier research suggests (Johnson et al. 1998; Wallen et al 2011; Banna et al 2010). These low-literate participants do not volunteer for studies without intentional efforts during recruitment (Townsend et al. 2014).

The participant-recorded group-administered 24HDR can be a major hurdle for low-literacy adults (Townsend 2011). An unintended consequence of shifting the evaluation protocol/method to a group setting from the educator completing the forms in the participant's home is that participants are now expected to read and write to complete the 24HDR forms. At the same time, the national EFNEP evaluation tools for the 24HDR have remained essentially the same in most states, not reflecting the changes in delivery to the group setting with its correspondingly high cognitive load for participants (Townsend 2011; National EFNEP Coordinator's Website).

5 EFNEP participant-recorded group-administered recall process components

Five components of the EFNEP recall process are listed in [Table 11](#), along with analysis of the component quality, potential for errors and potential future upgrades. WebNEERS is a high quality diet assessment web-based macro- and micro-nutrient analysis platform. The issue is not with WebNEERS but with the quality of the data entered into it.

Table 11. Components of EFNEP group recall, component quality, potential for errors and potential for upgrade.

Component of EFNEP recall process	Component Quality*	Explanation	Potential for errors	Potential for upgrade
• Data collection	√√	The group process puts a substantial burden on participant who is recalling foods plus reading and writing. The largest source of error is food omissions. Most recalls do not contain sufficient calories to sustain body weight.	Major The weak link in this process is data collection which is an issue of recall methodology and staff training.	Major Ways to improve would include MORE training and insistence on a consistent protocol.
• Data entry WebNEERS	√√	Foods are limited to 7500 with a few annual additions. Foods from Brazil, Peru, Ecuador, Syria, African countries, Cambodia, Viet Nam, Laos, China, etc. are not in the database. Among the 'poorest of the poor' are immigrants with limited English skills and minimal ability to assimilate. We hire educators from these groups with the respective language skills.	Major	The recipe capability is being added. This will make a major quality improvement. Upgrade: Ways to improve would include more training and a consistent protocol.
• Foods database [FNDDS]	√√√	Each food has an extensive lineup of components as this database is the one used for NHANES. EFNEP does not use most of these nutrients in its analyses.	The data base is fixed. Budgets allow for only a few foods to be added each year.	The recipe capability is being added. This will make a major improvement in data quality.
• Nutrient analyses	√√√√	The algorithms for the nutrient analyses are excellent but they are dependent on the quality of data collection and entry. Hence, the analyses generate errors. Quality in, quality out. Low quality, low quality out.		The algorithms are stellar and require no adjustments.
• WebNEERS Reports	√√√√	The algorithms for the reports are excellent but they are dependent on the quality of data collection and entry. Hence, they contain many errors. Quality in, quality out.		EFNEP coordinator training for the use of WebNEERS reports, including strengths and weaknesses of these reports would be recommended. A number of coordinators have confided they do not use the reports.

*per assessment by report authors – one √ = weak, two √√ = marginal, three √√√ = adequate, four √√√√ = strong, five √√√√√ = exemplary

5-step automated multiple-pass method [AMPM]

The 5-step automated multiple-pass method [AMPM] was developed and tested by USDA using a computer-assisted protocol (Moshfegh et al 2008). This 5-step approach, but without the computer assistance, has been adopted by EFNEP; many states are currently training staff to use the 5-step method (Sheik 2010; Townsend et al 2010). There are no published best practices studies to guide EFNEP professionals in the adoption of this AMPM protocol from a computer-assisted model with a trained interviewer to implementation without computer and

interviewer to a participant-recorded protocol with groups of low-income clients including those with limited literacy.

USDA's AMPM is a five-step, multiple-pass, interviewer-administered, computerized, 24 hour dietary recall method (Moshfegh et al 2008). The AMPM used by the USDA Food Surveys Research Group [FSRG] and the Department of Health and Human Services, National Center for Health Statistics for dietary data collection called 'What We Eat in America' as part of the National Health and Nutrition Examination Survey. The FSRG and its predecessor groups developed the 3- and 5-step multi-pass 24HDRs and has thoroughly vetted both 24HDR strategies and protocols for the trained interviewer-collected data from one subject using a computer-assisted individual model (3-step multi-pass 24HDR: Posner et al 1982; 5-step multi-pass 24 HDR: Conway et al 2004; Conway et al 2003; Moshfegh et al 2008). The validation studies were conducted with educated employees at the USDA laboratory (Conway et al 2003), obese and non-obese women (Moshfegh et al 2008), men (Conway et al 2003), elderly female food stamp recipients (Posner et al 1982) and using a telephone interview method (Posner et al 1982; Conway et al 2003). Foods are entered into the computer by the interviewer; the computer generates the probing questions customized to each respondent's foods. A telephone 24HDR was tested with rural low-income adults (Bogle et al 2001). Although sometimes considered by some as appropriate validation for the group recall, these studies did not employ protocols necessary for a group 24HDR. Therefore, the corresponding protocols for use in an EFNEP setting need to be developed and validated.

Funding for EFNEP evaluation research

A paucity of validation research on evaluation measures in general is a problem for programs serving low-income communities (Wallen et al 2011; Townsend et al 2009; Townsend 2006; Townsend et al 2008). The dearth of research for the group 24 HDR is surprising but consistent with the status of validation research for low-income programs. Validation experiments are difficult to execute and to execute correctly. There is a paucity of validation research on evaluation measures for all programs, but particularly those serving low-income communities (Contento et al. 2002; Townsend 2006). These experiments cannot be funded by EFNEP or SNAP-Ed, thus explaining the major reason why this work has not been executed (U.S. Department of Agriculture EFNEP Policies). Funding for research of this type is not permissible with these programmatic funds making grant writing to NIH and/or USDA NIFA AFRI funding sources essential. This type of research would establish the trustworthiness of evaluation tools and subsequently the outcomes they provide. This trustworthiness is essential for these nutrition education programs.

Limitations of this review

There are several limitations to consider when interpreting results presented in this review. There is a possibility of publication bias as only successful validation studies tend to be published. Searches were carefully conducted using major databases and the cross-referencing method, yet there is a possibility that the search terms may have left some studies undetected. The national EFNEP database housed at the Pennsylvania State University library was not searched because peer-reviewed journal studies are not differentially noted from non-peer-reviewed listings in that database.

CONCLUSION

The research base of the participant-recorded group-administered 24HDR for adult EFNEP evaluation consists of one study. This one study has methodological limitations due to substantial issues in study design and effect size, rendering a current lack of support for this evaluation method for EFNEP. Given that a proper scientific vetting of the participant-recorded group-administered 24HDR and best practices for the protocol, educator's script and participant's data collection form has never been reported in the peer reviewed literature, a priority should be given to such research. Additional research is needed to determine the best recall techniques for the EFNEP audience. Validation of participant-recorded group-administered 24-hour recalls using the five-step multiple-pass method, as recommended for individual 24-hour recalls by the literature, may be a next step. Thus, based on the body of evidence from our current expanded review and expert opinion revising the results from the earlier published McClellan et al. literature review, we conclude that the quality of the scientific underpinnings of the participant-recorded group-administered 24 HDR as used in EFNEP remains an unanswered question.

IMPLICATIONS FOR RESEARCH AND POLICY

The results of this review have implications for federal policy as it pertains to EFNEP. Two categories of recommendations emerged from this review. First, is the immediate and critical need for validation studies to support the EFNEP use of the participant-recorded group-administered version of the 24HDR at program entry and repeated at program exit. These studies should consider a research design comparing the group recall to a gold standard recall, the researcher-administered AMPM computer-assisted protocol for 24 hours or observation for one meal with sample sizes driven by power analyses. The goal would be to gain accountability for the EFNEP recall in a group setting where 87-90% of the recalls occurs.

The second category, is the critical need for a research base supporting best practices for the participant-recorded group-administered recall protocol, script and data collection form in the peer-reviewed journal literature. To facilitate accurate interpretation of EFNEP recall data, research should target many unanswered questions pertaining to the participant-recorded group-administered 24HDR as an evaluation tool. Some potential research questions are offered in [Table 12](#).

Table 12. Authors of this report propose 17 research questions for EFNEP research. The research questions are discussion topics for consideration.

#	Research question
1	How should the method [protocol, educator script, participant data collection form] vary when one educator administers the group 24HDR to 5, 15, 20 or 30 clients at a time?
2	What is the maximum number of participants in the group for valid recall results?
3	Is more than one educator required for valid results?
4	What is the protocol with two [or more] educators administering of the recall?
5	What are the best practices for the protocol for the group 24HDR?
6	What are the best practices for the educator's script?
7	What are the best practices for the paper data collection form for EFNEP participants?
8	What are the best practices for the paper data collection form for low-literacy participants? For various cultural groups? For mixed cultural groups?
9	What characteristics of the data collection form would facilitate group data collection?
10	How do outcomes vary for low-literacy participants with the 3-, 4- and 5-step multi-pass protocol?
11	An educator-reactive client-centered approach to the recall works well in setting with one participant, but not for a group of participants. Would an educator-proactive approach be an effective replacement?
12	What protocol would be most effective for low-literacy participants?
13	What are valid methods to use with minority cultural groups served by EFNEP?
With regard to alternative program evaluation options, questions to consider are:	
14	Do other evaluation practices, such as a more comprehensive behavioral checklist, provide more valid data than the group 24HDR? A systematic literature review should be explored to see what data currently exists. A tentative literature review suggests that food behavior checklist is more valid than a group or individual 24HDR with an EFNEP audience.
15	Is the computer-directed ASA24 feasible for literate participants?
16	Could sampling of participants enable educators to conduct 1:1 or 1:2 recalls, thus, improving the validity of the outcome data? Could a randomly selected sub-sample of EFNEP participants complete individual 24HDR phone recalls as an alternative evaluation to the participant-recorded group-administered 24HDR? A reviewer suggestion; EFNEP should "tax" every program and have someone like Penn State do multiple phone recalls with a small subset of participants.
17	Could we adapt the telephone-administered method with computer adapted from AMPM used by USDA Food Surveys Research Group to evaluate EFNEP? The purpose would be to have the educator administer an individual 24HDR and eliminate the participant-recorded group-administered 24HDR.

