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

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Abstract

Background: New meal pattern requirements have recently been introduced and emphasize the serving of vegetable subgroups. These regulations ensure students are offered certain food items, and the selection and consumption of these items are essential to track their progress and effectiveness. This study investigates whether production records are a feasible tool in tracking selection across time by comparing production records with direct observation of food selection in the lunchroom.

Methods: Food selection was measured through direct observation and production records for two consecutive weeks. The frequencies of daily items served were entered into Excel and each food item was coded into the appropriate food group for each method of data collection. The proportion of each food group selected was calculated by taking the total number of servings in each category and diving that number by the total number of items served.

Results: Entrées represented the food category that was served the most, followed by vegetables and fruits. Eleven out of fifteen values for food selection derived from production records fell outside the 95% direct observation confidence intervals. The confidence intervals tended to be relatively narrow because the sample was so large.

Conclusion: Production records have potential to track longitudinal changes in food selection. Using production records as a measurement tool is more feasible when tracking changes in meal component selection than changes in specific fruit and vegetable subgroups. The use of production records present challenges to measurement and should be used in conjunction with other measurement tools.

Keywords: National School Lunch Program, nutrition, production records, food selection

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

The National School Lunch Program (NSLP) is the second largest federally assisted food program in the nation and operates in over 100,000 public and nonprofit schools and residential childcare institutions within the United States (U.S. Department of Agriculture, 2014). Approximately 99 percent of public schools in the United States participate in the NSLP, providing meals to nearly 32 million children each day (Story, Neumark-Sztainer, & French, 2002). Participating schools must serve lunches that meet the nutrition standards defined by the U.S. Department of Agriculture (USDA) and are required to serve free or reduced priced lunches to eligible students. In return, the USDA provides schools with cash subsidies and commodities for each meal they serve. School lunches are required to meet Federal regulations, but school authorities make decisions regarding the specific foods offered and how the food items will be prepared. The NSLP is regulated by the Food and Nutrition Service (FNS) at the federal level and educational agencies at the state level.

The NSLP guidelines are based on the most recent version of the *Dietary Guidelines for Americans* and focus on increasing the availability of fruits, vegetables, and whole grains, and decreasing the sodium content of meals (U.S. Department of Agriculture [USDA] & U.S. Department of Health and Human Services, 2010). Calorie limits are placed on meals for K-5, 6-8, and 9-12 grade levels to ensure proper nutrition is provided to students. School meals are required to offer five components: a meat or meat alternate, fruit, vegetable, grain, and milk. Three to five meal components must be chosen for a meal to qualify as a reimbursable meal, and at least one of the components chosen must include a fruit or vegetable. The new guidelines place much emphasis on the fruit and vegetable categories. Specific requirements have been

implemented that set weekly requirements for the offering of dark green, red/orange, beans/peas, starchy and other vegetables. Overall, school lunches adhering to the NSLP guidelines supply approximately one third of the suggested daily amount of calories, protein, iron, calcium, and vitamins A and C to students (Story et al., 2002).

The NSLP is one of fifteen nutrition assistance programs that are administered by the FNS via the USDA. The USDA supplies food assistance to one in four Americans annually through food distribution programs, child nutrition programs, a supplemental nutrition assistance program (SNAP), a Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), a Farmers' Market Nutrition Program (FMNP), and a Senior Farmers' Market Nutrition Program (SFMNP) (USDA, 2014). The nutrition assistance programs target food security and diet quality among children and low-income individuals across the United States.

The impacts of these nutrition assistance programs, specifically the NSLP, are measured in a variety of ways. The intent of this study is to describe the current methods used to measure the progress of the NSLP and to examine whether production records are an accurate tool to measure long-term changes in student eating behavior.

Statement of Purpose

The purpose of this study was to determine the accuracy of production records by comparing food selection measured via direct observation to the production records produced by schools. My Tray, an indicator that illustrates the proportions of food groups selected by students in school cafeterias was created using both measures of food selection to illustrate differences between the two methods. This study also sought to determine if using My Tray is a good indicator to track changes in food selection over time.

Literature Review

In addition to the implementation of new polices that updated the guidelines for the NSLP, healthy eating in school lunchrooms is the focus of many organizations. The USDA recently released the HealthierUS School Challenge that recognizes schools for improvement in nutrition and physical activity (USDA, 2015). The Smarter Lunchrooms Movement targets healthy eating among students by providing schools with sustainable tools to encourage students to select healthy choices (Cornell Center for Behavioral Economics in Child Nutrition Program, 2010). The Jeffers Foundation (2011) created a Waste Reduction Awareness Program to limit the amount of food that gets thrown out. In addition, numerous national organizations, non-profit organizations, public health departments, universities, and colleges implement programs and tools to encourage healthy eating among students. These programs reach thousands of students each year and cost a lot of money.

Measurement of Lunch Consumption

Measuring changes in the school environment is essential in determining the impact of the new policies and programs that target healthy eating among students. Multiple methods of measuring lunch selection and consumption are available; the appropriate method for a study depends on available resources, research questions, and the specific setting. Measurement is a fundamental process when evaluating changes within a system and can be completed with a variety of techniques, including surveys from outside agencies, evaluating records kept by the cafeteria, or by performing direct observation and waste collection. This section details the various methods used to evaluate the measurement of lunch consumption**.**

National Surveys.

Numerous national surveys are conducted regularly to evaluate the health of school-age children on a variety of measures (see Table 1). One of these surveys is the School Nutrition Dietary Assessment Study (SNDA), which is funded by the USDA (2012). This survey collects data from nationally representative samples of schools and school districts within a given school year. The nutrient content of the average meals offered and served in the Nation's schools is analyzed and compared to the average nutrient content in the regulatory standards effective at the time. The most recent study, which evaluated the 2009-2010 school year, also collected information about the availability of competitive foods (USDA, 2012). The original SNDA first took place in 1980 and has been conducted on a five to seven year series since then. Overall, the survey reports back data about school meals offered, meals selected, and dietary intake.

Table 1

National Surveys Used to Evaluate School-Aged Children

Survey	Methods	Timeline	Scope	Findings
SNDA	•Menu survey •Survey of food service managers, directors and principles •Competitive food checklist	•1980-present •Conducted on a 5-7 year series	•Meals offered •Meals selected •Dietary Intake	•85% or more of all schools *offered* average NSLP lunches that met or exceeded the standards for the SMI target nutrients
YRBSS	•Monitors six categories of health risk behaviors •National school based survey •School-based state, territorial, tribal, and large urban school district surveys completed by education and health agencies	•1991-present •Conducted every other year •New year reporting starts in July	•Prevalence of health risk behaviors, obesity, and asthma	•33.2% of students had eaten fruit or drunk 100% fruit juices two or more times per day during the 7 days before the survey •28.4% of students had eaten vegetables two or more times per day during the 7 days before the survey
NHANES	•In person face to face interviews and physical examination	•1999-present •Continuous and ongoing	•Prevalence of selected diseases and risk factors •Dietary Habits	

The Youth Risk Behavior Surveillance System (YRBSS) is another survey that is funded by the Centers of Disease Control and Prevention (CDC) (1991). This survey monitors six types of health-risk behaviors that contribute to the leading causes of death and disability among youth and adults. The questionnaire addresses fruit and vegetable consumption, along with sugar-sweetened beverage consumption (Centers of Disease Control and Prevention [CDC], 2014). The YRBSS focuses on the 9^{th}-12^{th} grade age group and evaluates the status of school health policies and programs designed to address unhealthy dietary behaviors. The YRBSS was implemented in

1991 and is conducted on a biennial basis. The data reported from the survey focuses on prevalence of health risk behaviors, along with obesity and asthma.

