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Melissa Casey

Assessing the Long-term Effect of the Expanded Food and Nutrition Education
Program (EFNEP) on Participants' Diet Quality

Melissa Casey

A thesis

submitted in partial fulfillment of the
requirements for the degree of

Master of Public Health

University of Washington

2021

Reading Committee:

Hilary Karasz, Chair

Nicole Sadow-Hasenberg

Susan Baker

Program Authorized to Offer Degree:

Public Health, Health Services

University of Washington

Abstract

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Melissa Casey

Chair of the Supervisory Committee:
Hilary Karasz, PhD
Health Services

The objective of the study was to assess the long-term effect of the Expanded Food and Nutrition Education Program (EFNEP) on participants' diet quality using 24-hr dietary recall (24HDR) data collected from a sample of English and Spanish speaking EFNEP participants from January 2018 through October 2019. Healthy Eating Index (HEI) scores collected at 4 time points – pre-EFNEP (Week 1 of a 9-week nutrition education class series), post-EFNEP (Week 9), 6-months post-EFNEP, and 12-months post-EFNEP – were analyzed using Generalized Estimating Equations (GEE) linear regression and paired t-tests. This study was limited due to its small sample size, little variation in participant demographics, and missing data. Total HEI – estimated due to the missing data – improved substantially by 4.8 points from pre-EFNEP to the 12-month follow-up. HEI subcomponent scores improved in total fruit, whole fruit, and fatty acids whereas scores decreased in total vegetables, green beans, and sodium. Further research is essential to demonstrate the long-term impacts of EFNEP on participants' dietary behaviors and thus, the efficacy and value of evidence-based nutrition education programs targeting low-income families.

Introduction

The Expanded Food and Nutrition Education Program (EFNEP) is a federal nutrition education program funded by the United States Department of Agriculture National Institute of Food and Agriculture (USDA NIFA). EFNEP targets low-income families in all states, U.S. territories, and the District of Columbia. In 1969, EFNEP was the nation's first nutrition education program for low-income populations, introduced to reduce the social and health disparities associated with hunger, malnutrition, and poverty. The program's goals are to "teach families the knowledge, skills, attitudes, and behaviors necessary to have nutritionally sound diets, contribute to their personal development, and improve the total family diet and nutritional well-being" (USDA NIFA, 2013).

Washington EFNEP (WA EFNEP) educates low-income families with young children as well as low-income children and youth in King, Pierce, and Spokane counties. Historically, WA EFNEP has also reached families in Clark County and rural, migrant populations in Yakima County. Adult audiences are low-income parents (at or below 185% Federal Poverty Level), pregnant women, and other adult caregivers (such as guardians or grandparents) who have primary responsibility for obtaining and preparing food for their children, with emphasis on families and caregivers of young children. Program participants are recruited from agencies that serve these populations: community centers in low-income neighborhoods, public health offices, free clinics, Supplemental Food Assistance Program for Women, Infants, and Children (WIC), Head Start, Early Childhood Education and Assistance Program (ECEAP), low-income housing sites, domestic violence and homeless shelters, county community service agencies, and food banks. Teen parents are recruited from Title I schools (50% or more free/reduced lunch

participation) or agencies serving teen parents. In response to the national opioid epidemic and concerns from local stakeholders, WA EFNEP increased its focus on partnering with opioid treatment centers.

Using a peer educator model, WA EFNEP delivers an evidence-based nutrition education curriculum, *Eating Smart • Being Active* (ESBA) that is used in 40 states (Eating Smart • Being Active, 2015; National Institute of Food and Agriculture, n.d.). Over a series of nine 120-minute weekly lessons, ESBA engages adult participants through dialogue-based learning and hands-on activities grounded in Social Cognitive Theory (Bandura, 1986) and Adult Learning Principles (Knowles, 1984). Low-income adults learn to balance a healthier diet with physical activity, food resource management practices to stretch their food dollars, food safety practices to prevent illness, and improve household food security (Murray et al., 2015; National Institute of Food and Agriculture, n.d.).