Our findings and analysis contribute to the literature in two important ways. First, professionals now have a clearer picture of the status of the existing research base for the group recall currently used in 50 states and 6 territories. Second, they can now move forward with important next steps in establishing a firm footing to support impact evaluation for this esteemed USDA program.

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Author contributions

Townsend and Wilson contributed to the literature search, concept and drafts of report with Townsend writing the first draft. Dr. Townsend designed the search with research librarian and student Katie Anderson. Katie Anderson conducted the searches and identified the records.

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Competing interest

Both Townsend and Wilson work with EFNEP in their respective states.

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APPENDICES

APPENDIX A Current 24HDR Issues in Peer-Reviewed Literature

What are the recent issues discussed in journals about the validity of INDIVIDUAL 24HDR? The validity of self-reported dietary intake has been hotly contested in the current nutrition and dietetics literature. The validity of self-report diet assessment methods, specifically the 24-hour dietary recall [24HDR], has been called into question. The limitations inherent in self-report methods of collecting dietary intake data have long been recognized. Currently, the validity of such data collected annually as part of the National Health and Nutrition Examination Survey [NHANES] is being called into question. Indeed, this concern has been the topic of several recent publications and editorial.

What is biological implausibility? Concern about the 24HDR involves biological implausibility. Under- or over-reporting [misreporting] of dietary intake produces errors that have long been recognized by professionals. Also recognized is that these errors can reach the level of being outside of the expected range of a given physiological status. These errors produce a dietary intake that is termed 'biologically implausible' (Mitka 2013). When significant misreporting occurs, especially underreporting, the interpretation and application of dietary data can be compromised. The recalls are considered biologically implausible and are not considered valid.

What about the validity of INDIVIDUAL 24HDR with EFNEP? We examined this concern in low-income Spanish speakers in California in a recently published study. In that paper, we report that 44% of a sample of low income, Mexican-American women reported implausible dietary intakes, affecting interpretation of how well the study population met intake estimates for several nutrients. We imputed activity levels based on a self-report questionnaire, calculated BMI from measured heights and weights, calculated the ratio of reported energy intake to calculated total energy expenditure, and used a widely accepted cut-off for plausibility; the key questions for our paper about EFNEP and SNAP-Ed clients, NHANES and other studies utilizing self-reported dietary intake data are: To what degree do the study's results reflect findings that may be classified as biologically implausible? Are the results adjusted for this implausibility? What is the impact of misreported data on the validity and value of the data, and on the subsequent interpretation and application of the data to nutrition recommendations at the individual, group and policy level?

Recent literature on validity of dietary data. Researchers reporting recently in the nutrition literature created a firestorm around the validity of 24HDRs used to make national policies and food-based guidelines. These researchers, Edward Archer and colleagues Gregory Hand and Steven Blair, presented in 2013 evidence showing that spanning the 39-year history of the NHANES, the majority of dietary recalls collected were not sufficiently accurate to be considered valid. The findings of Archer et al. will be presented in more detail because of its relevance to EFNEP (Archer et al. 2013). Although other researchers have raised concerns about the quality of self-report dietary recall data, they have not presented such striking arguments as Archer et al. have in their recent paper. These researchers examined the validity of data from over 62,000 men and women from NHANES I (1971-1974) through NHANES 2009-2010. They assessed energy expenditure values, i.e. metabolic need, for these adults using measured heights and weights and self-reported physical activity levels and compared them to the estimated energy intakes from the dietary recalls. The recalls did not contain sufficient calories to maintain body weight, indicating systematic errors primarily due to underreporting of food quantities or food omissions altogether. The recalls with substantial systematic errors are not considered biologically plausible. Archer et al. estimated that 67% of women's and 59% of men's recalls did not contain sufficient calories to maintain body weight and are thus termed implausible [not considered plausible]. Archer et al. emphasizes the concern that those NHANES results with implausible recalls are used to drive policy. James Hébert and colleagues responded to

Archer et al. in their 2014 paper (Hébert et al. 2014). They recognize that self-reported dietary data have long been challenged by measurement error: both systematic and random. However, Hébert et al. raise a number of issues regarding the arguments that Archer et al. present. Their paper focuses on identification of problems with the methods used in the analysis, as well as the use and strengths of NHANES data. Raising a methodological issue with the cut points used in Archer et al.'s paper, Hébert et al. argue that these may have inflated the number of mis-reporters, and that cut points should be more liberal in estimating habitual dietary intake. Others followed (Subar AF, et al., 2015).

What are the implications for EFNEP data? The group administered 24HDR diet recall is considered the cornerstone of the EFNEP evaluation system. If the recalls from NHANES, collected individually in a clinical setting using the sophisticated AMPM software are not considered sufficiently valid, what does that say for the quality of the less rigorous EFNEP recalls collected by a paraprofessional with an individual or in a group? Archer et al. holds that dietary data from NHANES are largely invalid, and that the potential for use of self-reported dietary intake is extremely limited. Others have argued in support of the individually-administered 24HDR for the purposes to which they are put. This is the topic of this report.

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Article 1: Frankenfeld 2012

J Acad Nutr Diet. 2012 Oct;112(10):1642-7. doi: 10.1016/j.jand.2012.06.003. Epub 2012 Aug 9.

Dietary intake measured from a self-administered, online 24-hour recall system compared with 4-day diet records in an adult US population.

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The objective of this study was to compare nutrient intake of two 24-hour recalls collected using the Automated Self-Administered 24-Hour Dietary Recall to a 4-day food record. A convenience sample of university-affiliated adults was chosen because of the diverse population at this university. Ninety-three participants completed the 4-day record and were then prompted to complete two 24-hour recalls within 2 weeks after. Pearson correlation coefficients were calculated for nutrient intake and Healthy Eating Index 2005 (HEI-2005), a summary measure of diet quality. Nutrients and HEI-2005 were also divided into quartiles and percent agreement and κ values were calculated. Results indicated that mean nutrient intakes were similar across the recall and record. Pearson correlations comparing the record and recall ranged from 0.16 to 0.78; with most correlations being between 0.4 and 0.6. For quartiles of dietary intake, percent agreement was moderately high (62.6% to 79.8%), with low to moderate κ values ($\kappa=0.11$ to 0.52). The 24-hour recall provided a good overall ranking of intake compared to a 4-day food record. Overall correlations and percent agreement were moderate across the nutrients and HEI-2005, suggesting that the 24-recalls may have been capturing different information than the food record in our population. Individual researchers will need to weigh the benefits of a more automated system, such as efficiency, against the potential loss of food item detail and potential need for larger sample sizes, for their particular study populations.

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PMID: 22878341 [PubMed - indexed for MEDLINE]

Article 2: Baranowski 2012

J Acad Nutr Diet. 2012 Apr;112(4):527-32. doi: 10.1016/j.jada.2011.10.002. Epub 2012 Feb 1.

Comparison of a Web-based versus traditional diet recall among children.

Baranowski T, Islam N, Baranowski J, Martin S, Beltran A, Dadabhoy H, Adame SH, Watson KB, Thompson D, Cullen KW, Subar AF.

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Self-administered instruments offer a low-cost diet assessment method for use in adult and pediatric populations. This study tested whether 8- to 13-year-old children could complete an early version of the Automated Self Administered 24-hour diet recall (ASA24) and how this compared to an interviewer-administered 24-hour diet recall. One-hundred twenty 8- to 13-year-old children were recruited in Houston from June through August 2009 and randomly assigned to complete either the ASA24 or an interviewer-administered 24-hour diet recall, followed by the other recall mode covering the same time interval. Multivariate analysis of variance, testing for differences by age, sex, and ethnic/racial group, were applied to percentages of food matches, intrusions, and omissions between reports on the ASA24 and the interviewer-administered 24-hour diet recall. For the ASA24, qualitative findings were reported regarding ease of use. Overall matches between interviewer-administered and ASA24 self-administered 24-hour diet recall was 47.8%. Matches were significantly lower among younger (8- to 9-year-old) compared with older (10- to 13-year-old) children. Omissions on ASA24 (18.9% overall) were most common among 8-year-olds and intermediate among 9-year-olds. Eight- and 9-year-olds had substantial difficulties and often required aid in completing ASA24. Findings from this study suggest that a simpler version of an Internet-based diet recall program would be easier for children to use.

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PMCID: PMC3379547 PMID: 22717216 [PubMed - indexed for MEDLINE]

Article 3: Subar 2012

J Acad Nutr Diet. 2012 Aug;112(8):1134-7. doi: 10.1016/j.jand.2012.04.016. Epub 2012 Jun 15.

The Automated Self-Administered 24-hour dietary recall (ASA24): a resource for researchers, clinicians, and educators from the National Cancer Institute.

Subar AF, Kirkpatrick SI, Mittl B, Zimmerman TP, Thompson FE, Bingley C, Willis G, Islam NG, Baranowski T, McNutt S, Potischman N.

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Extensive evidence has demonstrated that 24-hour-dietary recalls (24HDRs) provide high-quality dietary intake data with minimal bias, making them the preferred tool for monitoring the diets of populations and, increasingly, for studying diet and disease associations. Traditional 24HDRs, however, are expensive and impractical for large-scale research because they rely on trained interviewers, and multiple administrations are needed to estimate usual intakes. To address these challenges, the National Center Institute (NCI), in collaboration with the research firm Westat (Rockville, MD), and with the support of other institutes and offices at the National Institutes

of Health, developed the Automated Self-Administered 14-hour dietary recall (ASA24). ASA24 is a public-access, freely available, web-based tool for researchers, clinicians and educators, modeled on the Automated Multiple Pass Method (SMPM). Development of an automated self-administered 14HDR for adults began in 2006 and was informed by input from stakeholders participating in an External Working Group and small-scale cognitive and usability testing. A Beta version released in August 2009 has been used by over 175 researchers to collect over 40,000 recalls; Version 1, which offers improved usability and new features, was released in September 2011. A modified version intended for self-administration by children is under development by researchers at the Baylor College of Medicine (Houston, TX) and is expected to be available mid-2012. This paper describes the features of ASA24 and planned evaluations.
PMID: 22704899 [PubMed - indexed for MEDLINE]

Article 4: Slimani 2011

Eur J Clin Nutr. 2011 Jul;65 Suppl 1:S5-15. doi: 10.1038/ejcn.2011.83.