The National Health and Nutrition Examination Survey (NHANES), also funded by the CDC, is a combination of analyses (CDC, 1999). These studies are designed to evaluate the health and nutritional status of adults and children in the United States. The examination is unique in the aspect that it uses both interviews and physical assessments for its data. The NHANES interview includes demographic, socioeconomic, dietary, and health-related questions, while the physical assessment component includes medical, dental, and physiological measurements, as well as laboratory tests (see CDC, 1999). The predominance of major diseases and risk factors are established from the findings of this survey. Information is used to evaluate nutritional status and its connection with health promotion and disease prevention. Additionally, NHANES findings are used by the government and private sector organizations to develop health programs and services. The first version of the survey was created in 1959, and it has been reconstructed multiple times and the current NHANES is recognized as being in existence from 1999 to present. This survey also became continuous and ongoing in 1999, which allows content to be changed to meet emerging needs.

Sales.

Sales records are an additional method used to measure lunch consumption. School cafeterias generate and keep track of sales records on a daily basis. A Point of Sale (POS) system is the method used to record each transaction. POS systems can be in multiple locations of the school and cafeteria such as the register, the checkout line, or vending machines throughout the school. The POS system is used by staff to record the type of entrée, milk, and à la carte items sold. Sales records are significant because they primarily measure participation. Record of free,

reduced, and paid meals are documented through reports from the POS system. The USDA reimburses the school for each meal sold, dependent upon the participation rate of the school (USDA, 2013a). An example of how this system works is that, if a school served less than 60 percent free and reduced lunches in the 2014-2015 school year, the reimbursable amounts were $0.28 for each paid meal, $2.58 for reduced-price meals, and $2.98 for free meals (USDA, 2013a). Sales records are fundamental to track reimbursable meal sales.

Sales records do provide important information, however they can lack depth. Not all items of a student's meal are documented in the POS. In a study by Just, Wansink, and Hanks (2014), researchers analyzed if chef created dishes increased meal and vegetable consumption within schools. To do so, sales datum were collected using the point of sale transaction system. In this study, the POS system recorded both the meal selected and the individual student selecting the meal. Data with this amount of detail allowed for within subject comparisons.

Observation.

Observation is another method of measuring school lunch selection and consumption. This method typically consists of individual surveillance and recording of what students are selecting when purchasing their meals. An evaluation was performed of the dietary intake of children participating in the USDA summer food service program. This study used observation as their main form of measurement. Observers were trained during one lunch period and used the checklist to note what menu items the child selected in the cafeteria. During the observation period, the portion (none, ¼, ½, ¾, all) of food items consumed and wasted was recorded. For the duration of the observation, children were not aware of the reason for the existence of the observers. Throughout this study, 302 children were observed, over a four week period, in 14 schools (del Rio-Rodriguez & Cullen 2014). Results of this study showed that on average,

children selected 1.1 servings of fruits and vegetables, rather than the two servings that were offered for each meal. Researchers also found that 61% of fruits and 44% of vegetables were consumed, while 39% of fruits and 56% of vegetables were wasted.

Plate Waste.

Plate waste is identified as the quantity of edible food remaining on a tray that a student has discarded. Reliably and accurately measuring tray waste, especially in a school cafeteria, is a key tool to measuring the impacts of food-behavior interventions. Waste measurement has become an even more important topic with the new regulations for the 2012 NSLP. Hanks, Wansink, and Just (2014) reported that in the first couple weeks of the 2012-2013 school year, reports emerged that students were wasting large quantities of foods, especially fruits and vegetables.

Plate waste in children's school lunches can be measured in a variety of methods including the direct weighing method, visual measurement with the half-waste and quarter-waste methods, and digital photography. The direct weighing method is highly accurate, and the most reliable method. However, it is a labor intensive method which requires a significant amount of space and time, and can result in a restricted number of observations. Visual measurements require less labor and space, and can be just as reliable and accurate as weighing waste. Visual estimation methods are becoming progressively more popular due to their ease of implementation and cost effectiveness. The most common visual measurement used is the quarter-waste method. With this method, a researcher visually estimates whether none, ¼, ½, ¾, or all of a specific food item was left on each tray. The quarter-waste method has been found to generate waste measures with 90% accuracy or better, and is highly consistent (95%) between researchers (Just, Wansink, & Hanks, 2014). Digital photography is another visual estimation

method, but is used less frequently. This method can be useful, but it is less common due to utilizing extra time and variability in reliability and accuracy. This method can under and over-estimate waste of food and beverages concealed in packages and containers that make it difficult to determine how much was left.

Hanks et al. (2014) conducted a study to measure the reliability and accuracy of visualization techniques used in reporting plate waste, focusing on validating the quarter-waste method. Their study compared the direct weighing, half-waste, quarter-waste and digital photography methods. Researchers found that when compared with the half-waste and photograph methods, the quarter-waste method was found to be the most reliable method. Additionally, a key part of this research is showing that there are visual techniques that have comparable accuracy of the gold standard of weighing every item.

Self-Report.

Self-report is one method used for the measurement of lunch selection and consumption. This method includes interviews, surveys, and questionnaires with food service staff and students. The SNDA collects nutrition information from food service managers throughout the country by telephone, mail, and web-based surveys. Multiple studies have used these tools to evaluate food selection and consumption within schools. Briefel, Crepinsek, Cabili, Wilson, and Gleason (2009) conducted a study to evaluate how school food environments and practices affect dietary behaviors of US public school children. To obtain the data needed, researchers used questionnaires administered to school food authority directors, onsite observer checklists of foods offered, school menus, and 24-hour dietary recall. The study evaluated many details of the dietary behaviors of children, including the consumption of fruits and vegetables. Through these methods, researchers found that about half of children reported consuming some amount of any

fruit or vegetable obtained at school, an average of one-half equivalents per day in elementary schools, declining to one-third cup in secondary schools. Researchers also found that consumption of solid fruits, 100% fruit juice, and vegetables declined as school level increased.

Production Records.

Production records are another way to measure lunch consumption. Production records are collected on a daily basis by school cafeterias and cafeteria staff maintains these records to document the daily production of the total number of servings prepared and taken of each food offered. These records express the planned number of portions, serving sizes, total amount of food prepared, and any food left over (Ohio Department of Education, 2015). Federal regulations require that a food production worksheet be completed for every lunch service to receive federal reimbursement (USDA, 2013b).

Production records can be helpful for measuring food selection, are low-cost to use, and include food selection data for all students. While production records are not detailed enough to provide student level information, they give aggregate counts for daily lunch sales, which can be validated with sales records (Just et al., 2014). However, Cohen, Richardson, Austin, Economos, and Rimm (2013) recognized that using only production records will likely result in an overestimate of consumption due to the fact food waste is not accounted for with this method.

There are a large variety of tools available for measuring selection and consumption of food items in school cafeterias. Accurately measuring changes in the fruit and vegetable selection and consumption in schools is important in determining the progress and effectiveness of the new guidelines and programs and whether these efforts should be continued. Since schools are required to generate daily production records and this measure may be the easiest to use on a large scale because their use does not require any additional costs or time, production records

will be compared to selection via direct observation of food selection, to determine their potential for measuring longitudinal behavior change.

