

# RNECE Longitudinal Study

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## Introduction

Effective nutrition education has the potential to reduce health disparities (differences in how often people get diseases) between higher and lower income Americans by promoting healthy diets and thereby reducing the risk of chronic disease. The Expanded Food and Nutrition Education Program (EFNEP) and the Supplemental Nutrition Assistance Program Education (SNAP-Ed) are two large nutrition education programs, sponsored by the US Department of Agriculture (USDA), which aim to improve health-related behaviors among the low-income population through direct nutrition education and by changing nutrition-related policies and systems and/or the food environment. They educate participants on nutrition, physical activity, and food resource management.<sup>1,2</sup>

The motivation for this research grant was that for EFNEP and SNAP-Ed to be effective and sustainable, ongoing investment in rigorous evaluation tools is needed. The grant included two projects, both of which used technology to develop and evaluate rigorous and potentially sustainable tools to evaluate the effectiveness of EFNEP and SNAP-Ed.

The first project developed and evaluated the Grocery Purchase Quality Index-2016 (GPQI-2016), a tool for assessing the quality of household grocery food purchases. The main research aim was to develop the GPQI-2016,<sup>3</sup> and the main finding was that the GPQI performs similarly to the Healthy Eating Index-2015 (HEI-2015),<sup>4,5</sup> a validated and well-accepted tool.<sup>6,7</sup>

The second project assessed the feasibility of using the Automated Self-administered 24-hour Recall (ASA24),<sup>8</sup> a diet assessment tool developed by the National Cancer Institute (NCI), in the low-income population. The main research question was whether ASA24 could be used to collect recalls from women with low incomes, and the main finding was that ASA24 worked relatively well, but produced slightly less accurate recalls\* than in a previous study that had included participants with a variety of income levels.<sup>9,10</sup> Tools for training paraprofessional nutrition educators how to use ASA24 in EFNEP and SNAP-Ed were also developed and tested.<sup>11</sup>

The first project was a collaboration among researchers at the University of Utah and Utah State University. The second added researchers from University of Waterloo, Ontario, Canada; the National Cancer Institute; and Westat, a private research firm, and directors of EFNEP and SNAP-Ed in several states.

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\* See page 7 for more details. Match rate between consumed and reported foods was 72-74% in this study and in a previous study in the general population using the same protocol the match rate was 80%.

## Grocery Purchase Quality Index

Household food purchases are potential indicators of the quality of the home food environment, which is known to influence household members' diet.<sup>12</sup> Further, grocery purchase behavior is an important component of USDA nutrition education programs; therefore, objective measures of grocery purchases are needed.

### Development of the Grocery Purchase Quality Index-2016 (GPQI-2016)

It is difficult to measure accurately the impact of nutrition education programs because it is difficult to measure what people eat and drink. So, nutrition and biomedical informatics researchers at the University of Utah decided to look at another targeted and related behavior, what food and beverages people purchase.

Previous research had explored the quality of grocery purchases,<sup>13-16</sup> but it was limited for two reasons: 1) grocery purchase data are difficult to use and 2) there are no publicly available food composition databases for foods in their as-purchased form. Previous studies have assessed the nutrient content of grocery purchases by using proprietary databases that link barcodes to nutrient values, but the high cost of these databases makes using them for research or ongoing program evaluation cost prohibitive.<sup>17-20</sup>

Grocery purchase data usually consist of barcodes that are used to identify foods, called Universal Product Codes (UPCs) and Product Lookup Codes (PLUs), along with an abbreviated and usually difficult to understand description of the food. It typically requires painstaking and time-consuming manual coding to link them to nutrient databases. Further complicating things, amounts are often missing from the description, so researchers don't know if someone bought 3 pounds of carrots or a single carrot. This has obvious consequences when trying to decide how healthy someone's grocery purchases are. For example, a receipt for a small bag of chips, a small amount of bulk candy, a gallon of skim milk, and 3 pounds of carrots might be indistinguishable from a receipt for a large bag of chips, a large amount of bulk candy, a pint of skim milk, and a few carrots.

