

Abstract

Background

Methods

Funder References

Purpose: Examine if *Fuel for Fun* modeling & self-efficacy/outcome expectancy (SE/OE) assessments are related to fruit & vegetable (FV) behaviors & availability in the home to predict Healthy Eating Index (HEI) scores. **Methods:** Parents of children participating in Fuel for Fun, a school-based culinary and physical activity intervention, completed online, tested surveys about modeling FV eating behaviors (11 items, possible score 0–33), FV SE/OE (12 items, possible score 12–60) and FV availability in the home (20 items, possible score 0–20). Upon baseline survey completion (n=356) a subset (n=83) completed an internet-based diet assessment (DA) using the ASA24 platform to obtain HEI scores. Linear regression with *a priori* selected covariates (gender, race, education) examined predictive validity of FV availability, modeling, SE/OE surveys for targeted HEI components. **Results/Findings:** DA participants (mean age 38.0 ± 6.5 y) were mostly white (87%), female (87%), and highly educated. BMI was overweight/obese for 42%. Their demographic characteristics and baseline scores were not significantly different from parents only completing surveys. Genders did not differ for any HEI or parent survey score. At baseline, total HEI ranged from 22.0 – 77.4, mean 55.5 ± 1.4. HEI component mean scores were: total fruit 3.0 ± 0.2; whole fruit 3.4 ± 0.2; total vegetables 4.1 ± 0.1. Modeling mean was 15.0 ± 3.9; SE/OE mean was 52.6 ± 10.0 and FV availability mean was 12.3 ± 2.7. Parent modeling predicted total fruit HEI (P= 0.046), whole fruit HEI (P=0.034) and total vegetable HEI component scores (P= 0.039) in the anticipated direction. SE/OE was suggestive of an association with Total HEI (P=0.098). FV availability was positively associated with HEI component scores of whole fruit (P=0.018) and total vegetables (P=0.014). Fruit availability positively predicted total vegetable HEI (P=0.008). Vegetable availability was positively associated with total and whole fruit HEI (P=0.026 and 0.034, respectively), and suggestive of an association with total vegetable HEI (P=0.097). FV availability positively predicted whole fruit HEI (P=0.018) and total vegetable HEI (P=0.014). **Conclusions:** Modeling of eating behaviors and FV availability predicted nearly all FV HEI component scores independent of race, gender, and education, suggesting that *Fuel for Fun* parent outcome measures capture behaviors associated with FV intake.

The assessment of *Fuel for Fun*, a year long, classroom based, culinary and physical activity intervention for 4th graders that included parent engagement, utilized adapted tools previously determined to be face and content valid. The purpose of this study was to examine the construct validity of the parent instruments to predict Healthy Eating Index (HEI) (<https://epi.grants.cancer.gov/he/developing.html>) scores and dietary quality by comparing responses related to food practices, with results of a dietary assessment utilizing 24-hour recalls.

Recruitment

Teachers of 4th graders in 8 participating schools (32 classrooms) sent flyers home announcing the study & included information in routine online or e-blast announcements that included a URL to link to an online consent and survey (Qualtrics, Provo UT). The last frame of the survey ascertained interest in participation in a dietary study component. Parents expressing interest were emailed a link to an online consent; submission of this consent triggered delivery of contact information to the Penn State University Diet Diet Assessment Center (PSU DAC).

Instruments

Target Measurement	Instruments & Description
Eating Competence	Satter Eating Competence Inventory ¹ (ecSI 2.0). 16 items, 5 response options scored from 3 to 0. Possible score 0 - 48; scores ≥ 32 indicate eating competence. Cronbach α 0.87.
Modeling Eating Behavior	How often do you eat . . . with your child? ~breakfast; fruit at breakfast ~lunch; vegetables at lunch; fruit at lunch ~dinner; vegetables at dinner; fruit at dinner ~a snack; vegetables as a snack; fruit as a snack. 11 items modified from original scale, ² each with 4 response options (Never (0), sometimes (1), often (2), always (3)). Possible scores 0 - 33. Cronbach α 0.75.
Self-efficacy/ Outcome expectancies (SE/OE)	Perceived ability to offer fruits and vegetables that their child will eat. Sample item: I can prepare vegetables that my child will like. 12 items modified from tested measure ³ each with 5 response options. Possible scores 12 - 60. Cronbach α 0.97.
In-home Fruit and Vegetable (FV) Availability	Fruit and Vegetable Availability Inventory ^{4, 5} 20 items (fresh, frozen, canned fruits, vegetables and 100% juices) listed. Availability was affirmed or denied. Possible scores 0 - 20.
Parenting Style	Caregiver’s Feeding Style Questionnaire. ⁶ 19 items, 5 response options. Scores converted to 4 caregiver feeding styles.