Pilot Study – The Development of the My Tray Tool

An indicator, My Tray, was developed by Narayan, Orlowski, and Spears (2014) based on the structure of MyPlate (USDA, 2011). My Tray was created to illustrate the proportions of food groups that students select for their lunch meal. The food groups consist of the five meal components: entrees, grains, fruits, vegetables, and milk. In this study, production records were used to determine the number of portions that were selected during lunch and these items were then coded so they could be categorized into one of the food groups. See Appendix A for the coding guidelines. The proportions and percentages were calculated for the food groups by combining all of the codes that represented each food group and dividing those totals by the total number of servings used. The My Tray tool is designed to illustrate the proportion of entrees, grains, fruits, vegetables, and milk that were selected during a lunch period.

In order to gain a better understanding of the breakdown of each food group, Narayan et al. (2014) created My Tray entrees, My Tray vegetables, My Tray fruits, and My Tray milk. These tools illustrate the proportion of items that are selected by each category within each food group. This was determined by dividing the number of items served for each category by the total number of servings used within that respective food group during that lunch period.

More specifically, My Tray entrées consist of the following categories: entrees with a red or orange vegetable (code 1.12), entrees with a meat or meat alternate and grain (codes 1 and 1.2), and entrees with a vegetable (codes 1.1, 1.11, 1.13, 1.14, 1.15, and 1.3). Entrees with a red or orange vegetable were kept separate from entrées with other vegetables because they appeared frequently. My Tray vegetables consist of the following categories (see Appendix B): dark green

vegetables (code 3), starchy vegetables (code 4), red and orange vegetables (code 5), beans and peas (code 6), other vegetables (code 7) and mixed vegetables (code 8). For the purposes of the present study, an additional vegetable category was added for vegetable juice (code 7.1). My Tray fruits consisted of the following categories: fruit, canned fruit, fresh fruit and other fruit (codes 9, 9.1, 9.2 and 9.3). This present study also introduced two new fruit codes for whole fruit (code 9.4) and fruit juice (code 9.5). These codes were developed to gather a better understanding of fruit and vegetable selection. My Tray milk consisted of the following categories: flavored milk (code 10.2), milk and unflavored milk (codes 10 and 10.1). The category of My Tray grains was not developed for the present study because grains only represented one code (code 2). The intent of developing the My Tray tools were so comparisons in selection could be made across school districts, schools, grade levels, and longitudinally across time.

My Tray was developed to measure food selection in a school lunchroom setting by using production records to visually display the proportions of food groups selected. The intent of the present study was to examine the accuracy of production records by comparing food selection via production records to direct observation of food selection of school lunches. My Trays were used to allow for visual comparison among two tools.

Research Questions

Based on reviewed literature and a lack of tools to measure health behaviors in school lunchrooms, the following research questions were developed:

1) How does selection of meal components measured in production records compare with direct observation?

2) How do fruit and vegetable subgroup selection measured in production records compare with direct observation?
3) Is creating a My Tray using production records an accurate measure of selection and can this method of selection measurement be easily disseminated?

Methods

Setting

This study was completed at an intermediate school in Midwest Ohio that enrolls approximately 840 students in the 5th and 6th grades. Participation in the school lunch program was approximately 48% and the percentage of students receiving free and reduced priced meals was 22%. Students were divided into four lunch periods, enter the serving area through two single-file lunch lines, and from the line, selected their meal components. In general, students selected from six entrées, three fruit options, four vegetable options and beverages. Beverages included white, chocolate, strawberry and vanilla milks. Following federal guidelines, a reimbursable meal included three to five items, one of which had to be a fruit or vegetable. Students then moved to the POS, where cafeteria employees recorded the number of meals purchased and food category of any single food item. Students formed four lines around two cafeteria workers standing at the POS, recording students' food selection. At this school, a la carte items could not be purchased at this time; students were able to purchase snacks and any additional food items after all of the students in their lunch period purchased a lunch. A school staff member dismissed students interested in purchasing additional food items to do so. Each of the four lunch periods lasted approximately 30 minutes, and typically, 400 students moved through the line each day. Graduate students from Wright State University's Master of Public Health Program stood behind the cafeteria workers at the point of sale, recording all of the food

items observed on each tray as students passed through the line. The quickness of this process allowed each graduate student to observe food selection from one line, gathering data for a total of two of the four lunch lines. On average, 406 students purchased a school lunch on the days of data collection and graduate students coded 2,687 trays or 66.1% of trays. The Wright State University Institutional Review Board (IRB) determined this project, SC# 5783, did not involve the research of human subjects and was deemed exempt (see Appendix D).

Design

Food selection of 5th and 6th grade students was assessed for two consecutive weeks. There were two data sources for this project: production records and direct observation of trays. Production records were completed daily by kitchen staff and describe the amounts of all food prepared, taken, and unused. The second data source, observation of food items on trays, was collected over a two-week period. Graduate students measured food selection through direct observation of food items on lunch trays and compared findings to production records.

Production records.

The cafeteria manager provided researchers with daily production records for the month of February. Production records were entered into Excel following a protocol (see Appendix C), food items were coded to specific food groups, and a My Tray summary was calculated following methods described by Narayan et al. (2014). My Tray is a visual summary of the percentage of food items by food component, and food subgroup, served during a designated time period. The frequencies of daily items served were entered into Excel and each food item was coded into the appropriate food group. The percentages of each food group were calculated by taking the total number of servings in each category and dividing that number by the total number of items served. These values represent the proportion of each food group selected.

A coding system developed by Narayan et al. (2014) based on the USDA food categories was used, with the addition of a few vegetable and fruit subgroups. This coding system included the USDA food categories of a meat/meat alternative, grain, vegetable, fruit, and milk. However, Narayan and colleges expanded this coding system to include other items purchased in cafeterias, such as a la carte items. Expanding the coding system allowed for a more detailed analysis of food selection. For example, the USDA does not distinguish between types of fruit, such as canned, frozen, fresh, and whole. Capturing this detail allows us to better understand selection and consumption among students. The coding system is included in Appendix A.

Tray observation.

Tray observation took place daily for two weeks, February 2-16, during the four lunch periods. Two graduate students observed trays and recorded food item selection as students purchased meals. Two registers were present, with lines available on both sides of each register. Students entered a unique student number into a keypad for meal charges to be assessed. Cafeteria employees enter pre-programmed keys for food charges. The entries into the point of sale system are minimal, typically either for “reimbursable meal,” “extra milk” or “snack item”. The pre-programmed keys and minimal entries allow for the students to move through the lines quickly. Graduate students documented the meal items purchased by manually recording the observed items. A coding system was developed to assign an abbreviation to each food item so that observers could quickly record the items selected. Abbreviations were recorded on a template that contained a labeled box with lines to document the food items for each tray. Documentations were transferred to an Excel spreadsheet for data analysis purposes. This coding system was piloted in January during one lunch period. The two graduate students who observed trays throughout this project coded the same trays during the pilot collection, allowing for a

measure of inter-rater reliability to be calculated. Records were stored in a shared folder in an online storage system.

Data Analysis

Wright State University's statistical consulting center assisted the graduate students with the data analysis of this project. Confidence intervals were created for each food group and for vegetable and fruit subgroups based on direct observation of food selection. Food selection measured through production records was compared to the findings for direct observation, and values derived from production records falling inside the direct observation confidence intervals were considered to be accurate values.