Nationally, EFNEP has utilized a Behavior Checklist (BC) to evaluate the impact of the program on changes in participants' food-related behaviors and a group five-pass method 24-hour dietary recall (Townsend et al., 2013) collected from participants at entry and exit to the program. In 2018, the BC was replaced by the Food and Physical Activity Questionnaire (FPAQ) (Murray et al., 2017), a validated pretest-posttest tool composed of 20 core questions to evaluate behaviors in five domains: 1) diet quality, 2) physical activity, 3) food safety, 4) food security, and 5) food resource management (Table 1). When a participant begins the WA EFNEP, the FPAQ is administered at Lesson 1 and at Lesson 9 when the participant exits the program, establishing a baseline of the participant's behaviors prior to taking the EFNEP class and measuring changes in behavior as a result of attending the class.

The 24-hr dietary recall (24HDR) is collected using the “Food Tracker: What I ate yesterday” and is facilitated by peer educators using visual aids and guides to assist participants in accurately documenting their meals over the last 24-hr period (Townsend et al., 2013). At entry, the 24HDR is collected at Lesson 2 and at exit collected at Lesson 9.

Paraprofessional nutrition educators are trained to enter FPAQ and 24HDR data into the Web-based Nutrition Education Evaluation and Reporting System (WebNEERS) (Scott-Pierce et al., 2015), which generates summary reports of participant behavior change in each of the five domains and an assessment of participant diet quality at pre-intervention and post.

The Healthy Eating Index (HEI) is a measurement of overall diet quality. Originally developed in 1995, the structure of HEI was revised in 2005 and is updated every five years (USDA FNS, 2019). HEI-2010 evaluates how well an individual’s diet follows the dietary recommendations outlined in the *2010 Dietary Guidelines for Americans (DGA)*. A scoring system from 0 to 100 is used to evaluate 12 components that represent the different food groups and key recommendations in the DGA. Scores are not affected by total caloric intake as they are standardized to a density of 1,000 calories.

The 12 components are divided into two groupings: adequacy components (food groups and dietary elements that are desirable) and moderation components (food groups and dietary elements to limit). HEI-2010 emphasizes adequacy of total fruit, whole fruit, total vegetables, greens and beans, whole grains, dairy, total protein foods, seafood and plant proteins, and specific types of fatty acids, while limiting refined grains, sodium, and empty calories (Table 2). The total HEI score, indicates overall diet quality, while the component scores collectively show a pattern of diet quality. The higher the HEI score, the greater the adherence to the DGA (USDA FNS, 2019).

Nutrition education programs such as EFNEP aim to teach participants the importance of a nutritionally sound diet and hands-on practice for achieving a balanced diet that adheres to the DGA. The HEI is therefore an ideal tool for assessing the quality of EFNEP participants' diets at baseline before intervention and after to measure the effectiveness of the educational content in influencing dietary behaviors.

Bonnett et al. (2019) assessed the effectiveness of EFNEP by comparing a short-term, self-reported behavior questionnaire that was completed by participants before the program, immediately after the program, and at least six months after the program. The checklist asked a variety of questions related to participants' nutrition practices, food resource management practices, food safety practices, and food security. The analysis outcomes suggest that EFNEP graduates may benefit from continued communications through reminders to use the new skills learned in the EFNEP classes. The qualitative component of this study concluded that participants demonstrated willingness to continue healthy behaviors with additional supports after the EFNEP class. The motivation for behavior change is not captured in the quantitative 6-month follow-up data.

Arnold et al. (2000) sought to examine the benefits gained and maintained by EFNEP participants in food practices, nutrition knowledge, nutrient intake, and other areas. A prospective, within-subject design was used to examine a randomly selected sample. Self-reported information was gathered at entry into EFNEP, graduation from the program, and follow-up 1 year after completion of the program. Participants increased and maintained knowledge and reported practices related to food budgeting, food preparation, food safety practices, and nutrition. Dollahite et al. (2014) conducted a longitudinal randomized controlled trial to assess the effectiveness of EFNEP long-term, using a comparison group and a delayed

intervention group. Participants in the immediate intervention received EFNEP classes the first 8 weeks, and those in delayed intervention received classes the second 8 weeks, with no intervention during alternate periods. Data were collected in 3 repeated measures. The immediate intervention group showed improvement in nutrition, food resource management, and food safety practices immediately post-EFNEP and sustained these changes between post and 8 weeks after graduation. This study demonstrates an assessment of intermediate outcomes as they are not limited to immediate post-EFNEP and lays a foundation for future opportunities to assess EFNEP outcomes long-term.

