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## **Evaluation of the Youth Expanded Food and Nutrition Education Program: What Contributes to its Effectiveness?**

### **Background**

Evaluation of federally funded programs is important to improve their effectiveness and to ensure their public accountability (General Accounting Office [GAO] 2004). USDA provides funds and manages the Expanded Food and Nutrition Education Program (EFNEP). Every year, EFNEP spends over 66 million US dollars (68 million in 2010) of federal budget (NIFA, 2011). There has been an increased emphasis on the evaluation of federally funded programs to improve the effectiveness and public accountability of the federal programs (GAO 2004). Despite being one of the largest and longest (in operation for more than 40 years and implemented in all 50 states and six US territories) nutrition education programs in the US (GAO 2004), its evaluation has been sparse and its effectiveness largely unknown.

EFNEP is designed to serve the limited resource audiences, both adults and youths, by helping them acquire “the knowledge, skills, attitudes, and changed behavior necessary for nutritionally sound diets, and to contribute to their personal development and improvement of the overall family diet and nutritional well-being” (USDA 2011). According to the USDA’s annual impact report of EFNEP, the participants have shown improvements in different domains of nutrition behavior (USDA 2011). Effectiveness of EFNEP for adults is substantiated by several studies that have appeared in the peer reviewed journal (Arnold and Sobal 2000; Rajgopal et al. 2002; Dollahite et al. 2008). Although youths comprise a large portion, more than 75% of EFNEP beneficiaries, evaluations of youth EFNEP have largely remain undocumented. Townsend and colleagues (2006) are only scholars to study the effectiveness of youth EFNEP. By using USDA’s selected youth impact indicators as outcome measures, they found that the participants who received the lessons had higher post-test scores than the counterparts. Routine evaluation of the Youth EFNEP by USDA is primarily based on the number of youths who improve in any of the following four impact indicators: (i) increase in variety of foods they eat; (ii) increase in nutritional knowledge; (iii) increase in ability to select low-cost, nutritious food; and (iv) improvement in food preparation and safety practices.

Part of the reason for the scantiness in evaluation studies on youth EFNEP is due to the lack of valid and reliable assessment tools. No federal guideline mandates the use of any specific instrument or even curricula for youth EFNEP. For evaluation, the state program often creates their own survey instruments. This results in the lack of consistency and standardization across EFNEP program evaluation.

Recently, a concerted effort has been made to develop a standardized instrument to measure the outcomes of the youth EFNEP. This effort was a part of the larger project on the cost effectiveness of youth EFNEP and the process was closely monitored and guided by the “advisory board” that consists of nationally recognized faculty with expertise in nutrition, EFNEP, economics, item response theory, and program evaluation. We utilize the data collected using this instrument to evaluate effectiveness of the youth EFNEP in Virginia. In particular, we attempt to measure the outcomes of the youth EFNEP program and to explore the factors that contribute to the effectiveness of the program. We take an item theoretic approach and applied a Rasch measurement model<sup>1</sup> to measure program outcomes. Application of the Rasch measurement model is novel in the current context, and is an improvement over the outcome measure in practice by USDA. Using the Rasch outcome scores as a dependent variable, we

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<sup>1</sup> Details about this measurement model are discussed in the model section.

explore the factors that affects outcome using a hierarchical linear model (HLM). HLM is used to account for the possible differences in outcomes across schools and classes.

The attributes of effective program are of interest to the EFNEP policy makers as it can potentially provide information for evidence based decision-making and help devise policies for better management of the program. Identification of the attributes of effective program would serve as a tool for the youth EFNEP policy makers to improve overall efficiency. Characteristics of the high performing groups can be transferred to the low performing groups to improve the overall program effectiveness.

### **Organization of the Youth EFNEP program in Virginia**

The overall goal of the youth EFNEP program is to bring a positive change in nutrition behavior of its participants'. One of the major components of the youth EFNEP program in Virginia is the *Healthy Weights for Healthy Kids* (HWHK) curriculum. The program targets youth participant ages 7 to 14 years. The core of this curriculum is to address the problem of obesity and overweight among the youths by educating them about smart nutritional choices, helping them develop positive attitudes and behavior involving diet, physical activity, and body image. The curriculum consists of six lessons that cover different aspects of nutrition smart foods, smart choices, smart activities, smart drinks, smart snacks, and smart image. Each lesson has a number of experiences associated with them.

