The Accuracy and Feasibility of Production Records to Measure Food Selection in School Cafeterias

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INTRODUCTION

The National School Lunch Program (NSLP) is the second-largest federally assisted food program in the nation and provides lunch to approximately 31.6 million children each day (USDA, 2013). New policies and programs that target healthy eating among students are continuously being implemented: measuring changes in food selection is essential to determine their impact.

PURPOSE

The purpose of this study was to determine the accuracy of production records by comparing food selection measured through direct observation to production records.

METHODS

Food selection was measured through direct observation and production records for two consecutive weeks at an intermediate school located in Ohio. Inter-rater reliability of the researchers' direct observation data was determined using Cohen's Kappa coefficient and was calculated as 95.5% agreement.

Direct Observation
Direct observation was performed by two graduate students who observed trays and recorded all of the food items on each tray as students exited the lunch line. A coding system was developed to assign an abbreviation to each food item so observers could quickly record the items selected. Each researcher observed trays from one of the four lines, coding 2,687 trays (66.1%) throughout the study period.

Production Records
The cafeteria manager provided researchers with production records, documents completed daily by kitchen staff describing the amounts of all food prepared, selected, and unused, for the ten consecutive days direct observation of food selection was performed.

Data Analysis
Food selection findings from direct observation and production records were entered into Excel and items were coded based upon USDA food groups. Confidence intervals were developed based on food selection gathered from direct observation. Production record values falling within the confidence intervals indicated that food selection measured through both methods were similar. Pie charts were used to illustrate the proportions of food groups selected and were created for each method of measurement.

RESULTS

Throughout the study period, 98.39% of the trays observed contained one or more entrées, 64.39% contained one or more vegetables, and 71.50% contained at least one fruit. Although more trays contained a fruit than a vegetable, when vegetables were selected they were typically selected in a greater quantity, contributing to a larger number of total portions selected.

RESULTS (cont.)

Entrées consisted of nearly 40% of the meal components served, vegetables were approximately one-third of meal components served, and fruits contributed to the remaining portion (Table 1, Figure 1). None of the production record values for percentages of meal components selected were contained within the confidence intervals (Table 1, shaded rows).

Table 1. *Comparing Food Selection From Observation With Production Records*

	Percentage of Food Item by Observation	Confidence Interval	Percentage of Food Item by Production
Entrées	38.48	37.37-39.59	37.28*
Vegetables	32.83	31.75-33.91	36.29*
Dark Green	20.97	19.34-22.60	13.00*
Starchy	38.74	36.79-40.69	50.48*
Red/Orange	14.36	12.96-15.76	11.06*
Beans/Peas	5.41	4.51-6.31	4.18*
Other	7.53	6.47-8.59	9.04*
Vegetable Juice	6.41	5.43-7.39	5.24*
Mixed	6.58	5.59-7.57	**7.00**
Fruits	28.69	27.65-29.73	26.43*
Canned	48.33	46.19-50.47	**50.08**
Fresh	24.76	22.91-26.61	**24.18**
Other	8.14	6.97-9.31	**7.95**
Whole	8.24	7.06-9.42	10.30*
Juice	10.53	9.22-11.84	7.49*

Note: Starred (*) indicates food selection from production records fell outside the 95% direct observation confidence intervals; bolded indicates selection fell within.

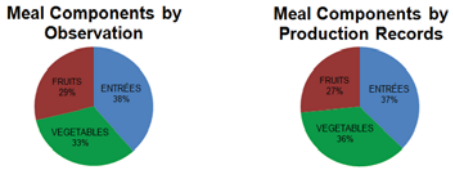

Figure 1. Comparing meal component selection between observation and production records.

Starchy vegetables were the subgroup served most often, followed by dark greens, red and orange, other, mixed, vegetable juice, and beans and peas (Table 1, Figure 2). The only vegetable subgroup with a production record value within the confidence interval was mixed vegetables (Table 1).

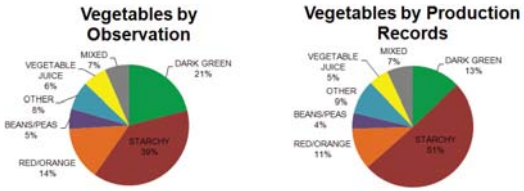

Figure 2. Comparing vegetable subgroup selection between observation and production records.

RESULTS (cont.)

Canned fruit was the fruit served most often, followed by fresh fruit. The ranking of the remaining fruit subgroups varied between observation and production records (Table 1, Figure 3). The three fruit subgroups with production record values within the confidence intervals were canned, fresh, and other fruits (Table 1).

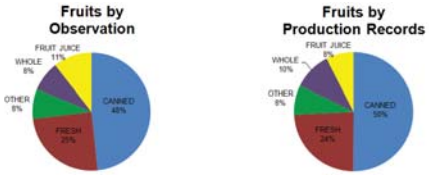

Figure 3. Comparing fruit subgroup selection between observation and production records.

DISCUSSION

Eleven out of fifteen values for food selection from production records fell outside the 95% direct observation confidence intervals, indicating poor method match. The confidence intervals were relatively narrow because the sample was so large. The smallest confidence interval was 1.8 percentage points in width and the largest was 4.28 percentage points in width.

Limitations
Production records currently provide limited information. Milk and a la carte items, which are extremely popular in school lunchrooms, may not be recorded in the production records. Made-to-order items were difficult to code because toppings were often concealed by other items and were self-selected by students, therefore serving sizes varied. Lastly, this study was only performed at one school and replication is needed because lunchroom environments can vary greatly.

PUBLIC HEALTH IMPLICATIONS

Although production records provide detailed information regarding food selection, they do not represent food consumption. Food waste is typically high in school lunchrooms, especially among fruits and vegetables. We recommend that resources measuring food consumption be used with production records to determine if students actually consume the food they selected.

Using production records as a measurement tool is more feasible when tracking changes in meal component selection than changes in specific vegetable and fruit subgroups. Underreporting leftover food items, items that became available after lunch began, and items that were not originally on the menu may be areas for improvement. Moving towards electronic production records would streamline the process of measuring food selection.

REFERENCES

United States Department of Agriculture (September 2013). National School Lunch Program Fact Sheet. Retrieved from http://www.fns.usda.gov/sites/default/files/NSLPFactSheet.pdf