A secondary analysis of EFNEP dietary recalls collected from participants in the Mountain region compared the differences between HEI-2005 scores at entry and exit from the program. The median total HEI-2005 score at entry was 49.1 (out of a maximum score of 100) and at exit, 55.2 (n=3,338). The 6.1 median change in HEI-2005 scores reported by Guenther and Luick (2015) indicated an overall improvement in participant diet quality following the EFNEP classes. Weatherspoon et al. (2015) sought to determine the factors – demographic, program-related, and behavioral – that influenced the participant outcomes after completion of EFNEP and Supplemental Nutrition Assistance Program-Education (SNAP-Ed) programs in Michigan. This secondary analysis of 24HDR data (n=2,687) between 2011 and 2012 found an improvement of 2.3 points in HEI-2005 total mean scores for participants across both low-income nutrition education programs. Perkins et al. (2019) conducted a secondary analysis of 24HDR data between 2013 and 2016 to assess the relationship between EFNEP participation and food-related behavior change. This study found that EFNEP participation using the ESBA curriculum was associated with improvements in diet quality, resulting in 7.2 points mean change in Total HEI from pre-EFNEP to post.

The Expanded Food and Nutrition Education Program targets low-income families and uses evidence-based curriculum and standardized evaluation tools and data collection methods. This consistently evaluated program presents a foundation for future research such as the assessment of long-term impacts on underserved and limited-resource populations as a result of attending EFNEP classes. EFNEP evaluation is currently limited to short-term, self-reported behavior, and lacks a consistent method of assessing intermediate and long-term outcomes. Research on behavior change from EFNEP participation is limited to post-data available immediately following the intervention, at Week 9. Positive impacts are widely observed at this stage when the knowledge is fresh and new skills are actively being practiced and utilized (National Institute of Food and Agriculture, n.d.). The critical piece that is largely unknown and scarce in the literature is how programs like EFNEP influence families to make long-term behavior changes that become embedded in their daily lives and routines.

Methods

Study Design and Population

This study was a secondary analysis of the 24-hr dietary recall (24HDR) data collected from a sample of English and Spanish speaking EFNEP participants from January 2018 through October 2019. At the time of study enrollment, all participants were screened to meet the following criteria: 1) one child at home between 2 and 8 years old, 2) no previous exposure to EFNEP, 3) use of a smart phone, and 4) internet access. As part of the program study, participants completed the standard EFNEP evaluation forms at the beginning of the program and again at the end, which includes demographic information, the Food and Physical Activity

Questionnaire (Murray et al., 2017), and a facilitated group five-pass method 24HDR using the form “Food Tracker: What I ate yesterday” (Townsend et al., 2013). Participants were invited to complete additional paperwork 6 months and 12 months after program graduation, including the 24-hour dietary recall. Participants received a total of \$170 for participating in this study: \$30 at Data Collection 1 (entry), \$40 at Data Collection 2 (exit), \$50 at Data Collection 3 (6-month follow-up), and \$70 at Data Collection 4 (12-month follow-up). Participants were not paid for lesson attendance. For parents who missed scheduled data collections, additional data collection opportunities were offered. Participants were considered withdrawn from the study after three failed contact attempts as suggested by Dillman et al. (2000).

Data Collection

The standard EFNEP program evaluation forms were administered in class by trained paraprofessional staff. For additional data collections, data collectors (usually graduate students or professional staff) provided initial instructions, answered questions, and ensured completion of all paperwork. Data collectors were trained by a Master’s prepared Registered Dietitian Nutritionist on the 5-Step Multiple Pass 24-Hour Dietary Recall Method. Trained professional staff entered 24HDR data into the Web-based Nutrition Education Evaluation and Reporting System (WebNEERS) (Scott-Pierce et al., 2015).

Data Analysis

Statistical analysis was performed in R version 4.0.2 (R Core Team, 2020). Changes in HEI component scores between any combination of all 4 time points – Week 1, Week 9, Month 6, and Month 12 – were tested using Generalized Estimating Equations (GEE) linear regression.