The HWHK curriculum is usually provided in a school setting by educators, called as youth paraprofessionals (PA's). There is one youth PA in each of the selected county. All youth PAs are trained in delivering the HWHK curriculum. Schools where at least 50% of students are eligible for free or reduced school lunch are selected for program implementation. Youth PA's in collaboration with local schools, 4-H clubs, after-school and before-school programs, and camps, identify the youths in need and deliver the program. Depending on convenience of school/group and PA's schedule, the duration of program and class size can vary substantially.

## **Methods**

### **Data and Variable Description**

This paper uses primary data collected from all youth EFNEP participants in Virginia who participated in the HWHK program during September 2011 and May 2012<sup>2</sup>. The sample used in this paper includes 702 students from 17 schools and studying in 3<sup>rd</sup> to 7<sup>th</sup> grade. Nine program assistants (PAs) from nine counties delivered the program to these students in 40 different groups/classes. Survey questionnaire consisting of questions that measure nutrition behavior, together with socio demographic information were given to students before and after the completion of the program. The PAs were present while the students took the survey and walked the students through the survey when necessary.

*Outcome of the Youth EFNEP:* Outcome of the youth EFNEP program is defined as the change in *nutrition behavior* among the student participants due program. Understanding individual's health behavior is complex and so is its change. It however is a crux in the evaluation of programs directed towards such goal. Nutrition behavior is a latent construct and cannot be observed directly. The common approach then is to use a pool of items that reveal different dimensions of nutrition behavior to capture the underlying behavior of individuals. Eighteen

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<sup>2</sup> This paper uses only a part of the total data which was available at the end of March. This includes most of the data that is collected until end of February 2012. Data is still being collected from the field and being processed.

items, consistent with the Dietary Guideline for Americans 2005, and which cover the content of HWHK curriculum were used to measure nutrition behavior. The responses on most of the items were measured on a four point Likert type scale with responses ranging from 0 time per day to 3 or more times per day. Two items were measured on five point Likert type scale with responses ranging from 0 to 4 units per day. One item was measured on four point Likert type scale with response categories ranging from ‘strongly disagree’ to ‘strongly agree’.

Responses from multiple items can be used in many ways to measure the underlying latent construct. In this paper, a single behavior score from participants’ response to these items is obtained by using a Rasch measurement model. Difference between the pretest and posttest Rasch score is used as the measure of outcome.

### *Explanatory variables*

*Self-efficacy:* Self-efficacy is an individual’s confidence in performing a particular behavior (Bandura, 1986). It affects the amount of effort put by an individual in taking a particular action. Theories on individual health behavior (for example: social cognitive theory, health belief model) suggest self-efficacy as a precursor of behavior and is often used as predictor of behavior in empirical studies (Baranowski et al., 2000). Self-efficacy is also a latent construct. We measure self-efficacy using sixteen items related to different aspects of nutrition and generate self-efficacy score for each individual using a Rasch measurement model. Change in self-efficacy scores from pre to post test is used to predict change in behavior. We hypothesize that students with high self-efficacy score will have higher nutrition behavior and that the students who have higher change in self-efficacy will have a higher change in behavior from pre to post test.

*Student Characteristics:* Demographic characteristics of students such as age, gender and ethnicity are included in the analysis. These characteristics are also called as behavior modifying factors (Health belief model). Including these variables allow us to see the differences in behavior across students of different socio demographic characteristics. We also controlled for the type of family that a student belong to. The variable family type is defined as whether the student lives with a single parent, both parents, or with others (others include grandparents)<sup>3</sup>. Food habits in households belonging to different family type could potentially be different, the variable family type controls for such factors.

Literature suggests that, besides knowledge about healthy and unhealthy foods, individual’s eating behaviors depends on their taste and preference for food, and more importantly on availability and accessibility of healthy foods (Domel et al., 1996, Hearn et al., 1998, Taylor et al., 2005, Bere and Klepp, 2005, O’Dea, 2003). These results are intuitive especially in the case of children who usually have less or no control over the availability and accessibility of food at home or school. They eat what they are offered and not necessarily what they know is healthy. We therefore controlled for availability of food at home in our analysis. Students reported the number of days of a week for which a typical food (eight items) was available at their home. Types of food were divided into healthy (include food such as fresh fruits and vegetables) and unhealthy (include food such as soda) food. Food availability score one each for healthy and unhealthy food, were generated by adding the raw scores on the number of days healthy and unhealthy food were available.