This study addressed these problems by creating a tool, the GPQI-2016,<sup>3</sup> that relies on expenditures for food categories (based on the components of the Healthy Eating Index) rather than on amounts of nutrient to assess healthfulness. The components of the GPQI-2016 and their maximum number of points are listed in Table 1 on the next page.

The GPQI-2016 uses the amount of money spent on foods (not the amounts of foods purchased) to calculate how healthy grocery purchases are. The index was derived from Food Plans, published by USDA, that describe the types and amounts of foods families should buy to meet the Dietary Guidelines for Americans.<sup>3,21</sup> The Food Plans list the number of pounds of food from each of 29 food categories to buy, and they also specify the percentage of all food costs that would be spent on each of the 29 food categories if the Food Plans were followed.

## **Table 1. GPQI-2016 Components**

### **Adequacy**

Total Fruit (5)  
Whole Fruit (5)  
Total Vegetables (5)  
Greens and Beans (5)  
Whole Grains (10)  
Dairy (10)  
Total Protein Foods (5)  
Seafood and Nuts (5)

### **Moderation**

Refined Grains (10)  
Processed Meats (5)  
Sweets and Sodas (10)

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**Total Score (75)**

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Steps for calculating the GPQI-2016 are:

- Sort items the items purchased by each household into the 29 food categories used in the USDA Food Plans.
- Group the food categories into the 11 components of the GPQI-2016 (shown in Table 1).
- Compare the observed to the ideal expenditure share for each component.
- Calculate the score.

To see how well the index worked, the researchers used a sample of a grocery sales data set provided by a national grocery chain. The dataset did not contain any information about the characteristics of households, but it was possible to see which households purchased tobacco products. Tobacco users typically have poorer diets than non-users,<sup>22,23</sup> therefore, if the GPQI-

2016 does a good job of quantifying the healthfulness of grocery purchases, scores should be lower for households that purchase tobacco products than for those who do not.

And this is what the researchers found. The 12,460 households that never purchased tobacco products from this particular grocery chain had significantly higher median (i.e., middle) total quality scores (31.3 of a possible 75 points) than those 3540 households who did purchase tobacco from this particular grocery chain (median score 26.6,  $P<0.01$ ), as well as significantly higher scores for each of the 11 components of the GPQI-2016 ( $P<0.01$ ). A limitation of this work is the fact that we only have data from purchases at one grocery chain, and data about other food and tobacco purchases is not available.



## Evaluation of the GPQI-2016

In a second study, the researchers further investigated how well the GPQI-2016 worked to measure the quality of food purchases.<sup>4</sup> The objective was to evaluate the GPQI-2016 as a tool for assessing grocery food purchase quality by using the HEI-2015, a validated and well-accepted tool for assessing the quality of any group of foods, as the reference standard.<sup>6,7,24</sup>

For this study, the researchers used data from a unique, publicly available dataset. In 2012, the USDA Economic Research Service (ERS) had conducted the National Household Food Acquisition and Purchase Survey. Members of participating households recorded all foods they acquired for a week. All households in the lower 48 states were eligible for the survey. ERS and their contractors manually matched all of the items purchased with food items found in USDA's food composition databases. For this study, data from 4,276 households were used. GPQI-2016 and HEI-2015 scores were calculated and then compared using statistical analysis.<sup>†</sup>

**Table 2. Correlations of GPQI-2016 and HEI-2015 total and component scores**

Whole Fruit	0.91
Total Fruit	0.89
Total Vegetables	0.86
Greens & Beans	0.79
Whole Grains	0.76
Total Protein Foods	0.72
Seafood & Nuts/Plant Proteins	0.70
Dairy	0.67
Refined Grains	0.66
Sweets & Sodas/Added Sugars	0.65
<b>Total Score</b>	<b>0.70</b>

As shown in Table 2, the correlation coefficient<sup>‡</sup> for the total GPQI-2016 score and the total HEI-2015 score was 0.70. For the component scores, the strongest correlations were for Total and Whole Fruit (0.89 to 0.90); the weakest were for Dairy (0.67), Refined Grains (0.66), and Sweets and Sodas/Added Sugars (0.65) (all,  $P < 0.01$ ). In conclusion, the GPQI-2016, estimated from a national survey of households, performed similarly to the HEI-2015.