Paired t-tests were used to test for overall changes in HEI scores between Week 1 and Month 12, to assess long-term dietary behavior change from pre-EFNEP to 12-months post-EFNEP. Due to the small sample size and similar demographics, the analysis was not adjusted for covariates such as age, sex, race/ethnicity, or education level. Data for Empty Calories was missing at Month 6 and at Month 12 and not included in the analysis. However, the Empty Calorie scores from weeks 1 and 9 were averaged (15.9 points) and added to the Total HEI at Months 6 and 12 to provide an estimate of Total HEI.

Results

Over 90% of EFNEP participants in this sample were women, 88% were between the age of 31 and 50 years, 65% were Hispanic or Latino, and less than half (49%) had at least a high school diploma or equivalent. Table 3 presents the descriptive statistics of the whole sample.

Table 4 presents the summary statistics for HEI component scores at Week 1, Week 9, Month 6, and Month 12. Though not precise due to missing data for Empty Calories at Months 6 and 12, the estimated scores added to the HEI Totals resulted in an overall improvement of Total HEI from pre-EFNEP intervention to 12-months post-EFNEP. From Week 1 to Month 12, the estimated Total HEI improved by 4.8 points without decreasing between time points.

Improvements in HEI component scores between Week 1 and Month 12 – without decreasing between time points – were observed in total fruit, whole fruit, and fatty acids. The improvement in HEI component scores ranged from 0.6 points (total fruit and whole fruit) to 1 point (fatty acids). The estimated increase in Total HEI and the three subcomponent scores show evidence that participants' diet qualities improve as a result of attending the EFNEP class series.

The majority of HEI component scores increased and decreased at different time points between Week 1 and Month 12. After completion of the program at Week 9, Total HEI improved by 3.4 points. HEI component scores increased by less than 1 point in whole grains (0.6), total protein (0.4), and seafood and plant protein (0.5). The most notable improvement was observed in refined grains, which improved by 1.4 points from pre- to post-EFNEP. Six months after completion of the program, Total HEI improved by 1.2 points from Week 9. HEI component scores from Week 9 to Month 6 improved slightly in greens and beans (0.1), dairy (0.8), and sodium (0.5). The biggest improvement was 1 point in whole grains. Between the two follow-up time points at Month 6 and Month 12, Total HEI improved slightly by 0.2 points.

HEI component scores improved slightly by less than 1 point in total vegetables (0.1), total protein (0.5), seafood and plant protein (0.5), and refined grains (0.6). Despite increasing between time points, the HEI component scores decreased overall from Week 1 to Month 12 in total vegetables (0.5), greens and beans (0.6), and sodium (0.6).

Discussion

Improvements in diet quality is associated with lower risk of chronic disease such as cancer, cardiovascular disease, and type 2 diabetes (McCullough et al., 2002; Fanelli et al., 2020). Even if they are not statistically significant ($p < 0.05$), the findings of this study suggest improvements in the dietary quality of EFNEP participants as a result of the program and align with the outcomes of other studies assessing the efficacy of low-income nutrition education programs. Perkins et al. (2019) similarly assessed the relationship between EFNEP participation and food-related behavior change, as measured by the HEI-2005, and found that using ESBA specifically was associated with dietary improvements in EFNEP participants. The study did

boast a larger, more diverse sample (n=507) and adjusted for age, sex, race, rural/urban residence, county, highest grade completed, income, number of children, public assistance programs, and number of hours in EFNEP. As such, the analysis was more robust and precise and found an improvement of Total HEI and several subcomponents scores from pre- to post-intervention at the 5% significance level or better. The findings in the current study were not statistically significant but may have been if the analysis controlled for these covariates.

Guenther and Luick (2015) conducted a secondary analysis of 24HDR collected from 8 states (n=3,338). Similar to Perkins et al., the strengths of this study include the larger sample that was adjusted for age, race/ethnicity, pregnancy/lactation status, and state of residence. Median numbers of lessons participants received were also calculated. The lack of consistent or standardized data collection, coding, and cleaning protocols compromised the quality of the 24HDR data in Guenther and Luick's study. This limitation was conversely a strength in this current study as data collectors were trained by a Master's prepared Registered Dietitian Nutritionist on the 5-Step Multiple Pass 24-Hour Dietary Recall Method and trained professional staff entered all 24HDR into WebNEERS. The 24HDR were collected consistently using a scripted instruction guide at all data collections, and the data was entered by a single trained professional staff.