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<sup>3</sup> For students whose family type and ethnicity do not match from pre to post test and the students who check multiple responses are categorized in a separate category.

*Class/Group Characteristics:* Youth EFNEP is primarily taught in a class setting. Program duration, class size, and place of residence are some of the common group specific characteristics that we control in this study. Program duration is the duration between pretest and posttest measured in number of days. PAs in collaboration with local schools and teachers determine the duration of program and deliver accordingly. Duration of program ranges from about seven days to 150 days. Wide variation in duration of program is because some PAs deliver the program once a month and take six months to complete the program whereas some choose to deliver the program every day and complete the curriculum in one week. We hypothesize that there is a difference in outcomes by duration of program. Learning and change in behavior could be affected by the duration of program. Retention of learning and hence change in behavior could be a decreasing function of duration. Higher outcomes are hypothesized to accompany students with shorter class duration.

Class size in our sample varies widely. Some students are taught in a small group of about 10 students, whereas some groups are composed of more than 70 students. Instructors could possibly reach to individual students and help them learn more effectively in a small class, whereas in a large class one-to-one interaction between student and instructor might not be feasible. We hypothesize that students in small class would have more positive changes in outcomes than their counterparts in a large class.

Information on the residence of students is available at the group level. Students residing in different geographical unit might have different nutritional behavior. Further, the availability of food might be different in different geographic area. We therefore control for residential area at the group level. Numbers of students in each group/class are categorized into those who reside in farm, rural, suburbs or in cities.

*Program Assistant Characteristics:* Program assistants are the key personnel who design and implement the program. Selection of schools, formation of groups, selection of lessons and activities within the HWHK curriculum, determining the duration of program all falls within the jurisdiction of PA. Program implementation and thus the program outcomes could be explained by PA specific characteristics. We therefore control for characteristics of PA such as age, gender, ethnicity, and years of experience with the youth EFNEP program. PA’s years of experience with the program is hypothesized to have a positive effect on outcome. Students taught by PA’s with many years of experience working with the youth EFNEP program might be better at delivering the HWHK curriculum. Also they might know the ideal class size and have mastered the tricks to better educate youths leading to better outcomes.

Table 1 provides the summary statistics of the variables used in this paper.

**Table 1: Summary Statistics**

<b>Variables</b>	<b>N</b>	<b>Mean</b>	<b>Std.</b>	<b>Min</b>	<b>Max</b>
<b>Outcome variables</b>					
Behavior Raw Score Before	692	28.74	9.73	3.00	54.00
Behavior Raw Score After	690	31.48	9.39	5.00	53.00
Behavior Rasch Score Before	692	62.37	10.30	16.24	99.27
Behavior Rasch Score After	690	64.38	10.81	0.00	100.00
Change in Behavior	690	1.98	9.78	-66.42	38.69

<b>Student Characteristics</b>					
Gender	702	0.49	0.50	0.00	1.00
Age	700	9.42	0.83	7.00	13.00
	697	9.58	0.85	8.00	13.00
Ethnicity	697	2.40	0.97	1.00	4.00
Family Type	683	2.16	0.88	1.00	4.00
Food Availability					
Good /before	348	28.47	9.66	1.00	42.00
Bad / before	555	8.70	4.44	0.00	14.00
Good/ After	422	30.15	9.22	1.00	42.00
Bad/After	600	8.48	4.44	0.00	14.00
Change in Self-efficacy	690	3.15	11.12	-57.90	46.36
<b>Group Characteristics</b>					
Class size / Group Size	40	20.30	10.29	12.00	77.00
Exposure					
Residence	39	2.51	1.05	1.00	5.00
Frequency of Teaching	40	56.20	30.21	10.00	150.00
Total number of handouts	41	8.59	4.57	0.00	14.00
<b>Program Assistant Characteristics</b>					
Age	9	46.67	18.21	24.00	68.00
Gender	9	0.11	0.33	0.00	1.00
Ethnicity	9	0.78	0.44	0.00	1.00
Experience	9	4.06	3.38	1.00	10.00

### **Measuring Outcomes of the Youth EFNEP using the Rasch Measurement Model**

The Rasch model is a common method used to measure latent variables in the social science discipline. A test composed of a set of questions/items, is developed and is employed to the individuals of interest. All items are defined in relationship to a single underlying latent variable that we want to measure. Individuals are believed to have different levels of a latent trait (generically called as ability) according to the number of questions they answer correctly in the test (Bond and Fox, 2007). Also, different questions have a varying level of difficulty measured by the number of individuals correctly answering a particular question.