Although using the GPQI to assess grocery purchases avoids the problems related to self-reporting, obtaining and processing food purchase data has its own challenges. Nevertheless, the tool has potential for evaluating the effect of nutrition education interventions in retail settings on grocery purchase quality when the nutrient content and gram weights of foods purchased are not available.

<sup>†</sup> Correlation of scores was assessed using Spearman's correlation coefficient. Linear regression models with fixed effects were used to determine differences among various subgroups of households

<sup>‡</sup> In general, two scores are more alike the closer the correlation coefficient is to 1. Correlation coefficients of 0.3 or greater indicate a weak relationship between the scores, 0.5 or greater indicates a moderate relationship, and 0.7 or greater is typically considered a strong relationship.

## ASA24 Tool Evaluation for the Low-income Population

### ASA24 Validation Study in the Low-Income Population

The Automated Self-Administered 24-hour Recall is a tool developed by National Cancer Institute (NCI).<sup>8</sup> It is an online computer program that leads participants through the process of doing a 24-hour recall<sup>††</sup> using a modified version of the USDA's interviewer-administered Automated Multiple-Pass Method (AMPM), which is currently the industry standard for measuring what people eat. ASA24 is available in English and Spanish and works on computers, tablets, and smart phones when connected to the internet.

NCI had previously looked at how well ASA24 works compared to AMPM in a sample of individuals from the general population. The study showed that ASA24 performed nearly as well as the AMPM but with considerable cost savings.<sup>25</sup> However, questions remained about how well ASA24 would work with individuals who have low incomes because of differences in digital skills and internet use.<sup>26-28</sup>

To address that issue, the researchers conducted a study that looked at how well ASA24 worked for women with low incomes.<sup>9,10</sup> Only women were included in the study because women make up the majority of participants in USDA's two large nutrition education programs for adults, the Expanded Food and Nutrition Education Program (EFNEP) and the Supplemental Nutrition Assistance Program-Education (SNAP-Ed). The study compared how individuals performed in a

#### Study Design

- Day 1
  - Participants eat three meals from a buffet at the study site
  - Only one participant goes through the buffet at a time, and everyone eats in a separate dining room.
  - All buffet items are counted or weighted before and after each participant.
  - Anything left on plates is weighed.
- Day 2
  - Participants returned to study site
  - Randomly assigned to complete ASA24 individually or as part of a small group with an assistant

small-group setting with the help of a trained paraprofessional (similar to the situation in an EFNEP or SNAP-Ed class) to how individuals performed on their own, with only a telephone help line to call for support.

Participants were 302 women, 18 years old or older, who had household incomes below 130% of the Federal poverty level. Participants came to the study site and had three meals in one day--breakfast, lunch, and dinner. They served themselves from a buffet.<sup>§</sup> The amounts of food taken, as well the food left on their plates,

<sup>††</sup> In this measurement tool, participants are asked to remember everything they ate and drank yesterday. For the purposes of this research only the three observed study meals were analyzed.

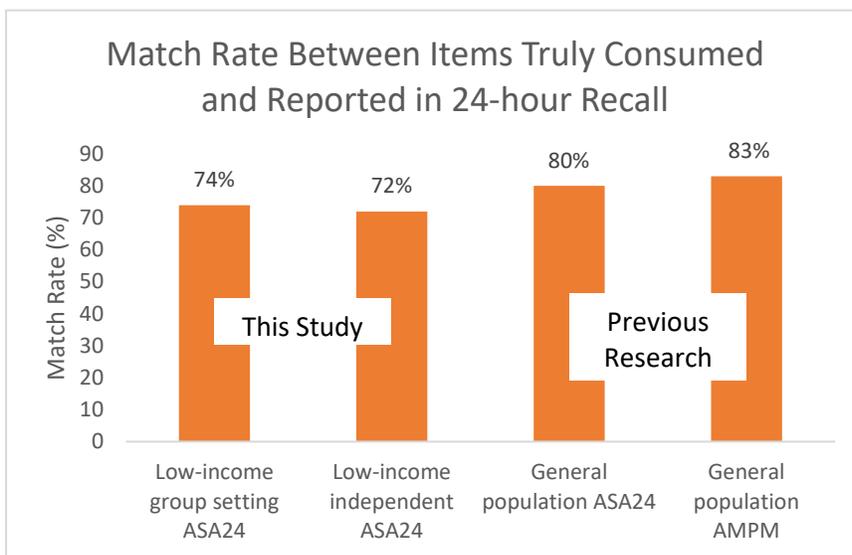
<sup>§</sup> The buffet was in a separate room from the dining room so that research staff could count and weigh buffet items before and after each participant without them knowing. Participants were only able to go through the buffet line once.