The standardized computerized 24-h dietary recall method EPIC-Soft adapted for pan-European dietary monitoring.

Slimani N, Casagrande C, Nicolas G, Freisling H, Huybrechts I, Ocké MC, Niekerk EM, van Rossum C, Bellemans M, De Maeyer M, Lafay L, Krems C, Amiano P, Trolle E, Geelen A, de Vries JH, de Boer EJ; EFCOVAL Consortium.

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BACKGROUND/OBJECTIVES: The EPIC-Soft program (the software initially developed to conduct 24-h dietary recalls (24-HDRs) in the European Prospective Investigation into Cancer and Nutrition (EPIC) Study) was recommended as the best way to standardize 24-HDRs for future pan-European dietary monitoring. Within European Food Consumption Validation (EFCOVAL), EPIC-Soft was adapted and further developed on various aspects that were required to optimize its use. In this paper, we present the structure and main interview steps of the EPIC-Soft program, after implementation of a series of new specifications deemed to satisfy specific requirements of pan-European monitoring surveys and other international studies.

SUBJECTS/METHODS: Updates to optimize the EPIC-Soft program were ascertained according to the following stepwise approach: (1) identification of requested specifications to be potentially implemented through an ad hoc 'EPIC-Soft specifications questionnaire' sent to past, current and possible future users of the software; (2) evaluation of the specifications in collaboration with two ad hoc task force groups and through a workshop; (3) development of a technical solution for each retained specification; (4) implementation of the specifications by software developers; (5) testing and amendment of bugs.

RESULTS: A number of new specifications and facilities were implemented to EPIC-Soft program. In addition, the software underwent a full reprogramming and migration to a modern Windows environment, including changes in its internal architecture and user interface.

Although the overall concept and structure of the initial software were not changed substantially, these improvements ease the current and future use of EPIC-Soft and increase further its adaptation to other countries and study contexts.

CONCLUSIONS: EPIC-Soft is enriched with further functions and facilities expected to fulfil specific needs of pan-European dietary monitoring and risk assessment purposes. The validity, feasibility and relevance of this software for different national and international study designs, and the logistical aspects related to its implementation are reported elsewhere.

PMID: 21731006 [PubMed - indexed for MEDLINE]

Article 5: Liu 2011

Public Health Nutr. 2011 Nov;14(11):1998-2005. doi: 10.1017/S1368980011000942.

Epub 2011 Jun 1.

Development and evaluation of the Oxford WebQ, a low-cost, web-based method for assessment of previous 24 h dietary intakes in large-scale prospective studies.

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OBJECTIVES: To describe the development of the Oxford WebQ, a web-based 24 h dietary assessment tool developed for repeated administration in large prospective studies; and to report the preliminary assessment of its performance for estimating nutrient intakes.

DESIGN: We developed the Oxford WebQ by repeated testing until it was sufficiently comprehensive and easy to use. For the latest version, we compared nutrient intakes from volunteers who completed both the Oxford WebQ and an interviewer-administered 24 h dietary recall on the same day.

SETTING: Oxford, UK.

SUBJECTS: A total of 116 men and women.

RESULTS: The WebQ took a median of 12.5 (interquartile range: 10.8-16.3) min to self-complete and nutrient intakes were estimated automatically. By contrast, the interviewer-administered 24 h dietary recall took 30 min to complete and 30 min to code. Compared with the 24 h dietary recall, the mean Spearman's correlation for the 21 nutrients obtained from the WebQ was 0.6, with the majority between 0.5 and 0.9. The mean differences in intake were less than $\pm 10\%$ for all nutrients except for carotene and vitamins B12 and D. On rare occasions a food item was reported in only one assessment method, but this was not more frequent or systematically different between the methods.

CONCLUSIONS: Compared with an interviewer-based 24 h dietary recall, the WebQ captures similar food items and estimates similar nutrient intakes for a single day's dietary intake. The WebQ is self-administered and nutrients are estimated automatically, providing a low-cost method for measuring dietary intake in large-scale studies.

PMID: 21729481 [PubMed - indexed for MEDLINE]

Article 6: Wallen 2011

J Nutr Educ Behav. 2011 Jan-Feb;43(1):50-4. doi: 10.1016/j.jneb.2009.12.008.

Validation of a group-administered pictorial dietary recall with 9- to 11-year-old children.

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Department of Food Science and Human Nutrition, Colorado State University, Fort Collins, CO 80523-1571, USA.

OBJECTIVE: Determine validity of Day in the Life Questionnaire-Colorado (DILQ-CO) as a dietary assessment tool for classroom-administered use.

METHODS: Agreement between DILQ-CO responses and weighed plate waste measured in 125 fourth-grade students in 2 low-income schools. Validity assessed by comparing reported school lunch items and portion size estimations on DILQ-CO to plate waste. Agreement calculated using Spearman correlations, κ statistic, percent agreement, exclusions, intrusions, and mismatches.

RESULTS: Substantial-to-almost-perfect agreements for students' reports of food eaten in all but the dessert category (κ coefficients: 0.65-0.97; 81%-99% matches). Significant correlations ($P \leq .05$) were found between students' reports of how much was eaten and plate waste measurements for 6 of 10 items; agreement ranged from 47%-82%.

CONCLUSIONS AND IMPLICATIONS: Classroom-administered DILQ-CO provided a valid measure of reported school lunch items, with amounts reported eaten of lower but still acceptable agreement. This tool shows promise as a group-administered dietary recall with children.

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PMID: 21216366 [PubMed - indexed for MEDLINE]

Article 7: Sun 2010

J Am Diet Assoc. 2010 May;110(5):773-8. doi: 10.1016/j.jada.2010.02.003.

Reliability and predictive validity of energy intake measures from the 24-hour dietary recalls of homebound older adults.

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Twenty-four-hour dietary recalls are used frequently to study homebound older adults' eating behaviors. However, the reliability and predictive validity of this method have not been established in this population. The purpose of this study was to examine whether homebound older adults provide reliable and valid measures of total energy intake in 24-hour dietary recalls. Two hundred thirty homebound older adults were interviewed in their homes using a questionnaire to assess eating behaviors and factors that could affect those behaviors. Participants completed three 24-hour dietary recalls at baseline and again at 6-month follow-up. Two subsamples were identified for analyses. For participants who were not hospitalized during the 6-month interval and had their weight measured at both assessments ($n=52$), sufficient test-retest reliability of energy intake was observed ($r=0.59$), but energy intake deficiencies relative to estimated energy requirements did not predict actual weight loss ($r=0.08$). When this sample was supplemented with 91 participants who experienced any adverse event (weight loss of 2.5% or more, hospitalization, institutionalization, or mortality) in the 6-month period ($n=143$), adverse events were more likely to occur for those with insufficient energy intake (odds ratio 3.49, $P=0.009$), and in white participants compared to African-American participants (odds ratio 3.13, $P=0.016$). Adequate test-retest reliability of the 24-hour dietary recall was demonstrated, but additional research with larger samples and longer follow-up intervals is needed to better evaluate the predictive validity of energy intake measures for this population.

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PMCID: PMC2869206 PMID: 20430140 [PubMed - indexed for MEDLINE]

Article 8: Subar 2007

J Am Diet Assoc. 2007 Jun;107(6):1002-7.

Formative research of a quick list for an automated self-administered 24-hour dietary recall.

Subar AF, Thompson FE, Potischman N, Forsyth BH, Buday R, Richards D, McNutt S, Hull SG, Guenther PM, Schatzkin A, Baranowski T.

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Twenty-four-hour dietary recalls are used to collect high-quality dietary data. Because they require highly trained interviewers, recalls are expensive and impractical for large-scale nutrition research, leading to the use of food frequency questionnaires. We are developing a computer-based, self-administered 24-hour dietary recall for use by adults. Our goal is an easy-to-use, low-cost, publicly available, Web-enabled instrument that will include elements of the Automated Multiple Pass Method developed by the US Department of Agriculture, which uses five passes to enhance recall. The initial pass is called the "quick list" and allows respondents to report foods consumed the previous day freely, in any order, and without detail. Using a crossover design, we conducted initial formative pilot testing among 18 adults

in a self-administered computer environment. We tested two versions of a "quick list" (the first Automated Multiple Pass Method pass) for remembering foods consumed the previous day: "unstructured" and "meal-based." Respondents showed a strong preference for the meal-based version (13 of 18), although positive features of both were identified. Chronological reporting was most common, although many foods were sporadically reported out of order. Versions did not appreciably differ in number of foods reported, moved, or deleted. Usability issues and preferences were also identified. If these developmental efforts prove successful, the use of affordable automated recalls could be valuable in clarifying diet-disease associations in observational epidemiologic studies and measuring dietary compliance in clinical trials. This pilot work illustrates the usefulness of formative cognitive and usability testing for questionnaire and software development.

PMID: 17524721 [PubMed - indexed for MEDLINE]

Article 9: Zoellner 2005

J Am Diet Assoc. 2005 Aug;105(8):1206-14.

Comparative validation of a bilingual interactive multimedia dietary assessment tool.

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OBJECTIVE: To perform comparative validity testing for a bilingual interactive multimedia (IMM) dietary assessment tool that mimics a dietary recall against an interview-administered dietary recall.

DESIGN: This was a two-period crossover design study. First, participants were randomly assigned to complete an IMM recall or interview-administered 24-hour recall. The IMM recall generated a nutrient profile that included 20 dietary constituents. The interview-administered recall was analyzed using the Food Intake Analysis System (FIAS) and the Expanded Food and Nutrition Education Program (EFNEP) Evaluating/Reporting System. The effect of substituting standardized portion sizes for reported portion sizes was examined.

SUBJECTS/SETTING: Of 80 adult participants, 71 (91%) were female, 45 (56%) had 12th grade or less education, 65 (81%) had an annual income of dollar 15,000 or less, and 21 (26%) completed the IMM recall in Spanish.

STATISTICAL ANALYSES PERFORMED: Analysis of variance and unadjusted and energy-adjusted correlations were used.