The Rasch measurement models the individual probability of success in answering the questions correctly as a logistic function of the difference between the ability parameter and the difficulty parameter. According to the Rasch model, when an individual with some ability encounters an item of some difficulty, the probability of a correct response is modeled as a logistic function of the difference between the ability and difficulty parameter (Fisher and Molenaar, 1995). Let  $\beta$  denote the vector of item (difficulty) parameters, and  $\theta$  the vector of person (ability) parameters. Then, the probability of an individual selecting the  $h^{\text{th}}$  category in a given item is modeled as:

$$Pr(X_{vi} = h) = \frac{\exp(\theta_{vh} + \beta_{ih})}{\sum_{l=0}^m \exp(\theta_{vl} + \beta_{il})}$$

These formulation allows the estimation of the parameters,  $\beta_i$  and  $\theta_v$ , independently of each other. Maximum likelihood is the most common method used for estimation in the Rasch model. The software “Winsteps” was used to estimate the Rasch model. This program uses a joint maximum likelihood approach for parameter estimation. Item difficulty was anchored to the difficulty parameter derived from the pretest data, which allows comparison of pretest and posttest person parameters. The logit measures derived from the Rasch model were transformed to be within the range of 0 to 100 to facilitate interpretation. Summary statistics of these scores together with the raw score are given in Table 1. For each individual, the difference between the posttest and the pretest Rasch score is the measure of outcome, which is used as a dependent variable in the subsequent analysis for identifying the factors affecting the outcomes of the program.

Summation of the raw scores on each item would be an alternative over using the Rasch model. Raw score, however, is not much appealing because the items are measured in ordinal scale. The main advantage of using the Rasch model over the raw scores is that this model transforms the raw scores into the logit measure which is an interval scale and permits flexibility over ordinal scale.

### Factors Affecting the Outcomes

The design of this study leads to a three-level clustered data set. The data have a nested structure: students nested within class/group, groups within school, and schools within county. A standard approach to deal with the clustered data is hierarchical linear models (HLM). HLM can be applied to data with a nested structure and allows for analyzing the outcome variables at multiple levels of a hierarchy.

**Model Specification:** HLM is the generalization of an ordinary linear regression which allows for the random effect of the variables other than the random error term. The general form of the HLM can be written as (Leeuw and Meijer, 2008; Cameron and Trivedi, 2005)

$$Y = X\beta + Z\gamma + u \quad (1)$$

where,  $X\beta$  is the fixed effect and  $Z\gamma$  is the random effect. The random effects are not directly estimated, but are characterized by the elements of the variance component along with the overall residual. When  $\gamma = 0$ , equation (1) reduces to ordinary linear regression. The residual term  $u$  is assumed to be uncorrelated with  $X$  and  $Z$ , and distributed normally. Parameter estimation is done by maximum likelihood method.

A three-level random intercept hierarchical linear modeling approach is used to explore the factors affecting the outcome of youth EFNEP. Each level in the data structure is formally represented by its own sub-model and each sub-model represents the structural relations occurring at that level and the residual variability at that level (Leeuw and Meijer, 2008). Equation 1 can be expanded to three levels to show the hierarchal structure.

$$\text{Level-1 model: } y_{ijk} = \beta_{0jk} + \sum_{p=1}^P \beta_{pjk} X_{pijk} + u_{ijk} \quad (2)$$

$$\text{Level-2 model: } \beta_{0jk} = \gamma_{qk} + \sum_{q=1}^Q \gamma_{qk} W_{qjk} + v_{jk} \quad (3)$$

$$\text{Level-3 model: } \gamma_{00k} = \varphi_{00} + e_k \quad (5)$$

Level 1 model is specified at the individual student level, which is the unit of analysis. At this level, the outcome ( $y$ ) of the  $i^{\text{th}}$  individual in  $j^{\text{th}}$  group/class, in  $k^{\text{th}}$  school is modeled as a linear function of the individual specific characteristics ( $X$ ), given in Table 1.  $\beta_{0jk}$ , the intercept in Level 1, is an average outcome over all students in all schools. These outcomes are hypothesized to be different across class/group. Level 2 model allows level 1 intercept (average outcome) to vary by groups or class (equation 3). Class/group specific variables such as group size and program duration are used as predictors of average outcome. Intercept in the level 2 model is the average outcome for all school. Given that classes are nested within school, we allow for the level 2 intercept to vary by school. We model the random intercept at level 3. Level 2 error terms are assumed to follow a multivariate normal distribution. Level 3 error term is also assumed to be normally distributed. In addition,  $u, v, e$  are assumed to be independent.