Weatherspoon et al. (2015) sought specifically to determine which demographic, programmatic, and behavioral factors influenced the outcomes of Michigan EFNEP and SNAP-Ed participants. Adjusted for demographic variables and socioeconomic variables, the study found that income, gender, residence, and race were most significantly related to improvements in HEI scores. This strength was a limitation for the current study, which did not adjust for any variables and greatly limited the opportunities to observe statistically significant changes. A

common strength is that the data collected for Weatherspoon et al. were based on standardized and consistent data collection and data entry methods. A final comparison between the analysis conducted by Weatherspoon et al. and this study is that their analysis assessed the outcomes for both EFNEP and an additional low-income nutrition education program, which differed in baseline HEI scores and improvement outcomes.

The improvements in diet quality, especially if sustained long-term, suggest EFNEP participants may reduce the risk of chronic disease by eating more balanced diets that align with dietary recommendations. A systematic review of studies investigating the association between diet quality as measured by several scales, including HEI, found a significant reduction in the risk of overall mortality due to chronic disease. High-quality diets are thus proven to be important factors in the prevention of chronic disease (Schwingshackl & Hoffmann, 2017). As several studies have demonstrated, EFNEP plays a role in improving the diet quality of program participants, and thus validates the efficacy of low-income nutrition education programs. The study design for future research may be strengthened by adopting the consistency and standardization of the data collection and data entry protocols apparent in this study and adjusting the sample for demographic and other variables as demonstrated in previous studies on HEI and EFNEP.

Limitations

One limitation of this study was the small sample size. Only participants with complete data collected at all four timepoints were included. Additionally, there is little variation in age, gender, and race; the majority of participants were Hispanic or Latino females in the 31-50 age range. This study did not adjust for these covariates, which limited the potential for statistically

significant changes in behavior. Adjusting for demographic variables would have allowed for more precision in the analysis using least square means and standard error as opposed to standard deviation, increasing the likelihood of $p < 0.05$. Another limitation was missing data. HEI scores for Empty Calories were not calculated at Month 6 or at Month 12, further impacting the calculation of Total HEI. The estimated empty calories scores added to Total HEI demonstrated an improvement in diet quality over the one-year follow-up period.

Implications for Practice and Future Research

The goals of EFNEP are to teach families the knowledge, skills, attitudes, and behaviors necessary to have nutritionally sound diets, contribute to their personal development, and improve the total family diet and nutritional well-being. This study explored the methods of collecting and analyzing EFNEP evaluation data over a longer period of time to assess the true efficacy of this program. By following this small sample of participants of WA EFNEP, we have observed that dietary improvements appear to continue months after taking EFNEP classes. Evaluating the long-term impacts of EFNEP on participants' dietary behaviors may demonstrate the need for nutrition education programs that target low-income people and communicate the value of EFNEP to key stakeholders and decision-makers who support the funding and continued programming of such programs.

Table 1: EFNEP Education Domains and Goals

Domain	Goals
Diet Quality	Improved diets and nutritional well-being through adoption of the US Dietary Guidelines for Americans (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010)
Physical Activity	Improved physical well-being through adoption of the Physical Activity Guidelines for Americans (U.S. Department of Health and Human Services, 2018)
Food Safety	Improved household food safety and sanitation practices
Food Security	Increased ability to obtain food directly (and from food assistance programs) to ensure having enough healthy food to eat
Food Resource Management	Increased ability to buy, grow, or otherwise appropriately obtain, prepare, and store food that meets nutritional needs

Table 2: Healthy Eating Index-2010 (Reference) components and standards for scoring¹

Component	Maximum Score	Standard for maximum score (per 1,000 kcal)	Standard for minimum score (per 1,000 kcal)
Adequacy:			
Total Fruit ²	5	≥ 0.8 cup eq	0 cup eq
Whole Fruit ³	5	≥ 0.4 cup eq	0 cup eq
Total Vegetables ⁴	5	≥ 1.1 cup eq	0 cup eq
Greens and Beans ⁴	5	≥ 0.2 cup eq	0 cup eq
Whole Grains	10	≥ 1.5 cup eq	0 cup eq
Dairy ⁵	10	≥ 1.3 cup eq	0 cup eq
Total Protein Foods ⁶	5	≥ 2.5 cup eq	0 cup eq
Seafood and Plant Proteins ^{6,7}	5	≥ 0.8 cup eq	0 cup eq
Fatty Acids ⁸	10	(PUFAs + MUFAs)/SFAs ≥ 2.5	(PUFAs + MUFAs)/SFAs ≤ 1.2
Moderation:			
Refined Grains	10	≤ 1.8 oz eq	≥ 4.3 oz eq
Sodium	10	≤ 1.1 gram	≥ 2.0 grams
Empty Calories ⁹	20	≤ 19% of energy	≥ 50% of energy