RESULTS: No significant group differences were found for order of administration or demographic characteristics. There was only one significant ($P=.025$) method effect, whereby vitamin C intake was higher in the IMM recall than the FIAS. The unadjusted correlations between the IMM recalls and interview-administered recalls analyzed using both FIAS and EFNEP Evaluating/Reporting System were generally approximately 0.6. Energy-adjusted correlations were consistently lower. Substituting standardized portion sizes resulted in significant differences for six nutrients and caused all correlations to decrease.

CONCLUSIONS: The IMM dietary recall is a valid method for assessing dietary intake within the tested group. The results of comparative validity testing and positive reactions received from participants and nutrition educators indicate that diet assessment using IMM has tremendous potential.

PMID: 16182635 [PubMed - indexed for MEDLINE]

Article 10: Vereecken 2005

Eur J Clin Nutr. 2005 May;59(5):658-67.

Young adolescents' nutrition assessment on computer (YANA-C).

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OBJECTIVE: To assess the relative validity and acceptability of the computerised 24-h recall 'Young Adolescent's Nutrition Assessment on Computer (YANA-C)'.

DESIGN: Food and nutrient intakes assessed with YANA-C were compared with food records (study 1) and 24-h dietary recall interviews (study 2).

MAIN OUTCOME MEASURES: Intakes of food groups (fruit, fruit juice, vegetables, potatoes, bread, cereals, milk, cheese, other milk products, soft drinks, diet soft drinks, sugar/sweets, pastry/cookies, savoury snacks, butter/sauces, eggs, fish, meat) and nutrients (energy, carbohydrates, protein, fat, fiber, calcium, vitamin C and iron).

SUBJECTS AND SETTING: A total of 237 pupils (11-14 y) from two primary and four secondary schools (study 1: $n = 136$; study 2: $n = 101$) in Belgium-Flanders.

RESULTS: YANA-C proved to agree well with both standard methods in categorizing subjects in consumers and nonconsumers (κ (study 1) = 0.48-0.92; κ (study 2) = 0.38-0.90). Spearman's correlations for energy and nutrient intakes ranged between 0.44 and 0.79 for study 1 and between 0.44 and 0.86 for study 2. Nutrient and energy intakes were in general (excluding calcium) significantly higher in YANA-C in comparison with the food record, but not in comparison with the interview (only fiber). Statistics used to investigate whether YANA-C agreed with the other methods in ranking portions/amounts in consumers only were fair to moderate for most of the food groups (weighted κ study 1 = 0.11-0.55; study 2 = 0.04-0.73); amounts in consumers only, were significantly lower in YANA-C against both standards for cereals; amounts were significantly higher in YANA-C against the food record for milk, soft drinks, sugar/sweets and savoury snacks and against the interview for potatoes. Only a few pupils evaluated the program negatively.

CONCLUSION: YANA-C is a promising method to collect detailed dietary information from young adolescents with relatively low staff resources, useful in many nutrition research applications.
PMID: 15741983 [PubMed - indexed for MEDLINE]

Article 11: Yanek 2001

J Am Diet Assoc. 2001 Nov;101(11):1361-4.

Comparison of food frequency and dietary recall methods in African-American women.

Yanek LR, Moy TF, Becker DM.

Center for Health Promotion, Johns Hopkins University, Baltimore, MD 21205, USA.

Objective To examine the comparative accuracy of telephone and in-person 24-hour dietary recall methods.

Subjects One hundred eighty-five African-American females, aged 40 years and older, recruited from Sunday church services in Baltimore City, Md.

Methods Participants were trained to estimate portion size with plastic food models and a 2-dimensional food recall booklet. Dietary intake was then assessed with 2 in-person 24-hour dietary recalls and 1 telephone 24-hour dietary recall, all using a computer-assisted, multiple pass approach. Results from the 2 in-person recalls were averaged and compared with the results from the telephone recall.

Statistical analyses Cross-tabulation, paired *t* test, Pearson's correlation, chance-corrected agreement, and stepwise linear regression analyses were performed.

Results There were no significant differences between the telephone and in-person methods for any nutrient. Agreement between methods was moderate for all major dietary components, with corrected correlations between methods ranging from 0.26 to 0.97 ($P < .001$), and kappas ranging from 0.155 to 0.372 ($P < .01$). Levels of low-energy reporting were high (88% telephone, 91% in-person), though there were no significant differences between methods.

Conclusions The telephone 24-hour dietary recall method appears to be comparable to the standard in-person method among older African-American women. Portion-size training in person may make subsequent telephone dietary recalls acceptable in this population.
PMID: 11716320 [PubMed - indexed for MEDLINE]

Article 12: Slimani 2000

Eur J Clin Nutr. 2000 Dec;54(12):900-17.

Standardization of the 24-hour diet recall calibration method used in the European prospective investigation into cancer and nutrition (EPIC): general concepts and preliminary results.

Slimani N, Ferrari P, Ocké M, Welch A, Boeing H, Liere M, Pala V, Amiano P, Lagiou A, Mattisson I, Stripp C, Engeset D, Charrondière R, Buzzard M, Staveren W, Riboli E.

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OBJECTIVES: Despite increasing interest in the concept of calibration in dietary surveys, there is still little experience in the use and standardization of a common reference dietary method, especially in international studies. In this paper, we present the general theoretical framework and the approaches developed to standardize the computer-assisted 24 h diet recall method (EPIC-SOFT) used to collect about 37,000 24-h dietary recall measurements (24-HDR) from the 10 countries participating in the European Prospective Investigation into Cancer and Nutrition (EPIC). In addition, an analysis of variance was performed to examine the level of standardization of EPIC-SOFT across the 90 interviewers involved in the study.

METHODS: The analysis of variance used a random effects model in which mean energy intake per interviewer was used as the dependent variable, while age, body mass index (BMI), energy requirement, week day, season, special diet, special day, physical activity and the EPIC-SOFT version were used as independent variables. The analysis was performed separately for men and women.

RESULTS: The results show no statistical difference between interviewers in all countries for men and five out of eight countries for women, after adjustment for physical activity and the EPIC-SOFT program version used, and the exclusion of one interviewer in Germany (for men), and one in Denmark (for women). These results showed an interviewer effect in certain countries and a significant difference between gender, suggesting an underlying respondent's effect due to the higher under-reporting among women that was consistently observed in EPIC. However, the actual difference between interviewer and country mean energy intakes is about 10%. Furthermore, no statistical differences in mean energy intakes were observed across centres from the same country, except in Italy and Germany for men, and France and Spain for women, where the populations were recruited from areas scattered throughout the countries.

CONCLUSION: Despite these encouraging results and the efforts to standardize the 24-HDR interview method, conscious or unconscious behaviour of respondents and/or interviewer bias cannot be prevented entirely. Further evaluation of the reliability of EPIC-SOFT measurements will be conducted through validation against independent biological markers (nitrogen, potassium).

PMID: 11114689 [PubMed - indexed for MEDLINE]

Article 13: Kahn 1995

Ann Epidemiol. 1995 Nov;5(6):484-9.

Validity of 24-hour dietary recall interviews conducted among volunteers in an adult working community.

Kahn HA, Whelton PK, Appel LJ, Kumanyika SK, Meneses JL, Hébert PR, Woods M.

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There is considerable uncertainty regarding the validity of dietary data collected from free-living populations. Nevertheless, few attempts have been made to validate dietary assessment instruments. To address this issue, we compared average daily protein intake estimated from 24-hour dietary recall interviews to protein intake estimated from urinary nitrogen excretion in 24-hour samples. Among 244 community-dwelling adults who volunteered for a hypertension study, men (n = 139) overreported dietary protein intake by 12 to 19%. In contrast, women (n = 105) reported a dietary protein intake almost exactly in agreement with estimates based on urinary nitrogen levels. Thin men reported about one-third more protein intake than was reflected in their urinary nitrogen measurements. Our results suggest that the accuracy of dietary recall estimates may vary across subgroups of the population. Additional information from sufficiently large validation studies would be helpful in determining the role of dietary assessment instruments which are already in wide use in epidemiologic research. Until such information is obtained, doubts will remain regarding the validity of inferences drawn from nutritional epidemiologic studies.

PMID: 8680612 [PubMed - indexed for MEDLINE]

Article 14: Nicklas 1991

J Am Diet Assoc. 1991 Jun;91(6):711-3.

School lunch assessment to improve accuracy of 24-hour dietary recall for children.

Nicklas TA, Forcier JE, Webber LS, Berenson GS.

Cardiology Section, Louisiana State University Medical Center, New Orleans 70112-2865.

The critical need for improved methodology for dietary assessment is as much as concern today as ever [1-5]. Since the inception of the Bogalusa Heart Study, long-term epidemiologic investigation of cardiovascular risk factors in children and young adults residing in Bogalusa, La, more than 3,000 dietary recalls have been collected. Protocols for the Bogalusa dietary studies include five quality controls [6,7]. The purpose of this article is to describe in detail one of these quality controls--the school lunch assessment--that will improve the accuracy of the school lunch information in 24-hour dietary intakes of children.

PMID: 2040787 [PubMed - indexed for MEDLINE]

Article 15: Treiber 1990

J Am Diet Assoc. 1990 Jun;90(6):814-20.

Dietary assessment instruments for preschool children: reliability of parental responses to the 24-hour recall and a food frequency questionnaire.

Treiber FA, Leonard SB, Frank G, Musante L, Davis H, Strong WB, Levy M.

Department of Pediatrics, Georgia Institute for the Prevention of Human Disease and Accidents, Medical College of Georgia, Augusta 30192-3770.