We estimate three separate models. At first, we model the pretest behavior score as a function of student characteristics only. Secondly, we model the posttest behavior score. It is natural to assume that the characteristics of the program and the instructor specific characteristics might have an effect on the outcomes. Third, we model the outcome that is the change in behavior measured by the difference between the pretest and posttest behavior scores. Because the student specific characteristics, gender, age, ethnicity, family type, etc. are fixed, these will be differenced out in the model when we model the change in behavior. One can argue that the age of the student is not fixed in two periods. Because we control for the duration of the program, change in students' age from pre to posttest will be perfectly correlated, hence is dropped from the third model. Assuming that the program did not have effect on availability of food at home, this variable is also differenced out in the final model. This assumption saves us a lot of observation because questions on availability of food at home are not reported by many students.

## Results and Discussion

The measure of nutrition behavior using a Rasch model is given in Table 1. The average pretest behavior is 62.37 units with standard deviation of 10.30. There only a slight increase in the average posttest behavior score which is 64.38 units. The average of the outcome of youth EFNEP, measured as a difference between the pretest and the posttest behavior scores, is 1.98 units. The range of outcome is -66.42 to 38.69 units. The negative scores imply that the nutrition behavior actually decreased from pretest to posttest.

The estimates from the hierarchical linear model are displayed in Table 2. First three columns of Table 2 report coefficients from the null model for the pretest behavior, posttest behavior and change in behavior from pre to posttest. Intercept in models 1 and 2 are the expected value of pretest and posttest behavior, respectively, and represent the average behavior averaged over all individuals, in all groups and schools. The average behavior score in the pretest is 61.9 units and that for posttest is 64.27 units. The random effects, that are the estimates of variance for random intercept at school level is 9.41 and 6.4 for pretest and posttest; and at class level is 0.72 and 4.5 for pretest and posttest, respectively. The estimates of variance are relatively small compared to the intercept. However, these estimates are large enough to provide evidence for the presence of hierarchical structure in our data. The likelihood ratio test for both models 1 and 2 favors the hierarchical model ( $\chi^2_2 = 0.00$ ) over OLS.

Intercept of model 3 provides the average change in behavior from pretest to posttest and is 2.29 units. The variances of the random intercept at the school and class level are 3.49 and

5.20, respectively, and are higher than the intercept itself. This implies that there is a significant difference in change in behavior across different schools and classes. The likelihood ratio test model 3 also favors the hierarchical model ( $\chi^2 = 0.00$ ) over OLS.

**Table 2: Coefficient estimates from the Hierarchical Linear Models**

Fixed effects	Null Model			Full Model		
	M1: Pretest	M2: Posttest	M3: Difference	M4: Pretest	M5: Posttest	M6: Difference
Intercept	61.9 *** (0.88)	64.27*** (0.86)	2.29*** (0.73)	27.97*** (6.48)	42.77*** (15.60)	17.04* (8.64)
Students Gender				-0.83 (0.85)	-0.79 (0.85)	
Students Age				0.34 (0.62)	-0.85 (0.63)	
Students Ethnicity (White)				-0.55 (1.34)	-0.38 (1.45)	
Students Ethnicity (Others)				-0.84 (1.59)	0.58 (1.66)	
Students Ethnicity (Unmatched)				-1.63 (1.58)	-0.04 (1.46)	
Students Family Type (Both Parent)				1.47 (1.12)	-0.63 (1.19)	
Students Family Type (Grand Parents)				0.32 (1.72)	-0.13 (2.17)	
Students Family Type (Unmatched)				1.17 (1.54)	-1.33 (1.53)	
Availability of Good food				0.05 (0.05)	0.26*** (0.06)	
Availability of Bad Food				-0.31*** (0.10)	-0.30*** (0.11)	
Self-efficacy				0.66*** (0.05)	0.40*** (0.04)	0.39*** (0.03)
Duration					0.00 (0.04)	-0.01 (0.02)
Residence: Rural <10,000 population					2.62 (5.39)	1.50 (3.48)
Residence: 10-50,000 population					6.25 (5.84)	-0.02 (3.73)
Residence: Suburban <50,000 population;					3.67 (8.32)	-3.04 (5.08)
Residence: Cities>50,000 population					-0.38 (10.55)	-0.41 (5.38)
Group/ Class Size					0.00 (0.07)	-0.07* (0.04)
PA Age					0.06 (0.17)	-0.29*** (0.10)