were unobtrusively observed and then weighed so that the participants' true intake for three meals could be recorded.\*\* The following day, the women returned to the study site and reported what they had eaten the previous day using ASA24 either by themselves or with assistance from the paraprofessional in a small group.

Statistical analysis was used to look at how well the participants reported what they had truly eaten the day before.††

Participants who completed ASA24 by themselves versus with assistance reported matches for 71.9% and 73.5% of items truly consumed, respectively (not a significant difference). Common omissions included foods that were added to salads and sandwiches like tomatoes, cheese, cucumbers. The missing items represented fewer than 50kcal on average. The average differences between the total calories for the foods observed and the foods reported were less than 100kcal total.††

These findings indicate that the women reported their food intakes with a moderate amount of error. Their accuracy was somewhat lower than previously reported for adults with a wider range of incomes using the same protocol.<sup>25</sup>



The fact that providing assistance did not significantly impact accuracy is an interesting finding because it indicates that researchers can use ASA24 with the low-income population as it was originally intended, that is, independently. This can reduce the cost of dietary data collection significantly and may encourage researchers to conduct longer-term follow-up studies.

\*\* Because participants were not confined to the study site for the day, the reported times of eating occasions from the 24-hour recall were used to remove eating occasions that did not occur during study meal times.

†† Regression modeling was used to examine differences by condition in agreement between true and reported foods; energy, nutrient, and food group intakes.

†† The mean differences in total calories should be interpreted cautiously because the women were in an unusual environment, and that might have made it easier for them to remember what they ate.

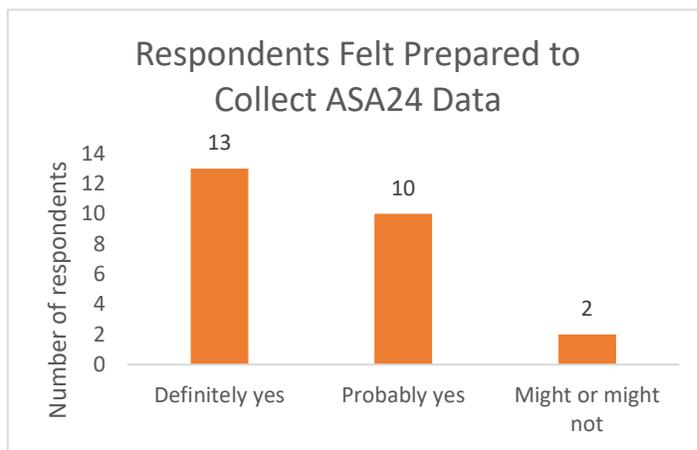
## ASA24 Training for Paraprofessional Nutrition Educators

Currently, EFNEP participants complete a paper-and-pencil, self-recorded, group-administered 24-hour recall as part of class education and program evaluation. These recalls have provided important data for program evaluation, but there are some concerns about data entry errors, missing data, and inconsistency in data collection and data entry procedures.<sup>29,30</sup>

To address these concerns, the researchers developed an online training to teach educators how to collect 24-hour dietary recalls using the Automated Self-administered 24-hour Recall (ASA24).<sup>11</sup> Educators from 17 states agreed to take the training. Of the 58 who started the training, only 29 finished all the tasks, which included completing the online training, assisting two individuals in completing a 24-hour recall using ASA24, and completing a survey about their experiences.