The five meal components of a school lunch include a meat or meat alternate, grain, fruit, vegetable, and milk, however, at this school, the only meal components that could be assessed were entrées, vegetables and fruits. In this study, grains were paired with the meat or meat alternates because the combination of these items formed entrées. Milk was not included in production records, so three food categories remained, representing 4 meal components: entrées, vegetable, and fruits. Students had to select ½ cup of fruit or vegetable and at least two other components to be counted as a meal. The additional two to four items could consist of any other food components.

Results

Inter-rater Reliability

Pilot data collection was completed to determine the usability of the data collection tool and inter-rater reliability of the graduate students when coding the same trays. The inter-rater reliability was determined by using Cohen's Kappa coefficient (see Landis & Koch, 1977) and

approximately 8.6% of trays were double-coded by researchers. The results shown in Table 2 were generated, indicating near perfect agreement between coders.

Table 2

Cohen's Kappa: Agreement of Inter-rater Reliability

Symmetric Measures

	Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Measure of Kappa Agreement	.955	.014	31.631	<.0001
N of Valid Cases	1054			

The results from calculating Cohen's Kappa indicated high inter-rater reliability. The coders had 95.5% agreement on the items tested.

Main Findings

Throughout the ten days of tray observation, 2,687 (66.1%) trays were observed of students that purchased a school lunch. During the study period, entrées represented the food category that was served most often, followed by vegetables and then fruits. 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.

Confidence intervals were developed based on food selection gathered from direct observation by researchers. Regarding the three meal components, none of the production record values for percentages of meal components served were contained within the 95% confidence intervals. Of the 7,319 food items observed throughout the study period, 2,816 were entrées, 2,403 were vegetables, and 2,100 were fruits. Of the 11,611 food items in production records throughout the study period, 4,328 were entrées, 4,214 were vegetables, and 3,069 were fruits.

Table 3 compares the percentage of foods selected by students using the two methods and Figure 1 illustrates these percentages.

Table 3

Comparing Selection of Meal Components via Observation and Production Records

	Percentage of food item by observation	Confidence Interval	Frequency of food item by observation	Percentage of food item by production	Frequency of food item by production	Difference in percentage of food items comparing observation and production
Entrées	38.48	37.37-39.59	2816	37.28*	4328	1.20
Vegetables	32.83	31.75-33.91	2403	36.29*	4214	3.46
Fruits	28.69	27.65-29.73	2100	26.43*	3069	2.26

*Food selection derived from production records fell outside the 95% direct observation confidence intervals

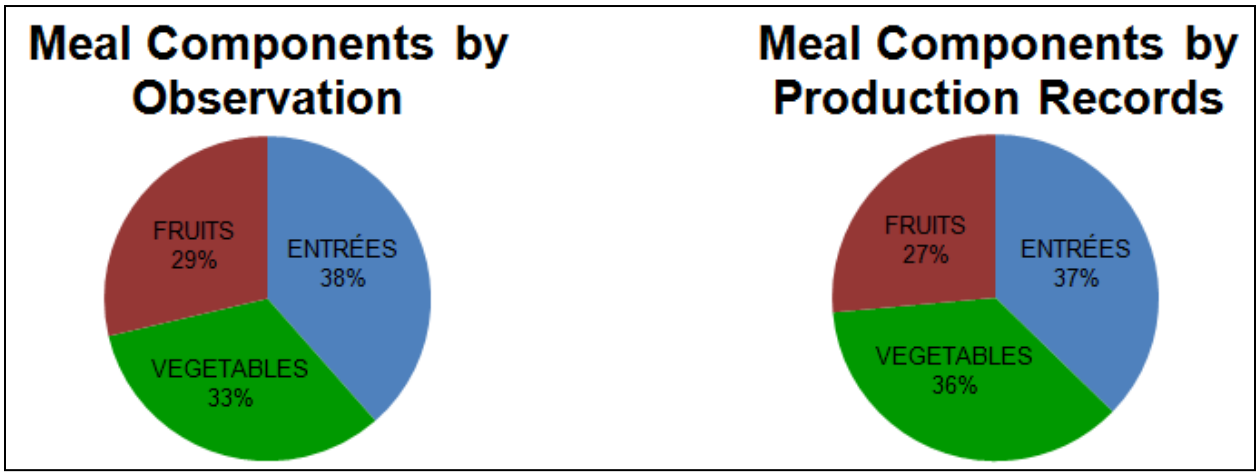

Figure 1

Comparing My Tray meal components from observation to production records.

My Tray – vegetables.

Within the vegetable category, starchy vegetables were the subgroup served most often, followed by dark greens, red and orange, other, mixed, beans and peas, and vegetable juice. The vegetable subgroups were selected in the same order with both observation and production records. However, the proportion of vegetable subgroup selection varied between observation and production records. The greatest differences between observation and production record

methods occurred in starchy and dark green vegetable subgroups; the difference in the percentage of food items comparing these methods was 11.74% and 7.97%, respectively. The smallest difference between observation and production records was found in mixed vegetables; the difference in the percentage of food items comparing these methods was 0.42%.

Regarding vegetable subgroups, six out of seven of the production record values were not contained within their 95% confidence interval. The six vegetable subgroups that contained values outside of the confidence interval include dark greens, starchy, red/orange, beans and peas, other, and vegetable juice. Mixed vegetables, the remaining subgroup, had a production record value that fell within the confidence interval. Of the 2,403 vegetables observed during the study period, 931 were starchy, 504 were dark green, 345 were red/orange, 181 were other, 158 were mixed, 154 were vegetable juice, and 130 were beans/peas. Of the 4,214 vegetables in production records, 2,127 were starchy, 548 were dark green, 466 were red/orange, 381 were other, 295 were mixed, 221 were vegetable juice, and 176 were beans/peas. Table 4 compares the percentage of foods selected by students using the two methods and Figure 2 illustrates these percentages.

Table 4

Comparing Vegetable Selection from Observation with Production Records

	Percentage of food item by observation	Confidence Interval	Frequency of food item by observation	Percentage of food item by production	Frequency of food item by production	Difference in percentage of food items comparing observation and production
Vegetables	32.83	31.75-33.91	2403	36.29*	4214	3.46
Dark Green	20.97	19.34-22.60	504	13.00*	548	7.97
Starchy	38.74	36.79-40.69	931	50.48*	2127	11.74
Red & Orange	14.36	12.96-15.76	345	11.06*	466	3.30
Beans & Peas	5.41	4.51-6.31	130	4.18*	176	1.23
Other	7.53	6.47-8.59	181	9.04*	381	1.51
Vegetable Juice	6.41	5.43-7.39	154	5.24*	221	1.17
Mixed	6.58	5.59-7.57	158	7.00	295	0.42

*Food selection derived from production records fell outside the 95% direct observation confidence intervals