PA Gender					6.44 (11.42)	-11.63 ** (5.88)
PA Ethnicity					-0.64 (4.37)	-3.15 (2.11)
PA Experience					-0.23 (0.42)	0.59*** (0.22)
Total Handouts Distributed					0.13 (0.17)	0.12 (0.16)
<b>Random Effects</b>						
Intercept (School)	9.41 (4.40)	6.391 (0.86)	3.48 (3.25)	5.43 (3.98)	7.62	0.00 (0.00)
Intercept (Class/ Group)	0.702 (1.79)	4.50 (2.85)	5.20 (2.95)	0.00 (0.00)	0.87 (2.50)	1.53 (36.39)
Group size						0.00 (0.00)
Duration						0.00 (0.00)
Residual	94.37 (5.22)	104.75 (5.81)	87.45 (4.85)	49.74 (4.27)	56.95	71.50 (4.18)
<b>LR test Vs. OLS: P &gt; chi2</b>	0.00	0.00	0.00	0.02	0.58	0.53
<b>Log restricted likelihood</b>	-2567.70	-2600.12	-2538.82	-1013.92	-1148.11	-2228.46
<b>N</b>	692	690	690	301	337	626

Models 4, 5 and 6 are full model for pretest, posttest and change in behavior, respectively. These are also the random intercept model, where the average behavior is allowed to vary by class/group and by school. Model 4 extends model 1 by adding student specific characteristics. Results show a small variance of the random effects at school level and zero variance at class/group level. Availability of unhealthy food and self-efficacy are the only significant predictors of pretest behavior. Availability of unhealthy food at home has a negative effect, whereas self-efficacy has a strong positive effect on pretest behavior.

Model 5 extends model 2 by including variables related to student characteristics, program and PA characteristics. The estimates of variance of the random effects do not provide evidence for the random intercept. None of the student specific characteristics have statistically significant effect on behavior except for the availability of food. As expected, availability of healthy food has a positive effect on behavior and availability of unhealthy food has a negative effect on behavior. Self-efficacy has a significant and positive effect on the posttest behavior.

Change in behavior from pretest to posttest is modeled in model 6. The estimates of the random effect do not provide evidence for difference in outcomes across schools and classes once other variables are controlled for, and the estimates from the hierarchical model is equivalent to OLS. In this model, change in self-efficacy is a significant predictor of change in behavior. Among the PA characteristics, age, gender and experience of PA are the significant predictors of change in behavior. PAs age has a negative effect on behavior indicating that students taught by young PAs are more likely to have positive changes in behavior. PAs gender also has a negative effect indicating that outcome is higher among students taught by female PAs than their male counterparts. Number of years of experience of PA has a positive effect. Among the group level variables, only class size has a significant effect on outcome. Consistent with our

hypothesis class size has a negative effect indicating that the program is more effective when taught in small classes.

## **Discussion**

This paper uses only a part of the data collected from the youth EFNEP program in Virginia and may not be a random representation of the program. Inclusion of sample in this study is based on the surveys completed in a first few months although the program runs through the whole academic year. Among 19 PA's who work for youth EFNEP throughout Virginia, this paper utilizes data only from 9 of them. Majority of data (83%) comes from 5 PAs. Also, we do not have data on all students participating in this program in each school. This severely limits the analysis and hence the results must be interpreted with caution.

HWHK is implemented with the goal of improving the nutrition related behavior of the participants. On an average, this program is successful in achieving its objective. The mean of the change in behavior is 1.98 units and it ranges from -66.42 to 38.69 (see Table 1). The negative outcome is somewhat counterintuitive but it could be a result of the way we measured the outcome variable. Behavior in our survey is measured by what students ate the day before the survey, which might not be representative of their general eating/nutrition behavior. Measuring the exact nutrition intake over a period of time (may be a week) would give a more precise measure of nutrition behavior. The tradeoffs here is the amount of resource used in collecting and analyzing such data, not to mention the burden of keeping data, especially for the young children. Another possible reason for only a small positive change in behavior might be the ceiling effect, if students report the most positive behavior in the pretest, the change in behavior in the posttest. Our data collection instrument is not sensitive to this effect. In our future work, we will explore other approaches that could possibly capture such issues.