Nutrient intakes of preschool-age children were assessed with a 24-hour dietary recall and a 3-month food frequency questionnaire (FFQ). Parents of 55 preschoolers (mean age = 4.25 +/- 0.59 years) completed the recall and FFQ on two occasions 1 week apart. The recalls and FFQs were analyzed for energy, cholesterol, protein, total carbohydrate, calcium, sodium, potassium, and saturated, polyunsaturated, and monounsaturated fats; each nutrient was expressed as raw value, value per kg body weight, and value per 1,000 kcal. Test-retest reliability estimates for the 24-hour recall indicated significant variability in reported total energy intake, but stable reports of intake were observed for one or all units of expression for polyunsaturated fats, cholesterol, protein, total carbohydrate, calcium, and potassium. The FFQ showed significant positive test-retest reliability estimates for all nutrients for all units of expression. Comparison of the recall and FFQ data showed similar percentages of intakes of energy from fat, carbohydrate, and protein and significant correlations for reported intakes of cholesterol, protein, calcium, and potassium. Comparison of the recall and FFQ data with recall data from a comparable cohort showed lower reported intakes for our sample, with the exception of protein, carbohydrate, calcium, and potassium. If validation studies are successful, the FFQ may be useful in epidemiological studies of preschoolers' intakes over extended periods. The recall may prove to be a useful tool in the assessment of day-to-day variations in macronutrient intakes.

PMID: 2345254 [PubMed - indexed for MEDLINE]

Article 16: Posner 1982

Am J Clin Nutr. 1982 Sep;36(3):546-53.

The validity of a telephone-administered 24-hour dietary recall methodology.

Posner BM, Borman CL, Morgan JL, Borden WS, Ohls JC.

This study assesses the operational feasibility and validity of a unique telephone-administered 24-h dietary recall methodology. Dietary interviews were conducted by telephone with 204 low-income elderly subjects. Food portion size estimation was done using a two-dimensional food portion visual aid that was mailed to respondents' homes. The mean intakes and distributions of nine nutrients among males and females in the research sample were compared with those reported in the 1971 to 1974 Health and Nutrition Examination Survey. After correcting for time trends in nutrient intake, the mean intake values found in the survey were very similar to those reported by the Health and Nutrition Examination Survey. In testing the frequency distributions of intakes, only two nutrients for

women and one for men had statistically significant differences. The telephone-administered dietary methodology thus produced acceptable estimates of the means and distributions of nutrient intakes among groups of individuals and has the potential of markedly reducing the cost, time, logistical, and personnel constraints associated with nutrition surveys.

PMID: 6180624 [PubMed - indexed for MEDLINE]

Article 17: Gersovitz 1978

J Am Diet Assoc. 1978 Jul;73(1):48-55.

Validity of the 24-hr. dietary recall and seven-day record for group comparisons.

Gersovitz M, Madden JP, Smiciklas-Wright H.

The internal validity of a 24-hr. dietary recall and a seven-day dietary record was investigated among a group of non-institutionalized elderly subjects who were participating in a congregate meals program. Internal validity was assessed by comparing reported intake with unobtrusively obtained data on actual intake. Validity results suggest that the recall is prone to over-reporting low intakes and under-reporting high intakes. This pattern has been referred to as the "flat-slope syndrome." Records collected during the first few days were less prone to this syndrome; however, validity declined by the fifth, sixth, and seventh record days. Also, as the record progressed to the seventh day, the demographic nature of the sample became biased due to drop-outs and decreased usability of the records.

PMID: 659761 [PubMed - indexed for MEDLINE]

Article 18: Graham 1977

Am J Clin Nutr. 1977 Dec;30(12):1939-41.

Validity of 24-hr dietary recall.

Graham GG.

PMID: 930864 [PubMed - indexed for MEDLINE]

Article 19: Frank 1977

J Am Diet Assoc. 1977 Jul;71(1):26-31.

Adapting the 24-hr. recall for epidemiologic studies of school children.

Frank GC, Berenson GS, Schilling PE, Moore MC.

Chemical analysis of food actually eaten would be the most accurate method for analyzing the diets of children, but this technique is not feasible for most nutrition staffs. An improved 24-hr. dietary recall can be used by a small, well trained staff to collect more reliable data on a large number of school children. Vigilant monitoring of school lunch operations, incorporation of known recipes in the ETV and organizing probing techniques are necessary to insure the reliability of the tool. The low coefficients of variation of duplicate recalls noted in the study indicate that the error of measurement between interviewers is small, if the tool is carefully tested and sophisticated before use in the field and if observers are carefully trained by a written protocol.

PMID: 864159 [PubMed - indexed for MEDLINE]

Article 20: Madden 1976

J Am Diet Assoc. 1976 Feb;68(2):143-7.

Validity of the 24-hr. recall. Analysis of data obtained from elderly subjects.

Madden JP, Goodman SJ, Guthrie HA.

Tests of the validity of the 24-hr. dietary recall were done by comparing actual with recalled intakes for eight nutrients and the MAR (mean adequacy ratio) for a sample of seventy-six subjects age sixty years or older. Validity was tested by using paired-t tests and regression analysis. In the paired-t test, no significant difference was found between the mean recalled and the mean actual intake of nutrients, with the exception of calories. Using regression analysis, results indicated that for three of the eight nutrients considered (calories, protein, and vitamin A), small intakes tend to be over-reported and large intakes under-reported (p less than .05). Thus, for these three nutrients, the recall seems to be statistically conservative for group comparisons; it would seldom, if ever, indicate a difference in intake where no difference exists. But, it could yield a false negative, i.e., an indication of no significant difference, when, in fact, a difference does exist. Clearly, more research is needed, both to replicate this study and to develop techniques with greater internal validity for comparing the dietary intakes of groups.

PMID: 1245715 [PubMed - indexed for MEDLINE]

Article 21: Conway 2004

J Am Diet Assoc. 2004 Apr;104(4):595-603.

Accuracy of dietary recall using the USDA five-step multiple-pass method in men: an observational validation study.

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OBJECTIVE: This observational validation study was conducted under controlled conditions to test the accuracy of dietary recall in normal weight, overweight, and obese men using the USDA five-step multiple-pass method for dietary recall.

DESIGN: Cross-sectional analysis of actual and recalled intake of food during 1 day.

SUBJECTS/SETTING: Forty-two men ranging in age from 21 to 65 years and in body mass index from 21 to 39 kg/m² who lived in the metropolitan Washington DC area were studied.

INTERVENTION: The subjects selected and consumed all meals and snacks, for 1 day, from a wide variety of foods provided at a human study facility.

MAIN OUTCOME MEASURES: Actual and recalled energy, protein, carbohydrate, and fat intakes were determined by direct observation and by a 24-hour dietary recall, respectively. Dietary recall was determined via telephone administration of the USDA five-step multiple-pass method the following day.

STATISTICAL ANALYSES PERFORMED: Analysis of variance and covariance tested the overall accuracy of recall and the effect of body mass index on dietary recall. Bland-Altman plots were used to assess bias in recall of food intake.

RESULTS: In this population of men, there were no significant differences between actual and recalled intakes of energy (3,294 \pm 111 and 3,541 \pm 124 kcal/day), protein (117 \pm 5 and 126 \pm 5 g/day), carbohydrate (414 \pm 16 and 449 \pm 16 g/day), or fat (136 \pm 7 and 146 \pm 8 g/day), respectively. Accuracy of recall was not related to body mass index in that the obese men recalled food intake as accurately as the nonobese men. The energy intake of these men was significantly correlated ($r=0.57$, $P<0.05$) with their estimated energy requirements. Significant interindividual variation in accuracy of recall was found.

CONCLUSIONS: Under controlled conditions, the USDA five-step multiple-pass method can accurately assess intakes of energy, protein, carbohydrate, and fat in a population of men regardless of their body mass index. Researchers and clinical dietitians need to continue to examine factors that influence underreporting and overreporting of food intake by the multiple-pass 24-hour recall method.

PMID: 15054345 [PubMed - indexed for MEDLINE]

Article 22: Conway 2003

Am J Clin Nutr. 2003 May;77(5):1171-8.

Effectiveness of the US Department of Agriculture 5-step multiple-pass method in assessing food intake in obese and nonobese women.

Conway JM, Ingwersen LA, Vinyard BT, Moshfegh AJ.

Diet and Human Performance Laboratory, US Department of Agriculture, Agricultural Research Service, Beltsville Agricultural Research Center, Beltsville Human Nutrition Research Center, Beltsville, MD 20705, USA.

conway@bhnrc.arsusda.gov

BACKGROUND: National surveys of food intake rely on the 24-h dietary recall method for assessing the nutrient intakes of Americans.

OBJECTIVES: This observational validation study was conducted under controlled conditions to test the effectiveness of the US Department of Agriculture (USDA) 5-step multiple-pass method for dietary recall; to test the ability of normal weight, overweight, and obese women to recall food intake; and to test the accuracy of macronutrient recall.

DESIGN: Women ($n = 49$) aged 21-65 y with a body mass index (in kg/m²) of 20-45 selected all meals and snacks for 1 d from a wide variety of foods. A 24-h dietary recall with the use of the USDA 5-step multiple-pass method was administered by telephone the following day. Analysis of variance and covariance tested the overall accuracy of recall and the effect of BMI on dietary recall.

RESULTS: As a population, the women overestimated their energy and carbohydrate intakes by 8-10%. No significant differences between mean actual and recalled intakes of energy and the macronutrients were observed in the obese women. Normal-weight and overweight women significantly ($P < 0.01$) overestimated their energy, protein, and carbohydrate intakes. Recalled fat intake was not significantly different from actual intake in women across the BMI range studied.

CONCLUSIONS: The USDA 5-step multiple-pass method effectively assessed mean energy intake within 10% of mean actual intake on the previous day. Obese women more accurately recalled food intake than did overweight and normal-weight women despite underreporting on the day of the study.

PMID: 12716668 [PubMed - indexed for MEDLINE]

Article 23: Baxter 2010

J Am Diet Assoc. 2010 Aug;110(8):1178-88. doi: 10.1016/j.jada.2010.05.006.

Shortening the retention interval of 24-hour dietary recalls increases fourth-grade children's accuracy for reporting energy and macronutrient intake at school meals.

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BACKGROUND: Accurate information about children's intake is crucial for national nutrition policy and for research and clinical activities. To analyze accuracy for reporting energy and nutrients, most validation studies utilize the "conventional approach," which was not designed to capture errors of reported foods and amounts. The "reporting-error-sensitive approach" captures errors of reported foods and amounts.

OBJECTIVE: To extend results to energy and macronutrients for a validation study concerning retention interval (elapsed time between to-be-reported meals and the interview) and accuracy for reporting school-meal intake, the conventional and reporting-error-sensitive

approaches were compared.