Data Collection

Parents completed the survey online in one sitting on their own. Data were collected using Qualtrics (Provo, UT). Dietary data were collected using the Automated Self-Administered 24-hour (ASA24), online dietary assessment tool developed by the National Cancer Institute. Requests to complete the ASA24 were managed by the Penn State University Diet Assessment Center so that one weekend and 2 weekdays were targeted. The study was approved by IRBs at Colorado & Penn State Universities & the Rochester Institute of Technology.

Data Analysis

- ~ASA24 analysis files contain the variables needed to calculate HEI. HEI-2010 was calculated by averaging up to 3 days of intake for each of the 12 nutrient and food group variables needed to create the individual component scores.
- ~Variables were expressed on a per 1000 kcal basis and algorithms were used to apply the standards for minimum and maximum component scores.
- ~Total HEI scores were then calculated by summing the individual component scores.
- ~HEI & component scores were examined for normality. Variables with a non-normal distribution were transformed to achieve normality.
- ~Separate linear regression models were used to determine predictive validity of fruit and vegetable availability, modeling, SE/OE for total HEI, fruit, whole fruit and vegetable HEI components.
- ~Models were examined unadjusted and adjusted for a priori covariates (gender, race, and education).
- ~Percent increase in HEI variables was calculated by dividing the regression beta coefficient by the possible range of values.
- ~All analyses were conducted using SPSS (24.0, 2016; Armonk, NY).