All null models indicate the presence of hierarchical structure in our data and suggest that the expected value of behavior is different across schools and classes. There is, however, no evidence for random intercept in models 5 and 6. This implies, contrary to our hypothesis, there is no apparent significant difference in the outcomes associated with different classes or schools once we control for other variables. Insignificance of the random effects in all models could be due to non-randomness of data used in this paper.

Most of the student specific characteristics are statistically insignificant in all models. Our results on the availability of food (both healthy and unhealthy) are congruent with the literature. The higher the number of days the unhealthy food is available at home, less desirable the nutritional behavior of students are. Similarly, the more the number of days the healthy food is available at home, more favorable the student's behavior are. Realization of behavior is dependent on what is available and what is served at home, irrespective of nutrition education programs, especially for young children who have very little say in what is served to them. This result suggests that the outcomes of nutrition education program can be easily diluted by the factors outside of the control of the program such as availability of food. Educating parents together with the students would have a synergistic effect achieving the outcomes of the program. Integration of education programs for both children and families together with the food assistance programs to ensure availability of healthy food seems indispensable in achieving the overall goal of improved nutritional health. Further, ensuring availability of healthy food at school cafeteria, where most students have their lunch is crucial as it affects student nutrition behavior. Efforts to improve nutrition behavior should be multidimensional and we recommend the current efforts on ensuring healthy food at cafeteria in schools to be sustained.

Literature on individual health behavior suggests self-efficacy as an important precursor of behavior. Consistently, our result suggests self-efficacy as a key predictor of behavior. Individuals with high self-efficacy practice more healthy nutrition behavior. The mean change in self-efficacy was higher than the mean change in behavior (3.15 units versus 1.98 units). Smaller change in behavior compared to self-efficacy suggests the challenges in changing behavior among children. Many environmental factors outside the control of children such as accessibility and availability of healthy food have important role in shaping children behavior. Self-efficacy could be a better measure of outcome particularly among children, when measuring behavior is very challenging and inaccurate.

Among group level variables, class size seemed to be particularly important. Children taught in large classes do not show much of an improvement in their nutrition behavior. Programs taught in small classes are more effective and should be advocated for improving program effectiveness. Handouts are used as supporting materials in delivering the curriculum. Different types of handouts are associated with each lesson and PAs can use/distribute them to students as a supporting material to help improve learning effectiveness. However, the number of handouts distributed has no effect on outcomes. Printing handouts incurs costs. Some handouts have been distributed multiple times by some PAs. Because the number of handouts distributed has no effect on outcomes, forbidding duplicate distribution of handouts would be an approach when cost containment is an issue.

Variation in outcomes by PA characteristics implies inherent personal characteristic bias in the program and the program is not equally effective across various PAs. It asks for collaborative experience sharing meetings among PAs. Sharing experiences would help PAs to learn from each other's experience and help improving the overall effectiveness of the program.

## **Conclusion and Limitations**

This paper evaluates the outcomes of youth EFNEP program in Virginia. Change in behavior due to the program is used as an indicator of outcome and is measured by using the pretest and posttest data collected from the program participants during the months of September and December 2011. A single measure of outcome is generated using a Rasch measurement model. Outcome of the program were hypothesized to be different across schools and classes/groups, and thus a three level random intercept and random coefficient hierarchical linear model was specified for estimation. To the contrary, we did not find any difference in outcomes by classes or by schools.

The key finding of this paper is that there is no heterogeneity in outcome across schools or classes once we control for PA characteristics and other variables. Self-efficacy and availability of food at home are the consistent predictors of nutrition behavior. Providing education to parents together with their children to help ensure the availability of healthy food at home would increase the outcome and thus the effectiveness of youth EFNEP program. Importance of the variable food availability at home calls for increased coordination between USDA's food assistance programs and nutrition education programs.

Results from this paper should be interpreted with caution. The sample used in this paper is not randomly selected from the total population. Sample is selected based on the convenience and availability in a given time. Statistical test that render the hierarchical structure specification futile might not necessarily hold with full sample. No wonder conclusions on factors affecting the outcomes would quite be different then.

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