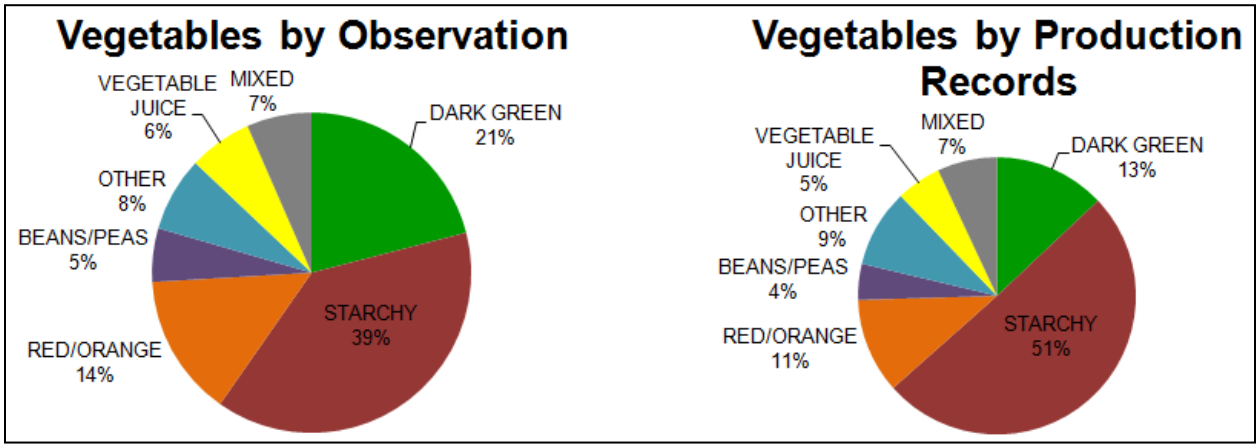

Figure 2

Comparing My Tray vegetables from observation to production records.

My Tray – fruits.

Within the fruit category, canned fruit was the most popular fruit served, followed by fresh fruit. The ranking of the remaining fruit subgroups varied between observation and production records. The greatest difference between the two methods occurred in the fruit juice subgroup; the difference in the percentage of food items comparing these methods was 3.04%.

The smallest differences between observation and production records was found in the other subcategory; the difference in the percentage of food items comparing these methods was 0.19%.

Regarding fruit, two out of five of the production record values were not contained within their confidence intervals. Whole fruit and 100% fruit juice were the two subgroups in which their food selection percentage via production records did not fit within their associated confidence interval based on direct observation. The remaining three fruit subgroups, canned, fresh and other, contained percentages within their confidence intervals. Of the 2,100 fruits observed, 1,015 were canned, 520 were fresh, 221 were fruit juice, 173 were whole, and 171 were other. Of the 3,069 fruits recorded in production records for this period, 1,537 were canned, 742 were fresh, 316 were whole, 244 were other, and 230 were fruit juice. Table 5 compares the percentage of foods selected by students using the two methods and Figure 3 illustrates these percentages.

Table 5

Comparing Fruit Selection from Observation with Production Records

	Percentage of food item by observation	Confidence Interval	Frequency of food item by observation	Percentage of food item by production	Frequency of food item by production	Difference in percentage of food items comparing observation and production
Fruits	28.69	27.65-29.73	2100	26.43*	3069	2.26
Canned	48.33	46.19-50.47	1015	50.08	1537	1.75
Fresh	24.76	22.91-26.61	520	24.18	742	0.58
Other	8.14	6.97-9.31	171	7.95	244	0.19
Whole	8.24	7.06-9.42	173	10.30*	316	2.06
Fruit Juice	10.53	9.22-11.84	221	7.49*	230	3.04

*Food selection derived from production records fell outside the 95% direct observation confidence intervals

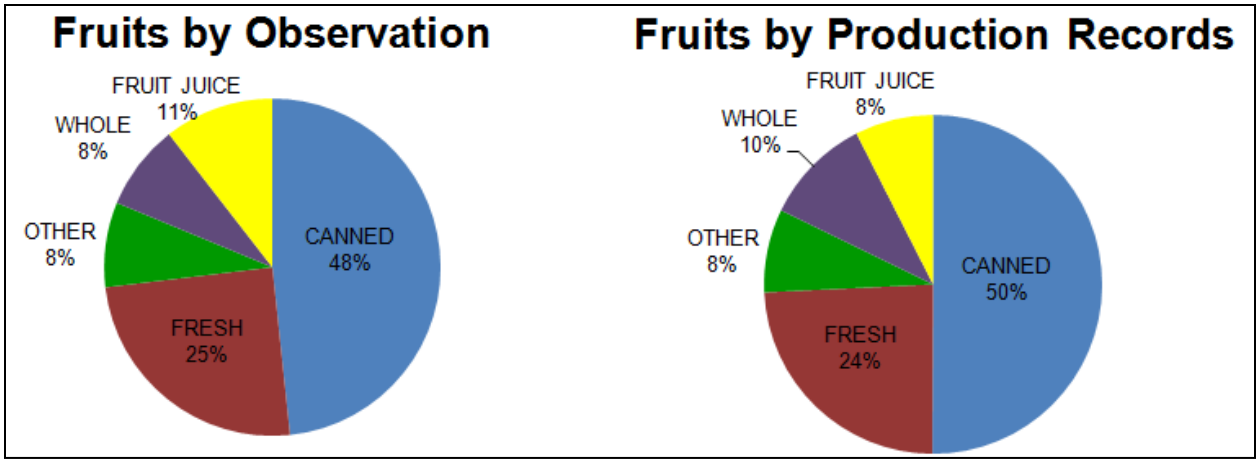

Figure 3

Comparing My Tray fruits from observation to production records.

Discussion

Entrées were the meal component served most often, followed by vegetables and then fruits. This finding differs from previous research that has found greater selection of fruits than vegetables in school lunchrooms (Hanks, Just, & Wansink, 2012). One possible explanation for this difference is that vegetables were consistently served more often in the school that participated in this study, whereas fruits are typically offered more. Variation was found in the percentage of meal components served, as well as in vegetable and fruit subgroups. The percentages of the three meal components served using production records were found outside of the 95% confidence intervals that were created based on direct observation. Within vegetable subgroups, percentages of dark green, starchy, red/orange, beans/peas, other, and vegetable juice measured via production records also contained values outside of the confidence intervals. In addition, within the fruit category, production record values for whole fruit and 100% fruit juice were outside of the confidence intervals. Mixed vegetables, canned fruit, fresh fruit, and other fruit were the only subgroups containing production record values within inside the confidence

intervals. Overall, eleven out of fifteen values for food selection derived from production records fell outside the 95% direct observation confidence intervals.

The confidence intervals tended to be relatively narrow because the observed sample size was so large. Confidence intervals were developed because the trays coded represented a sample of the population. The smallest confidence interval was 1.8 percentage points in width and was in the beans/peas category. The largest confidence interval was 4.28 percentage points in width and was in the canned fruit category.

The frequency in which items were offered affected their accuracy. Meal components are offered daily, whereas some vegetable and fruit subgroups were only offered twice during the two-week study period. Vegetable and fruit subgroups with smaller sample sizes may impact measures of selection.

Potential of Production Records

This study found that production record values varied from observation. Production records have the potential to track changes in food selection longitudinally. With new policies and programs targeting healthy eating in school lunchrooms, there is strong need for the development of an indicator that tracks changes in food selection across time. While other methods, such as direct observation and plate waste, are successful at measuring student-eating behaviors, they are often resource intensive, and production records are typically available at little to no cost. Plate waste involves the coordination of multiple staff members and student workers, and requires travel time and student labor costs. Additionally, researchers using this method must measure waste on multiple days and cafeteria staff may not be able to commit to such a research design. However, schools are required to use production records to document all food prepared, served and left over on a daily basis, producing valuable data regarding student

eating behaviors. Cohen et al. (2013) conducted a study to measure school lunch waste among middle school students and used production records as a low cost alternative to 24-hour recalls and questionnaires These records currently serve their purpose of providing the USDA with documentation regarding food selection; however, increasing the accuracy and detail of the production records would be extremely beneficial in evaluating the effectiveness of new policies and programs targeting healthy eating in school lunchrooms.