DESIGN AND PARTICIPANTS/SETTING: Fourth-grade children (n=374) were observed eating two school meals, and interviewed to obtain a 24-hour recall using one of six interview conditions from crossing two target periods (prior 24 hours and previous day) with three interview times (morning, afternoon, and evening). Data were collected in one district during three school years (2004-2005, 2005-2006, and 2006-2007).

MAIN OUTCOME MEASURES: Report rates (reported/observed), correspondence rates (correctly reported/observed), and inflation ratios (intruded/observed) were calculated for energy and macronutrients.

STATISTICAL ANALYSES PERFORMED: For each outcome measure, mixed-model analysis of variance was conducted with target period, interview time, their interaction, and sex in the model; results were adjusted for school year and interviewer.

RESULTS: With the conventional approach, report rates for energy and macronutrients did not differ by target period, interview time, their interaction, or sex. With the reporting-error-sensitive approach, correspondence rates for energy and macronutrients differed by target period (four P values <0.0001) and the target period by interview-time interaction (four P values <0.0001); inflation ratios for energy and macronutrients differed by target period (four P values <0.0001), and inflation ratios for energy and carbohydrate differed by the target period by interview-time interaction (both P values <0.005).

CONCLUSIONS: Shortening the retention interval of dietary recalls increases accuracy for reporting energy and macronutrients. For validation studies, it is best to obtain reference information from a method that provides details about foods and amounts consumed and to use an analytic approach that captures errors of reported foods and amounts.

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PMCID: PMC3399586 PMID: 20656093 [PubMed - indexed for MEDLINE]

Article 24: Arab 2010

J Am Diet Assoc. 2010 Jun;110(6):857-64. doi: 10.1016/j.jada.2010.03.024.

Eight self-administered 24-hour dietary recalls using the Internet are feasible in African Americans and Whites: the energetics study.

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OBJECTIVE: To support research and to provide food and nutrition practitioners with a strong foundation for nutrient-based counseling, there is a need for affordable automated 24-hour dietary recalls. Multiple days of intake, along with repeated reports over time, are needed to achieve stable indicators of individual intakes and to support evaluation of success in meeting dietary goals because of intraindividual intake variability. Little information has been published on subject responses, participation rates, and the perceived subject burden of repeated 24-hour recalls. Our aim was to determine the willingness of subjects to conduct eight 24-hour recalls via the Internet.

DESIGN: A study to validate a Web-based, automated, self-administered 24-hour recall (DietDay, Centrax Corporation, Chicago, IL).

SUBJECTS/SETTING: Two-hundred and sixty-one white and African-American subjects within 50 miles of the University of California-Los Angeles participated in the study. Subjects completed 3 DietDays at the study visits and another 5 days on their own. The last 2 DietDays were completed 1 and 2 months after the final clinic visit. Subjects were notified by automatic e-mail of the need for DietDay completion, and nonresponders were followed up with personalized e-mails and phone calls.

RESULTS: The perceived subject burden was minimal and, even after completing six recalls, 92% were willing to continue reporting their daily diets 1 and 2 months later. White subjects had a slightly higher rate of return, with 94% completing all eight recalls, compared to 91% of African-American subjects. Participants were able to access the Internet in their homes, offices, library, or homes of friends or family. It is also of interest that 82% of subjects believed the 24-hour recall was superior to a diet history in reflecting their normal diet.

CONCLUSION: These results open up new opportunities for food and nutrition practitioners to strengthen their nutritional counseling in an efficient and affordable manner without additional time investment.

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PMCID: PMC2909478 PMID: 20497774 [PubMed - indexed for MEDLINE]

Article 25: Zimmerman 2009

J Food Compos Anal. 2009 Dec 1;22(Supplement 1):S48-S51.

Challenges in converting an interviewer-administered food probe database to self-administration in the National Cancer Institute Automated Self-administered 24-Hour Recall (ASA24).

Zimmerman TP, Hull SG, McNutt S, Mittl B, Islam N, Guenther PM, Thompson FE, Potischman NA, Subar AF. Westat, Rockville, MD.

The National Cancer Institute (NCI) is developing an automated, self-administered 24-hour dietary recall (ASA24) application to collect and code dietary intake data. The goal of the ASA24 development is to create a web-based dietary interview based on the US Department of Agriculture (USDA) Automated Multiple Pass Method (AMPM) instrument currently used in the National Health and Nutrition Examination Survey (NHANES). The ASA24 food list, detail probes, and portion probes were drawn from the AMPM instrument; portion-size pictures from Baylor College of Medicine's Food Intake Recording Software System (FIRSt) were added; and the food code/portion code assignments were linked to the USDA Food and Nutrient Database for Dietary Studies (FNDDS). The requirements that the interview be self-administered and fully auto-coded presented several challenges as the AMPM probes and responses were linked with the FNDDS food

codes and portion pictures. This linking was accomplished through a "food pathway," or the sequence of steps that leads from a respondent's initial food selection, through the AMPM probes and portion pictures, to the point at which a food code and gram weight portion size are assigned. The ASA24 interview database that accomplishes this contains more than 1,100 food probes and more than 2 million food pathways and will include about 10,000 pictures of individual foods depicting up to 8 portion sizes per food. The ASA24 will make the administration of multiple days of recalls in large-scale studies economical and feasible.
PMCID: PMC2786178 PMID: 20161418 [PubMed]

Article 26: Burrows 2010

J Am Diet Assoc. 2010 Oct;110(10):1501-10. doi: 10.1016/j.jada.2010.07.008.

A systematic review of the validity of dietary assessment methods in children when compared with the method of doubly labeled water. Burrows TL, Martin RJ, Collins CE.

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Comment in J Am Diet Assoc. 2011 Aug;111(8):1124-5; author's reply 1125-6.

Measuring dietary intake in children enables the assessment of nutritional adequacy of individuals and groups and can provide information about nutrients, including energy, food, and eating habits. The aim of this review was to determine which dietary assessment method(s) provide a valid and accurate estimate of energy intake by comparison with the gold standard measure, doubly labeled water (DLW).

English-language articles published between 1973 and 2009 and available from common nutrition databases were retrieved. Studies were included if the subjects were children birth to age 18 years and used the DLW technique to validate reported energy intake by any other dietary assessment method. The review identified 15 cross-sectional studies, with a variety of comparative dietary assessment methods.

These included a total of 664 children, with the majority having <30 participants. The majority of dietary assessment method validation studies indicated a degree of misreporting, with only eight studies identifying this to a significant level ($P<0.05$) compared to DLW estimated energy intake. Under-reporting by food records varied from 19% to 41% ($n=5$ studies) with over-reporting most often associated with 24-hour recalls (7% to 11%, $n=4$), diet history (9% to 14%, $n=3$), and food frequency questionnaires (2% to 59%, $n=2$). This review suggested that the 24-hour multiple pass recall conducted over at least a 3-day period that includes weekdays and weekend days and uses parents as proxy reporters is the most accurate method to estimate total energy intake in children aged 4 to 11 years, compared to total energy expenditure measured by DLW. Weighed food records provided the best estimate for younger children aged 0.5 to 4 years, whereas the diet history provided better estimates for adolescents aged ≥ 16 years. Further research is needed in this area to substantiate findings and improve estimates of total energy expenditure in children and adolescents.

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PMID: 20869489 [PubMed - indexed for MEDLINE]

Article 27: Baxter 2007

Prev Med. 2007 Jan;44(1):34-41. Epub 2006 Sep 7.

Conventional energy and macronutrient variables distort the accuracy of children's dietary reports: illustrative data from a validation study of effect of order prompts.

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OBJECTIVE: Validation-study data are used to illustrate that conventional energy and macronutrient (protein, carbohydrate, fat) variables, which disregard accuracy of reported items and amounts, misrepresent reporting accuracy. Reporting-error-sensitive variables are proposed which classify reported items as matches or intrusions, and reported amounts as corresponding or overreported.

METHODS: 58 girls and 63 boys were each observed eating school meals on 2 days separated by $>$ or $=4$ weeks, and interviewed the morning after each observation day. One interview per child had forward-order (morning-to-evening) prompts; one had reverse-order prompts. Original food-item-level analyses found a sex \times order prompt interaction for omission rates. Current analyses compared reference (observed) and reported information transformed to energy and macronutrients.

RESULTS: Using conventional variables, reported amounts were less than reference amounts ($ps<0.001$; paired t-tests); report rates were higher for the first than second interview for energy, protein, and carbohydrate ($ps<$ or $=0.049$; mixed models). Using reporting-error-sensitive variables, correspondence rates were higher for girls with forward- but boys with reverse-order prompts ($ps<$ or $=0.041$; mixed models); inflation ratios were lower with reverse- than forward-order prompts for energy, carbohydrate, and fat ($ps<$ or $=0.045$; mixed models).

CONCLUSIONS: Conventional variables overestimated reporting accuracy and masked order prompt and sex effects. Reporting-error-sensitive variables are recommended when assessing accuracy for energy and macronutrients in validation studies.

PMCID: PMC2474708 PMID: 16959308 [PubMed - indexed for MEDLINE]

Article 28: Brustad 2003

Eur J Clin Nutr. 2003 Jan;57(1):107-13.

Comparison of telephone vs face-to-face interviews in the assessment of dietary intake by the 24 h recall EPIC SOFT program--the Norwegian calibration study.

Brustad M, Skeie G, Braaten T, Slimani N, Lund E.

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OBJECTIVE: To compare food group intakes in grams, total energy and energy contribution from macronutrients between two random samples of women, using a standardized computer program (EPIC SOFT) with either a face-to-face or a telephone 24 h recall interview design.

METHODS: Two groups of Norwegian women living in Tromsø were drawn at random from the Norwegian Women and Cancer Study (NOWAC) cohort. The EPIC SOFT computer program was used to conduct single 24 h dietary recalls either by telephone or face to face. For the latter, 160 women were invited, of whom 111 responded positively (crude response rate=69.4%) and 102 were interviewed. For the telephone option, 180 were invited to participate, 109 responded positively (crude response rate=60.6%) and 103 were interviewed.