### Training Modules

- Introduction to ASA24
- How to search for foods in ASA24
- Making changes in ASA24
- Unknown kind and other kind of food items
- Multi-ingredient foods
- Unfound foods
- Using visual aids to teach the ASA24 program
- Assistance techniques
- Putting it into practice



Overall, the majority of the 29 survey respondents agreed that the content, reading level, and appearance and design of the manual were appropriate. The majority of the respondents felt that the videos and readings were effective for learning and that the activities allowed them to develop and practice relevant skills. Half of the respondents felt that they definitely were prepared to collect ASA24 data, as shown in the chart at the left.

However, the findings raised several concerns about the training as well. First, over half of the participants who completed the training were college educated, even though typically EFNEP educators are paraprofessionals and do not have a college degree. It is possible that educators with less formal education may not have been able to finish the training or may not have chosen to participate in the study. A significant portion of the educators who did complete the training reported problems with completing the activities and using the training website. Finally, over half of those who completed the survey wanted additional assistance and/or training.

Based on these results and input from other experts, the researchers decided that the training would be most useful for training staff members who are comfortable with online trainings. These people could then train other educators in person. The training now includes an in-person

training curriculum as well as the online manual and can be accessed at <https://extensioncourses.usu.edu/product/utah-asa24-training-for-nutrition-education-programs/>.

## Summary

Public health officials want to know if their nutrition-related programs are leading to healthier diets, and people who invest in nutrition education programs want to know how cost effective they are. Assessing what foods people eat is difficult because people may have a hard time remembering and accurately reporting what they eat. To address this problem, the researchers conducted two research projects.

The first project developed a new tool, called the GPQI-2016, that does not rely on people reporting for themselves. Instead, the researchers used the foods families purchased at stores and created a scoring system to assess the overall quality of the foods they purchased (as opposed to the foods they ate) in terms of ability to promote health. Although food purchase does not exactly match food consumption, the two are related. Further, the educational aims of many nutrition education programs (such as EFNEP and SNAP-Ed) include changing food purchase behavior. In a national sample of 4,276 households, the new tool performed similarly to a highly regarded and widely used diet quality assessment tool and doesn't require the purchase of costly databases to calculate the nutrient values of foods in their as-purchased form. While it avoids the problems related to self-reporting, obtaining food purchase data has its own challenges, such as cost, concerns about data privacy, and representativeness of data if it comes from a single store. Studies using this tool to evaluate nutrition education should consider asking participants about how much of their shopping is done at the partner store and must obtain informed consent for the store to share their shopping data.

The second project examined how well the ASA24, an online diet assessment tool, worked to measure what women with low incomes ate. By discretely measuring what study participants ate one day and having them report what they ate the next day using ASA24, the researchers were able to show that this assessment tool performed quite well. The researchers also developed training for paraprofessional nutrition educators to learn how to use ASA24.

The results of these projects were widely disseminated through 14 conferences and invited presentations to a wide variety of research and practice audiences. The work resulted in six published manuscripts in top journals. Of note, the two major publications, one about each project, were accompanied by editorials in their respective issues. These editorials indicated the importance of these projects to the scientific community.<sup>5,10</sup> A complete list of the publications and presentations supported by this grant is found in the appendix.

In the future, the tools developed and evaluated by these projects could make it easier to collect data needed to understand relationships between food choices and health outcomes. They could be used to help determine whether or not nutrition programs and policies are working.

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## Appendix: Dissemination of the Results of These Projects

### Papers Published in Peer-reviewed Journals

Kirkpatrick S, Guenther PM, Douglass D, Zimmerman T, Kahle LL, Atoloye A, Marcinow M, Savoie-Roskos MR, Dodd KW, Durward C. The provision of assistance does not substantially impact the accuracy of 24-hour dietary recalls completed using the Automated Self-Administered 24-hour Dietary Assessment Tool among women with low incomes. *J Nutr.* 2019; 149(1):114-122.

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