Challenges of Using Production Records

Many schools complete production records with pencil and paper and all of this information regarding food selection must be entered into an electronic format before it can be evaluated. Converting original production records into an electronic format for analysis can create the potential for mistakes in data entry and become time consuming. The advancement of production records kept by pencil and paper to an electronic format would be extremely helpful to eliminate this process.

Production records also limit the information that can be measured. First, food selection is the only health behavior that can be measured through production records. It is important not to undermine the value of selection, but other health behaviors, such as waste and consumption, are missing. Schwartz, Henderson, Read, Danna, and Ickovics (2015) explored differences in selection and consumption before and after the implementation of the 2010 Healthy, Hunger-Free Kids Act. These researchers performed plate waste studies and found that vegetable selection decreased from 68% to 52% from 2012 to 2014, but that among students selecting vegetables, consumption increased by approximately 20%. Using multiple methods provides more detailed information that would be missed by only considering production records. Resources measuring food consumption should be used with production records to determine if

students actually consume the food they have selected. Second, production records do not include all of the food items available to students in the cafeteria. Items such as milk and a la carte items are typically missing from the records. These items are usually missing because they are stocked as needed, therefore including them in the records is unnecessary to the staff. However, the availability of competitive foods via vending machines and a la carte items influences the selection and consumption of lunch components. Kubik, Lytle, Hannan, Perry, Story (2003) found an inverse association between a la carte availability and fruit and vegetable consumption. Similarly, Marlette, Templeton and Panemangalore (2005) found significantly greater waste among students purchasing competitive food items with their lunch. Students purchasing competitive items wasted a significantly greater amount of fruits (52% vs. 36%), grains (26% vs. 14%), meats (25% vs. 16%), and mixed dishes (30% vs. 18%). Production records would become an even more valuable source of information if all food items available to students were recorded.

Plate waste data was collected during two of the days this study was conducted. Examining the waste on trays allows researchers to determine the items selected, the amount of each item wasted, and the amount consumed. This type of data collection also includes information about every food item offered in the school cafeteria, including milk and a la carte items. The main drawbacks of plate waste studies are that they are resource intensive and time consuming.

Another limitation of using production records in food selection measurement is they were less accurate in certain categories, primarily in vegetable subgroup selection. Dark green vegetables were under reported in production records, with an 8.39% difference between production records and observation, while starchy vegetables were over reported with an 11.70%

difference between production records and observation. The implementation of the new regulatory requirements for the National School program affected the offering of vegetables subgroups. Previously, there were no requirements regarding the types of vegetables offered. The new guidelines set weekly requirements for the offerings of dark green, red/orange, and legumes, and limit the amount of starchy vegetables offered. The production records used in this study under reported dark greens and over reported starchy vegetables, which limits the ability to determine if cafeterias are meeting or exceeding the weekly requirements of offering vegetable subgroups. Reasons for differences in selection may be due to under reporting leftover food items, items that became available after lunch began, and items that were not originally on the menu.

Benefits and Challenges of Using My Tray as an Evaluation Tool

My Tray can be useful in illustrating food groups and fruit and vegetable subgroup selection, however, challenges exist when using it as an evaluation tool. The general form of the My Tray tool can be difficult to comprehend at first. A basic My Tray illustrates the proportion of meal components selected and at first glance, can appear as a representation of an example of what a typical, individual, student tray is composed of. However, it is designed to illustrate the proportion of all of the meal components that were selected during a given time period for all students. Additionally, since it was designed to illustrate proportions of meal components selected, it does not represent the frequency in which meal items were offered.

My Tray was developed and piloted in an elementary school where meal component variation is minimal and limited. This study was conducted in an intermediate school where there is usually a greater amount of choice. The result of studying a greater variation of meal components is a more complex My Tray. Additionally, the use of this tool has not been explored

in a high school setting, where there is often greater variation of meal components and an increased complexity in summarizing results.

Another limitation of using My Tray as an evaluation tool is that small changes may be difficult to capture. For example, a project was done in which vegetable toppings were paired with popular student entrées, with the goal of increasing vegetable consumption among students. Production records were useful in assessing how many students selected these toppings, but could not be used to evaluate consumption. Additionally, limitations of the My Tray evaluation tool were noticed with this project evaluation as well. During the project, an increase in vegetable consumption occurred, but was rather minor. Unfortunately, the My Tray evaluation tool did not allow for enough specificity to effectively show the increases that occurred within the project.

Coding food items to make My Trays can be difficult. The basic meal component that created the greatest challenges was entrées. Entrées are often composed of multiple items including grains, meat/meat alternatives, and vegetables. Coding challenges often arise with items consisting of multiple components. For example, a chef salad is an entrée that consists of a meat, grain and vegetables. In cases with multiple food components, researchers must decide how to best code the item, often deciding between counting the food item in multiple places or excluding certain food components. These coding challenges limit the accuracy of My Tray and the ability to use it as an evaluation tool.

Limitations

Additional limitations of this study occurred during the direct observation performed by the two graduate students. Due to the large volume of students and the limited number of researchers, 66.1% of trays were observed of students that purchased a school lunch during the

observation period. While this is a large percentage that captures the majority of the students, a larger sample size would lead to a greater representation of the population.

The rapid pace in which students moved through the lunch lines was a limitation as well. Researchers attempted to document every food item on each tray that came through the line they were observing; however the quick pace made that a challenge at times. When lines began to move quickly, occasionally a tray would be missed or skipped to assure detailed recording of the trays prior to and after the missed tray.

Another limitation that occurred during the direct observation was regarding the presentation of food items. One example of this occurred when a burrito bar was offered. Students were able to choose a meat filling of beef or chicken, along with various toppings such as beans, lettuce, cheese, sour cream and tomatoes. By the time students made their way to the checkout lines, their burritos were often folded over, concealing the vegetables that were selected. In addition, burrito toppings were self-selected by students, therefore serving sizes varied. Researchers recorded when students selected multiple servings of an item, but were unable to record when students did not select a full serving. This may have led to under and over reporting of these vegetable toppings.

Additionally, the kitchen crew at the participating school was aware of the experiment. The cafeteria workers were not informed of the purpose of the project; however, the researchers were provided with copies of the school's production records. The kitchen staff may have improved the accuracy of the production records during the study period because they were sharing the documents with an outside institution for the purposes of this experiment.

Lastly, this study was only performed at one school. Replication is needed because lunchroom environments vary greatly.

Public Health Implications

Food selection is not currently a regularly monitored health behavior. Increasing the detail and accuracy of production records would allow them to become an accurate longitudinal indicator of food selection, which could measure progress of healthy eating interventions and programs in schools.

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

Another aspect to consider is whether cafeteria workers would actually see value in documenting more detail in production records to track changes in food selection. Currently production records do not typically include all the information necessary to efficiently evaluate meal selection. If cafeteria staff do not have any intentions of using the additional information that is needed to effectively evaluate selection, it may be difficult to encourage them to include this information.