¹Intakes between the minimum and maximum standards are scored proportionately.

²Includes fruit juice.

³Includes all forms except juice.

⁴Includes any beans and peas not counted as Total Protein Foods.

⁵Includes all milk products, such as fluid milk, yogurt, and cheese, and fortified soy beverages.

⁶Beans and peas are included here (and not with vegetables) when the Total Protein Foods standard is otherwise not met.

⁷Includes seafood, nuts, seeds, soy products (other than beverages) as well as beans and peas counted as Total Protein Foods.

⁸Ratio of poly- and monounsaturated fatty acids (PUFAs and MUFAs) to saturated fatty acids (SFAs).

⁹Calories from solid fats, alcohol, and added sugars

Table 3: Descriptive statistics of demographic variables (n = 40)

Variable	N (%)
Age	
19-30	5 (12)
31-50	35 (88)
51-70	0 (0)
Gender	
Male	3 (7)
Female	37 (93)
Race	
American Indian or Alaskan Native	0 (0)
Asian	0 (0)
Black	2 (5)
Native Hawaiian or Pacific Islander	1 (2)
White	5 (13)
Hispanic or Latino	26 (65)
Other	6 (15)
Education	
6 th grade or less	8 (20)
8 th grade or less	6 (15)
Some high school	6 (15)
High school graduate or GED	10 (25)
Technical school	1 (2)
Some college	8 (20)
College graduate	1 (2)

Table 4. Summary statistics for HEI-2010 component scores at entry and exit (n=40)

HEI Components (max score)	Week 1	Week 9	Month 6	Month 12	p-value ^a
	Mean (SD)				
Total Fruit (5)	3.1 (2.1)	3.1 (2.2)	3.4 (2.1)	3.7 (1.9)	0.28
Whole Fruit (5)	3.2 (2.3)	3.3 (2.2)	3.3 (2.4)	3.8 (2.0)	0.37
Total Vegetables (5)	4.1 (1.5)	4.1 (1.2)	3.5 (1.8)	3.6 (1.9)	0.1
Greens and Beans (5)	2.0 (2.5)	1.5 (2.3)	1.6 (2.3)	1.4 (2.2)	0.55
Whole Grains (10)	2.7 (3.6)	3.3 (4.0)	4.3 (4.2)	3.5 (3.9)	0.28
Dairy (10)	4.6 (3.1)	4.6 (3.7)	5.4 (3.1)	5.0 (3.7)	0.65
Total Protein (5)	4.3 (1.3)	4.7 (0.8)	4.0 (1.7)	4.5 (1.5)	0.14
Seafood and Plant Protein (5)	1.7 (2.2)	2.2 (2.4)	2.0 (2.1)	2.5 (2.3)	0.53
Fatty Acids (10)	5.2 (3.7)	5.3 (3.8)	6.2 (3.3)	6.2 (3.6)	0.44
Refined Grains (10)	4.2 (3.8)	5.6 (4.0)	5.1 (4.3)	5.7 (4.2)	0.13
Sodium (10)	3.3 (3.4)	3.2 (3.6)	3.7 (3.5)	2.7 (2.9)	0.43
Empty Calories ¹ (20)	15.8 (4.8)	15.9 (4.9)	15.9 (4.9)	15.9 (4.9)	-
HEI Total ²	53.7 (15.9)	57.1 (15.6)	58.3 (14.1)	58.5 (14.5)	-

¹Data for Empty Calories was not calculated at Month 6 or Month 12. An average of Week 1 and Week 9 were calculated to estimate Empty Calories at these time points.

²Average of 15.9 added to HEI Totals at Month 6 and Month 12.

^aBased on GEE linear regression

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