RESULTS: The two groups of women were similar with respect to age, body mass index, basal metabolic rate, smoking, education, physical activity and special diet status. No statistically significant difference in dietary intake was found between interviews conducted by telephone and face-to-face, except for 'egg and egg products' ($P<0.01$), for which intake was higher in the telephone group. Total energy intake differed, but the difference was attributable to one interviewer. The distribution of energy-contributing nutrients was not significantly different between groups, except for reported energy percentage from protein ($P=0.02$), which was significantly higher in the face-to-face group.

CONCLUSION: The telephone vs face-to-face interview design did not influence recalled diet when using the EPIC SOFT program.

PMID: 12548305 [PubMed - indexed for MEDLINE]

Article 29: Casey 1999

J Am Diet Assoc. 1999 Nov;99(11):1406-11.

The use of telephone interview methodology to obtain 24-hour dietary recalls.

Casey PH, Goolsby SL, Lensing SY, Perloff BP, Bogle ML.

Department of Pediatrics, University of Arkansas for Medical Sciences, Arkansas Children's Hospital Research Institute, Little Rock 72202, USA.

OBJECTIVE: To compare 24-hour dietary recalls collected over the telephone to in-person recalls collected in the 1994-1996 Continuing Survey of Food Intakes by Individuals (CSFII).

DESIGN: Trained interviewers collected 24-hour dietary recalls over the telephone using the multiple-pass approach. These results were compared to in-person interviews from a pooled subsample of CSFII respondents.

SUBJECTS/SETTING: List-assisted random-digit dialing was used to identify 700 women between the ages of 20 and 49 years. One eligible woman per household was selected to participate.

STATISTICAL ANALYSES: Approximate t tests to examine differences in average nutrient and energy intakes were conducted on weighted data.

RESULTS: The reported intakes of most nutrients in the current 24-hour dietary recalls collected over the telephone were significantly higher than those reported in the 1994 and 1995 CSFII, but there were no significant differences between the telephone survey and 1996 CSFII results. The 24-hour dietary recalls collected over the telephone yielded consistently greater mean nutrient intake per respondent compared with a comparable pooled subsample from the 1994, 1995, and 1996 CSFII. Generally, no significant differences were found in the food group data between the telephone survey and the CSFII survey. Mean dietary intakes reported by the comparable CSFII subsample increased from 1994 to 1996.

APPLICATIONS: Collecting 24-hour dietary recalls over the telephone is a practical and valid data collection tool for use in national food consumption surveys.

PMID: 10570678 [PubMed - indexed for MEDLINE]

Article 30: Margetts 1995

Eur J Clin Nutr. 1995 Dec;49(12):934.

Validation of dietary intake estimation.

Margetts BM, Thompson RL.

PMID: 8925797 [PubMed - indexed for MEDLINE]

Article 31: Beer-Borst 1995

Z Ernährungswiss. 1995 Sep;34(3):183-9.

Validation of a self-administered 24-hour recall questionnaire used in a large-scale dietary survey.

Beer-Borst S, Amadò R.

Swiss Federal Institute of Technology, Department of Food Science, Zurich, Switzerland.

This study investigated the relative validity of a self-administered 24-h recall questionnaire in a dietary survey on 3,653 men and women 7 years of age and older. The validation was carried out in a group of 41 men. An estimated dietary record kept over 3 days served as reference method. Comparison of the questionnaire and the estimated 3-day record showed good agreement. The Wilcoxon matched-pairs ranked signs test ($p < 0.05$) demonstrated that the only differences were the crude energy and carbohydrate intake and the estimated nutrient density of protein. The estimated proportion of calories from carbohydrate, fat, protein, and alcohol differed by no more than 2.4%. The median percentage differences in crude nutrient intakes and nutrient densities between the two assessment techniques ranged from -9% to 22%. The daily food intake differed significantly in only three of ten food groups. Spearman's correlation coefficients were higher than 0.35 for all density measurements. The highest correlation coefficients of about 0.60 were observed for alcohol and dietary fiber intake. It is concluded that the self-administered 24-hour recall questionnaire is a valid method for estimating the median and mean dietary intake of large groups of subjects.

PMID: 7502539 [PubMed - indexed for MEDLINE]

Article 32: Ferguson 1995

Eur J Clin Nutr. 1995 Aug;49(8):565-78.

An interactive 24-h recall technique for assessing the adequacy of trace mineral intakes of rural Malawian women; its advantages and limitations.

Ferguson EL, Gadowsky SL, Huddle JM, Cullinan TR, Lehrfeld J, Gibson RS.

Division of Applied Human Nutrition, University of Guelph, Ontario, Canada.

OBJECTIVES: To assess the relative validity of an interactive 24-h recall for estimating mineral intakes of rural Malawian women.

DESIGN: Repeated interactive 24-h recalls were compared with weighed records collected for the same 2 days of food intake, and for 2 days 1-2 weeks prior and subsequent to the weighed record data collection period.

SETTING: Three villages in traditional authority Jalasi, Mangochi District, Malawi.

SUBJECTS: 60 rural pregnant women.

RESULTS: Median daily intakes of most minerals (Ca, Fe, Zn, Mn) were comparable for the two methods, but slightly overestimated for recalled (R) intakes expressed per MJ (mg/MJ) compared to weighed (W) (R vs W = Ca, 48 vs 38; Fe, 2.1 vs 1.9; Zn, 0.9 vs 0.8; Mn, 0.40 vs 0.38; $P < 0.05$). By contrast, recalled median daily intakes of energy (kJ), protein (g), fat (g) and Cu (mg) were slightly underestimated (R vs W = 6588 vs 7824; 51 vs 57; 14 vs 15; 1.3 vs 1.6, respectively; $P < 0.05$). Discrepancies were attributed primarily to inaccurate estimates of main meal food portions [R vs W = nsima (the main meal cereal style) 475 vs 557; and legume relish 171 vs 118 $P < 0.001$]. For classifying intakes into tertiles, agreement between the two methods was poor for daily intakes (Cohen's kappa < 0.40), but fair when expressed per MJ, and as a percentage of energy from food groups (Cohen's kappa > 0.40). Variance ratios for recall data were higher than corresponding ratios for the weighed intakes (R vs W = for energy, 4.87 vs 0.87), indicating poorer recall measurement precision.

CONCLUSION: Results emphasise the importance of selecting the dietary method according to the study objectives, and the nutrients required.

PMID: 7588507 [PubMed - indexed for MEDLINE]

Article 33: Hulshof 1995

Eur J Clin Nutr. 1995 Jan;49(1):17-25.

Validity of food intake measurement of adult Turkish immigrants in The Netherlands.

Hulshof PJ, Burema J, van Staveren WA.

Department of Human Nutrition, Wageningen Agricultural University, The Netherlands.

OBJECTIVE: To study the validity of the reported food intake in a study which was designed to assess exposure to dioxins from food sources.

DESIGN: Repeated diet recalls were used to collect food intake data within a period of four months. Data on energy intake were related to computed basal metabolic rate (BMR).

SETTING AND SUBJECTS: A group of 69 Turkish immigrants (30 men and 39 women aged 18-59 years) from two municipalities in the Eastern part of the Netherlands, whose selected basic socio-demographic characteristics reflect those of adult Turkish living in the Netherlands.

RESULTS AND CONCLUSIONS: A mean energy intake (EI) to BMR ratio of 1.32 for women (mean EI = 8.1 MJ/day) and 1.36 for men (mean EI = 10.6 MJ/day) was found. Subjects in the lower and upper tertile of EI/BMR ratio differed only in body mass index (BMI: kg/m²). Pearson's correlation coefficient between EI/BMR and BMI was -0.39 ($P < 0.05$). The observed high prevalence of obesity in adult Turkish people complicates, as in other cultures, an accurate assessment of food intake.

PMID: 7713047 [PubMed - indexed for MEDLINE]

Article 34: Galasso 1994

Ann Epidemiol. 1994 Jul;4(4):332-6.

Relative validity of multiple telephone versus face-to-face 24-hour dietary recalls.

Galasso R, Panico S, Celentano E, Del Pezzo M.

Institute of Internal Medicine and Metabolic Disease, 2nd Medical School, University of Naples, Italy.

The relative validity of multiple telephone 24-hour dietary recalls was evaluated in a feasibility study within the framework of a large prospective investigation on the cause of chronic disease in women. Forty-nine women were interviewed four times both face-to-face and by telephone. Comparison of the total number of calories and intake of protein, carbohydrate, total and saturated fats, cholesterol, fiber, sodium, potassium, calcium, vitamin A, and vitamin C as estimated by multiple face-to-face and telephone interviews revealed an acceptable relative validity for the telephone procedure. Analysis of the position variation in the distribution (percent agreement) comparing the two procedures showed that a change in the distribution of none or one quintile occurs in more than 70% of individuals for all nutrients but vitamin C (69.4%), cholesterol (61.2%), and vitamin A (51.4%). Correlation coefficient analysis showed similar results. Adjustment for nutrient densities did not affect the overall results. Multiple 24-hour telephone dietary recalls appear to be a valid alternative to face-to-face interviews in population studies.

PMID: 7921324 [PubMed - indexed for MEDLINE]

Article 35: Lytle 1993

J Am Diet Assoc. 1993 Dec;93(12):1431-6.

Validation of 24-hour recalls assisted by food records in third-grade children. The CATCH Collaborative Group.

Lytle LA, Nichaman MZ, Obarzanek E, Glovsky E, Montgomery D, Nicklas T, Zive M, Feldman H.

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OBJECTIVE: The objective of the study was to validate the use of 24-hour recalls assisted by food records as a dietary assessment tool for use with third-grade children.

DESIGN: Trained staff observed children during mealtime at school, and parents observed and recorded what children ate in their presence. The following day children participated in a 24-hour recall interview. Children's ability to recall what they consumed during a 24-hour period was compared with observational data collected during the same period.

SETTING: All data were collected in elementary school settings at four sites involved in the Child and Adolescent Trial for Cardiovascular Health.

SUBJECTS: The sample of 49 children was self-selected, based on parents' willingness to observe and record their child's food intake.