Additionally, collecting production records, entering the data into Excel and creating My Trays is time consuming. Each month of production record data took approximately four hours

to correctly enter, code, and summarize into My Trays. Schools may not have this time available in their budget and this may create a barrier for the creation of My Trays.

Future Research

Additional research needs to be conducted to further assess the accuracy of using production records to measure food selection in cafeterias. Currently, many different methods of measuring food selection exist such as sales, observation, plate waste, and self-report. Future research should focus on validating production records with these methods that have previously been used to measure food selection among students. If future research is able to support production records reliability and validity as a surveillance tool for student food selection, it will encourage their use for long-term examination of food selection. In addition, this study measured food selection at one intermediate school. Since school lunchrooms are diverse in many ways, this study should be repeated in different environments and at different school levels.

Another aspect to consider for future research is whether data from production records can be used in other nutrition assistance programs. It would be beneficial to examine food selection in other programs to better understand the dietary patterns of individuals involved and the quality of nutritional assistance the USDA is providing.

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Appendix A: Coding Guidelines

Codes	Food Category
1	Meat/Meat Alternate
1.1	Combination Entrée (Meat/Meat Alternate, Grain, Vegetable)
1.11	Meat/Meat Alternate, Grain, Dark Green Vegetable
1.12	Meat/Meat Alternate, Grain, Red/Orange Vegetable
1.13	Meat/Meat Alternate, Grain, Beans/Peas
1.14	Meat/Meat Alternate, Grain, Starchy Vegetable
1.15	Meat/Meat Alternate, Grain, Mixed Vegetable
1.2	Entrée with Meat/Meat Alternate, Grain
1.3	Entrée with Meat/Meat Alternate, Vegetable
2	Grain
3	Dark Green Vegetable
4	Starchy Vegetable
5	Red and Orange Vegetable
6	Beans and Peas
7	Other Vegetable
7.1	Vegetable Juice/Dragon Juice
8	Mixed Vegetables
9	Fruits
9.1	Canned Fruit
9.2	Fresh Fruit
9.3	Other Fruit
9.4	Whole Fruit
9.5	Fruit Juice
10	Milk
10.1	Non-flavored Milk, White Milk
10.2	Flavored Milk
20	A la carte items
99	Condiments

Appendix B: USDA Vegetable Subgroups

The Vegetable Subgroups

Any vegetable or 100% vegetable juice counts as a member of the Vegetable Group. Vegetables may be raw or cooked; fresh, frozen, canned, or dried/dehydrated; and may be whole, cut-up, or mashed.

Vegetables are organized into 5 subgroups, based on their nutrient content.

Goal – Make half your plate fruits and vegetables.

Dark Green	Red and Orange	Beans and Peas	Starchy	Other
Bok choy	Acorn squash	Black beans	Cassava	Artichokes
Broccoli	Butternut squash	Black-eyed peas (mature, dry)	Corn	Asparagus
Collard greens	Carrots	Garbanzo beans (chickpeas)	Fresh cowpeas, field peas, or black-eyed peas (not dry)	Avocado
Dark green leafy lettuce such as Romaine	Hubbard squash	Kidney beans	Green bananas	Bean sprouts
Kale	Pumpkin	Lentils	Green peas	Beets
Mesclun	Red peppers	Navy beans	Green lima beans	Brussels sprouts
Mustard greens	Orange peppers	Pinto beans	Plantains	Cabbage
Romaine lettuce	Sweet potatoes	Soy beans	Potatoes	Cauliflower
Spinach	Tomatoes	Split peas	Taro	Celery
Turnip greens	Tomato Juice	White beans	Water chestnuts	Cucumbers
Watercress	Yellow yams	Edamame Beans	Jicama	Eggplant
Broccoli rabe			White yams	Green beans
Green or or red leaf lettuce				Green peppers
				Iceberg (head) lettuce
				Mushrooms
				Okra
				Onions
				Parsnips
				Turnips
				Wax beans
				Yellow Squash, crookneck
				Zucchini
				Yellow Peppers
				Purple bell peppers

The following websites may serve as reference for information on vegetable subgroups: www.choosemyplate.gov/food-groups/vegetables.html and www.cnpp.usda.gov/Publications/USDAFoodPatterns/ItemClustersAndRepFoods.pdf

ODE, OCN USDA is an equal opportunity employer and provider Last updated 7/2012

Appendix C: Production Record Entry Protocol

Production data is an important data source for the Ohio Smarter Lunchrooms project. It will be one of the three main data sources for the evaluation. Standardizing the process and entering data the same way is, therefore, important. Use this handout when entering data in the Excel spreadsheet, **Production_Records_Template**, on Dropbox.

Production Records

Production records, as usually kept by school lunch staff, are identified by the date and school name. The following information should be listed in these records:

- food item
- portion size
- total amount prepared
- total portions served to students
- total number of reimbursable lunches sold
- number of free and/or reduced priced lunches sold (if this information is available)
  Each of these items is important for analysis and should be entered.

Data Entry

The production data needs to be entered into an Excel spreadsheet. Follow these steps:

1. **Copy the Production_Records_Template.**

   One can copy the template, save it on the desktop, enter data, complete trend analysis, and then upload the file on Dropbox. We want to follow this procedure for each school. Label the tab at the bottom of the Excel workbook with the school name. Example: West Carrollton High School. If the name of the school does not fit on the tab, enter an abbreviated name.

2. **Enter column labels and data.**

   Date:
   Once the worksheet has been labeled, enter the date in the first column (from the production record) in this form: MM/DD/YY.

   School Information:
   In the second and third columns, enter the school name and the type of school (elementary, middle school, high school) respectively. Enter ES, MS, HS for elementary, middle, or high school, respectively. Please enter a note in the notes page (see below) to specify which grades attend the elementary school: K-5, K-6, etc. Do the same for middle schools and high schools.

Food:
Enter the name of the food item *as provided by the school cafeteria*. You can compare the name with the production records. Be sure that spelling is correct.

Food Category:
A food category list is available on the Excel worksheet. For each food item listed in the previous column, enter the appropriate food category number. Food category number is crucial for being able to sort data.

Portion Size:
This represents the amount of food in one serving. Ex.: "½ c" for vegetables or "5 each" for chicken nuggets. Use "c" for cup, "pt" for pint, "lb" for pound, and "oz" for ounce.