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Results-Participants

Figure. Parent Participation Flowchart

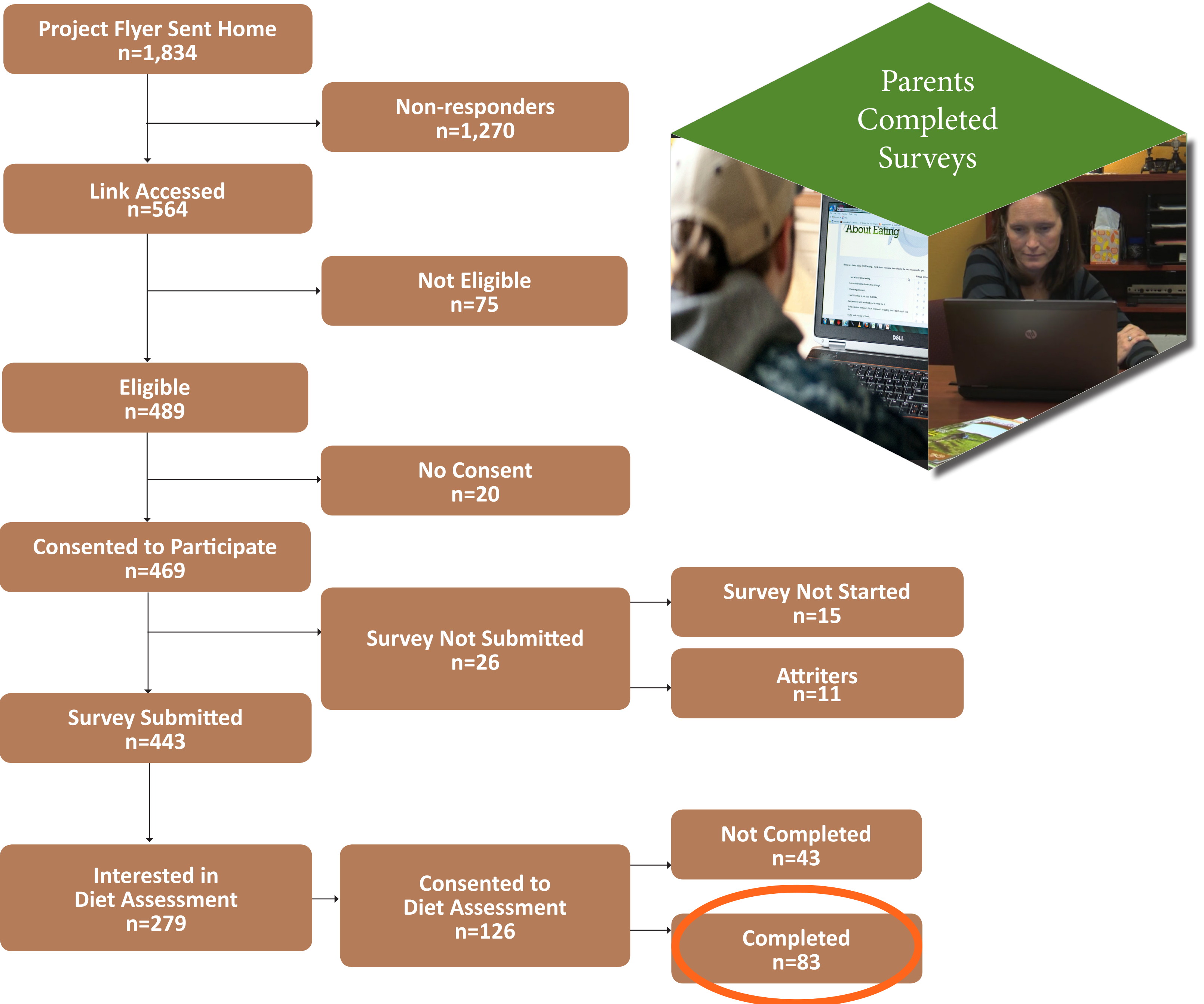


Table 1. Baseline Characteristics of Parent Dietary Participants (n=83)		Table 2. Participant Behaviors			
	n (%)	Survey	n	Range	Mean (SD)
Gender		SE/OE	82	12-60	52.7 (10.0)
Female	72 (87)	Parental modeling	81	2-23	15.0 (3.9)
Race/ethnicity		Fruit availability	83	1-8	4.5 (1.4)
White, non-Hispanic	72 (87)	Vegetable availability	83	2-9	6.7 (1.7)
White, Hispanic	5 (6)	Fruit & vegetable availability	83	5-18	12.3 (2.7)
American Indian/Alaskan	6 (7)	Healthy Eating Index (HEI)	83	22.0-77.4	55.5 (12.4)
Native/Asian/Multiple		~Total fruit HEI	83	0.0-5.0	3.0 (2.0)
Age, years, Mean (SD)	38.0 (7)	~Whole fruit HEI	83	0.0-5.0	3.5 (2.0)
BMI categories		~Total vegetable HEI	83	0.9-5.0	4.1 (1.2)
Underweight	1 (1)				
Normal weight	47 (57)				
Overweight	20 (24)				
Obese	15 (18)				
Highest Education					
High school graduate	4 (5)				
Some college	15 (18)				
4-year college graduate	34 (41)				
Post-graduate college	30 (36)				
Eating Competence, Mean (SD)	34 (7)				
Eating Competent	44 (56)				
Parenting Style					
Uninvolved	15 (18)				
Indulgent	27 (33)				
Authoritarian	26 (31)				
Authoritative	13 (16)				



Table 3. Predictive validity of survey measures with HEI & select HEI components*				
	Total Fruit	Whole Fruit	Total Vegetable	Total HEI
Survey	β (p-value)			
SE/OE	0.021 (0.35)	0.025 (0.28)	0.000009 (0.51)	0.242 (0.098)
Parental Modeling	0.122 (0.05)	0.134 (0.03)	0.000441 (0.04)	0.490 (0.20)
Fruit Availability	0.089 (0.62)	0.309 (0.09)	0.006561 (0.01)	-0.043 (0.97)
Vegetable Availability	0.296 (0.03)	0.289 (0.03)	0.001521 (0.097)	0.727(0.40)
Fruit & vegetable Availability	0.160 (0.07)	0.210 (0.02)	0.001369 (0.01)	-0.068(0.90)
*adjusted for race/ethnicity, gender, and education Results in bold are P ≤ 0.05				

- ~**Parent modeling** predicted total fruit HEI (P=0.046), whole fruit HEI (P=0.034) and total vegetable HEI component scores (P= 0.039) in the anticipated direction. Each unit increase in the modeling score predicted a 2% increase in total fruit and 3% increase in whole fruit.
- ~**SE/OE** was suggestive of an association with Total HEI (P=0.098). Each unit increase in SE/OE predicted a 2% increase in HEI.
- ~**FV availability** positively predicted whole fruit HEI (P=0.018) and total vegetable HEI (P=0.014). Each unit increase of Fruit and Vegetable Availability predicted a 4% increase in whole fruit.
- ~**Fruit availability** positively predicted total vegetable HEI (P=0.008).
- ~**Vegetable availability** was positively associated with total and whole fruit HEI (P=0.026 and 0.034, respectively), and suggestive of an association with total vegetable HEI (P=0.097).
- ~**FV availability** was positively associated with HEI component scores of whole fruit (P=0.018) and total vegetables (P=0.014).

Fruit and Vegetable intake of our parents was similar to NHANES 2011-2012 results. Compared to the reference population:

- ~Total Fruit intake was 14% higher
- ~Whole Fruit was 4% lower
- ~Total Vegetables was 17% higher
- ~Total HEI was 5% lower

The 11-item modeling survey can provide an accurate reflection of fruit and vegetable intake.

Fruit and vegetable availability in the home, as denoted by parents, is indicative of parent fruit and vegetable intake.

Conclusions