MAIN OUTCOME MEASURES: Recalled and observed data for energy and nutrient levels were compared using mean energy and nutrient analysis and quartile classification. In addition, recalled and observed foods were compared by meal type and estimation of portion size.

STATISTICAL ANALYSIS PERFORMED: Paired t tests, Pearson and Spearman correlations, and classification analysis were used to compare recalled and observed data.

RESULTS: Comparison of observed and recalled food intakes showed no significant differences in percentage of energy from total fat, saturated fat, monounsaturated fat, and polyunsaturated fat or in the amount of sodium consumed, although there were differences in energy intakes. Spearman rank order correlations between recalled and observed nutrients ranged from .45 to .79. A 77.9% agreement was found across all meals in the food items children recalled having consumed compared with those adults actually observed them consuming.

CONCLUSIONS: We conclude that the 24-hour recall assisted by food records is a valid method for assessing the dietary intake of children as young as 8 years old for the purpose of group comparison.

PMID: 8245378 [PubMed - indexed for MEDLINE]

Article 36: Eck 1989

J Am Diet Assoc. 1989 Jun;89(6):784-9.

Recall of a child's intake from one meal: are parents accurate?

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Although the accuracy of dietary intake information for children has previously been studied, methodological issues make the results of those studies difficult to interpret. In order to address one of the major methodological issues, unobtrusive observations were performed on the lunch meal of 34 children. These children ranged in age from 4.0 to 9.5 years (mean = 5.8 years, standard deviation = 1.6 years). Each child was accompanied by both parents. Dietary recalls were obtained the following day from (a) the mother alone, (b) the father alone, and (c) the mother, father, and child reporting as a group (consensus recall). Recalls were analyzed with nutrition software that yields information on energy, protein, carbohydrate, sugar, total fat, cholesterol, sodium, iron, and calcium. Strong correlations were seen between each recall and the observation (mean $r = .86$). However, the group accuracy in correctly reporting different types of foods varied from the fathers' under-reporting of breads (-27%) to fathers' over-reporting of fruit (+50%). When regression analyses were used, only the consensus recall resulted in a regression line not significantly different from 1.0 for the majority of the nutrients analyzed. Thus, it appears that the consensus recall produced a better estimate of the observed intake from one meal than did recalls obtained from mother or father.

PMID: 2723300 [PubMed - indexed for MEDLINE]

Article 37: Levine 1987

Br Med J (Clin Res Ed). 1987 Aug 8;295(6594):369-72.

Validation of a computer based system for assessing dietary intake.

Levine JA, Madden AM, Morgan MY.

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Dietary intake was assessed in 50 patients in hospital by using a dietary history method and computer based system for data collection and standard food tables to calculate the composition of nutrients. The results were compared with those from a weighed assessment that was calculated by using both food tables and manufacturers' food analyses. The use of the food tables overestimated mean (SEM) individual nutrient intakes by between 2.5% (1.5%) and 15.5% (3.0%). The mean errors associated with the dietary history assessment varied from -23% (7.8%) for fat intake to +21.4% (8.5%) for carbohydrate intake. Overall, 30% of the assessments of total nutrient intakes that were calculated using this method were within -20% to +20% of actual values; 18% were within -10% to +10%. The mean errors associated with the computer based assessment varied from -1.0% (4.3%) for carbohydrate intake to +8.5% (3.4%) for protein intake. Overall, 56% of the assessments of total nutrient intakes were within -20% to +20% of actual intakes; 31% were within -10% to +10%. The computer based system provides an accurate, reproducible, convenient, and inexpensive method for assessing dietary intake.

PMCID: PMC1247221

PMID: 3115455 [PubMed - indexed for MEDLINE]

Article 38: Räsänen 1979

Am J Clin Nutr. 1979 Dec;32(12):2560-7.

Nutrition survey of Finnish rural children. VI. Methodological study comparing the 24-hour recall and the dietary history interview.

Räsänen L.

The aim of the study was to evaluate and to compare the 24-hr recall method with the dietary history method as used in a food consumption survey of children. Information on the dietary intake was obtained by 24-hour recall from 158 children and by the history method from 134. The interviews are repeated 7 months later. In addition, 741 children were interviewed by both methods on the same occasion. The repeatability of the results was analyzed both at the individual and at the group level. The correlation coefficients between the first and second interview in terms of the individual intakes of energy and nutrients were fairly low for both methods. At the group level the results of repeated 24-hr recalls were in good agreement. The dietary history method, however, gave significantly different mean intakes when repeated. The correlation coefficients between the values obtained by the 24-hr recall and the history method varied from 0.20 (vitamin A) to 0.50 (energy). The history method gave consistently higher mean values than the 24-hr recall. Neither of the methods can be considered suitable for the measurement of an individual child's dietary intake. The 24-hr recall is preferable for food consumption surveys of groups of children.

PMID: 506978 [PubMed - indexed for MEDLINE]

Article 39: Touvier 2011

Br J Nutr. 2011 Apr;105(7):1055-64. doi: 10.1017/S0007114510004617. Epub 2010 Nov 17.

Comparison between an interactive web-based self-administered 24 h dietary record and an interview by a dietitian for large-scale epidemiological studies.

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Online self-administered data collection, by reducing the logistic burden and cost, could advantageously replace classical methods based on dietitian's interviews when assessing dietary intake in large epidemiological studies. Studies comparing such new instruments with traditional methods are necessary. Our objective was to compare one NutriNet-Santé web-based self-administered 24 h dietary record with one 24 h recall carried out by a dietitian. Subjects completed the web-based record, which was followed the next day by a dietitian-conducted 24 h recall by telephone (corresponding to the same day and using the same computerised interface for data entry). The subjects were 147 volunteers aged 48-75 years (women 59.2 %). The study was conducted in February 2009 in France. Agreement was assessed by intraclass correlation coefficients (ICC) for foods and energy-adjusted Pearson's correlations for nutrients. Agreement between the two methods was high, although it may have been overestimated because the two assessments were consecutive to one another. Among consumers only, the median of ICC for foods was 0.8 in men and 0.7 in women (range 0.5-0.9). The median of energy-adjusted Pearson's correlations for nutrients was 0.8 in both sexes (range 0.6-0.9). The mean Pearson correlation was higher in subjects ≤ 60 years ($P = 0.02$) and in those who declared being 'experienced/expert' with computers ($P = 0.0003$), but no difference was observed according to educational level ($P = 0.12$). The mean completion time was similar between the two methods (median for both methods: 25 min). The web-based method was preferred by 66.1 % of users. Our web-based dietary assessment, permitting considerable logistic simplification and cost savings, may be highly advantageous for large population-based surveys.

PMID: 21080983 [PubMed - indexed for MEDLINE]

Article 40: Fox 1992

J Am Diet Assoc. 1992 Jun;92(6):729-32.

Telephone surveys as a method for obtaining dietary information: a review.

Fox TA, Heimendinger J, Block G.

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The use of telephone surveys has increased significantly in the past decade. One advantage of telephone surveys is the ability to reach a large number of individuals: 97% of the US population owns telephones. Another advantage is cost savings: telephone surveys cost as little as one quarter to one half the amount of face-to-face surveys. Computer-assisted telephone interviewing has improved data collection, coding, and analysis. Random-digit dialing and a number of statistical advances such as weighting and stratification have significantly enhanced sample selection and research design of telephone surveys. The increasing need to collect dietary information from populations in an affordable fashion has expanded the use of telephone dietary surveys. To date, telephone dietary surveys have been used for follow-up after initial face-to-face contact has been made. The most common dietary instruments used are the 24-hour recall and the food frequency questionnaire. This review indicates that well-designed and well-administered telephone surveys are as good as, and may be better than, other methods for obtaining dietary information.

PMID: 1607571 [PubMed - indexed for MEDLINE]

Article 41: Kretsch 1990

Am J Clin Nutr. 1990 Mar;51(3):477-84.

Validation of a new computerized technique for quantitating individual dietary intake: the Nutrition Evaluation Scale System (NESSy) vs the weighed food record.

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US Department of Agriculture, Western Human Nutrition Research Center, San Francisco, CA 94129.

A validation study was conducted in which food intake recorded by research volunteers using a new computerized technique, the Nutrition Evaluation Scale System (NESSy), was compared with food intake obtained from a weighed food record concurrently measured and recorded by metabolic unit dietary staff. Nine women between ages 23 and 35 y resided in the metabolic research unit and recorded their food intake with NESSy for 16 consecutive days. The mean of the differences between NESSy and the manual technique was not significant on a group basis (p less than 0.05) for food energy or any other nutrient. All mean differences were less than 5% and Pearson correlation coefficients ranged from 0.81 to 0.98 (p less than 0.0001), with all but iron, potassium, sodium, and preformed niacin having correlations greater than 0.92. For the majority of the individuals, accuracy within 10% of their actual dietary intake was found for energy and selected nutrients. NESSy is a new computerized approach to dietary intake assessment that yields accurate data on both a group and individual basis.

PMID: 2309654 [PubMed - indexed for MEDLINE]

Article 42: Krantzler 1982

Am J Clin Nutr. 1982 Dec;36(6):1234-42.

Validity of telephoned diet recalls and records for assessment of individual food intake.

Krantzler NJ, Mullen BJ, Schutz HG, Grivetti LE, Holden CA, Meiselman HL.

Six methods of assessing individual food intake reported by telephone were compared for accuracy. A sample of 107 students eating in a dormitory dining hall was used. Two 7-day and four 3-day diet records were reported by telephone to either an interviewer or an answering device; and fourteen 6-h recalls and seven 24-h recalls were obtained by an interviewer over the telephone. To examine validity, the investigators observed respondents' intake for 28 days. Food item agreement scores comparing observed and reported data were calculated. Seven-day records were most accurate (87% food item agreement); 3-day records and 6-h recalls were equivalent (75%); and 24-h recalls were least accurate (69%). There were no significant difference in accuracy of reporting records to an interviewer versus a recording device, but respondents preferred the interviewer. Results of telephoned reporting compare favorably with personal interview techniques used by other investigators, indicating that telephoned methods should be further explored in community settings.

PMID: 7148742 [PubMed - indexed for MEDLINE]

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University of California Cooperative Extension and University of Nevada Cooperative Extension.

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