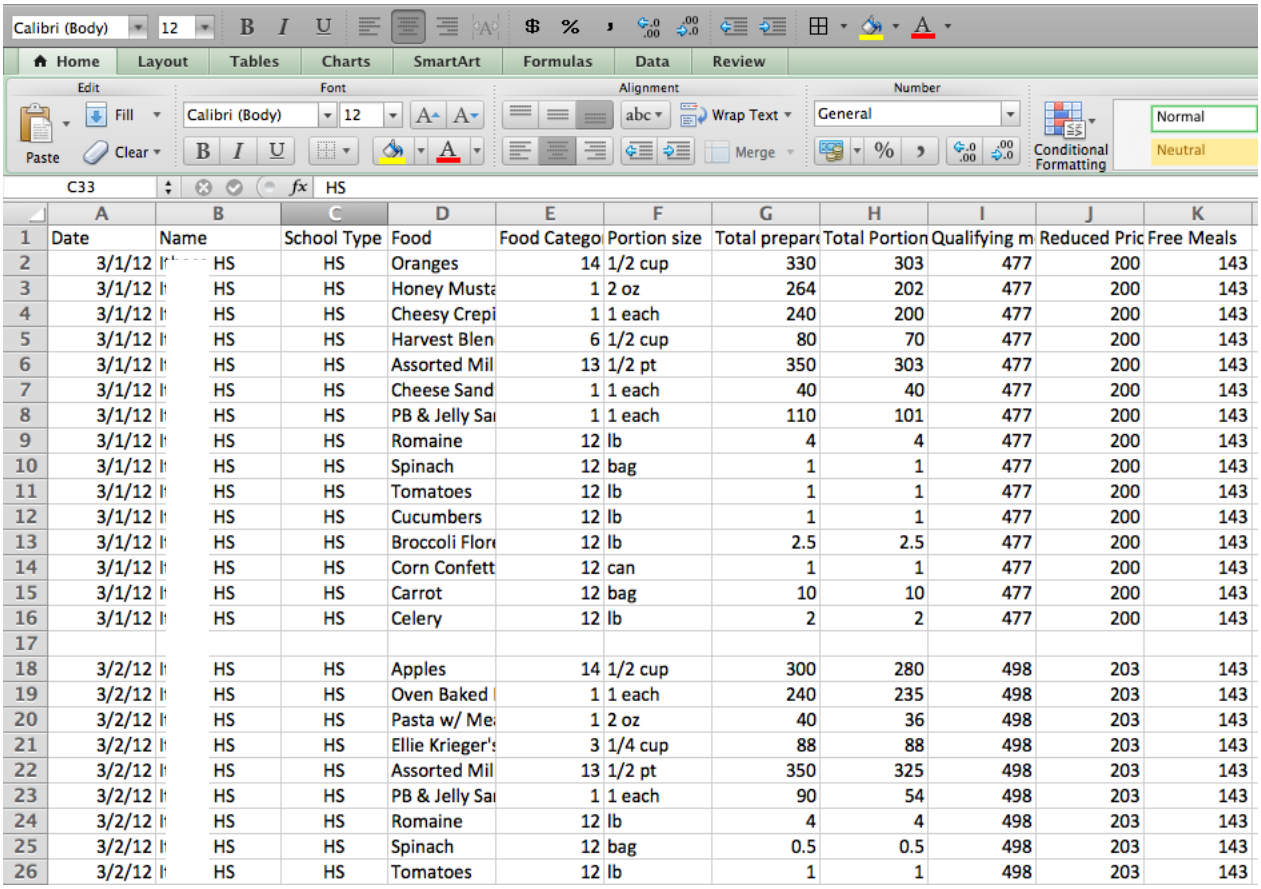
Total Prepared:
This represents the number of servings cafeteria staff prepared for the day, for each food item. This is available in production records.

Total Portions Used:
This represents the number of servings taken by the students, for each food item.

Paid Meals (Reduced Meals and Free Meals):
This column is also referred to as Qualifying Meals. Record the total number of paid meals sold. This is one number for the day. Then enter the number of free and reduced price meals sold in separate, adjacent cells.
NOTE: Enter each number (paid, free, and reduced meals) *once* in the respective column, per date. Then *fill* those columns for the rest of the date. To do this, highlight the three cells by clicking on one and with the mouse button still depressed, drag the mouse pointer over the other two cells. This will highlight the cells in blue there will be a small blue box in the bottom right hand corner. Hoover the mouse over the bottom right hand corner of the highlighted cell and when the mouse pointer turns into a darkened '+', click the left mouse button and drag the mouse pointer down so that all the cells for the specific date are filled.

3. **Enter data for the same school in the same tab.**
   Once entering the production record data for a school on a particular date is finished, skip one row of cells and begin entering production data for the next date, but for the same school.

4. **See the following screen shot for an example of data entry in Excel.**



	A	B	C	D	E	F	G	H	I	J	K
1	Date	Name	School Type	Food	Food Catego	Portion size	Total prepar	Total Portion	Qualifying m	Reduced Pric	Free Meals
2	3/1/12	I	HS	HS	Oranges	14	1/2 cup	330	303	477	200	143
3	3/1/12	I	HS	HS	Honey Musta	1	2 oz	264	202	477	200	143
4	3/1/12	I	HS	HS	Cheesy Crepi	1	1 each	240	200	477	200	143
5	3/1/12	I	HS	HS	Harvest Blen	6	1/2 cup	80	70	477	200	143
6	3/1/12	I	HS	HS	Assorted Mil	13	1/2 pt	350	303	477	200	143
7	3/1/12	I	HS	HS	Cheese Sand	1	1 each	40	40	477	200	143
8	3/1/12	I	HS	HS	PB & Jelly Sa	1	1 each	110	101	477	200	143
9	3/1/12	I	HS	HS	Romaine	12	lb	4	4	477	200	143
10	3/1/12	I	HS	HS	Spinach	12	bag	1	1	477	200	143
11	3/1/12	I	HS	HS	Tomatoes	12	lb	1	1	477	200	143
12	3/1/12	I	HS	HS	Cucumbers	12	lb	1	1	477	200	143
13	3/1/12	I	HS	HS	Broccoli Flor	12	lb	2.5	2.5	477	200	143
14	3/1/12	I	HS	HS	Corn Confett	12	can	1	1	477	200	143
15	3/1/12	I	HS	HS	Carrot	12	bag	10	10	477	200	143
16	3/1/12	I	HS	HS	Celery	12	lb	2	2	477	200	143
17												
18	3/2/12	I	HS	HS	Apples	14	1/2 cup	300	280	498	203	143
19	3/2/12	I	HS	HS	Oven Baked	1	1 each	240	235	498	203	143
20	3/2/12	I	HS	HS	Pasta w/ Me	1	2 oz	40	36	498	203	143
21	3/2/12	I	HS	HS	Ellie Krieger'	3	1/4 cup	88	88	498	203	143
22	3/2/12	I	HS	HS	Assorted Mil	13	1/2 pt	350	325	498	203	143
23	3/2/12	I	HS	HS	PB & Jelly Sa	1	1 each	90	54	498	203	143
24	3/2/12	I	HS	HS	Romaine	12	lb	4	4	498	203	143
25	3/2/12	I	HS	HS	Spinach	12	bag	0.5	0.5	498	203	143
26	3/2/12	I	HS	HS	Tomatoes	12	lb	1	1	498	203	143

5. **Enter notes in a separate tab.**

   Notes for specific dates will help identify observations that may not be useable in analysis. Notes may look like:

   - No data for milk entered
   - Servings of whole fruit prepared were not separated into individual fruits (apples, bananas, etc.)
   - An entry for total reimbursable meals sold was not entered

Table 1: Example of Production Record Entries

Date	Name	School Type	Food	Food Category Number	Portion size	Total prepared	Total Portions Used	Paid meals	Reduced Price Meals	Free Meals
3/1/12	IHS	HS	Oranges	14	1/2 cup	330	303	477	200	143
3/1/12	IHS	HS	Honey Mustard	1	2 oz	264	202	477	200	143
3/1/12	IHS	HS	Cheesy Crepini	1	1 each	240	200	477	200	143
3/1/12	IHS	HS	Harvest Blend Rice	6	1/2 cup	80	70	477	200	143
3/1/12	IHS	HS	Assorted Milk	13	1/2 pt	350	303	477	200	143
3/1/12	IHS	HS	Cheese Sandwich	1	1 each	40	40	477	200	143
3/1/12	IHS	HS	PB & Jelly Sandwich	1	1 each	110	101	477	200	143
3/1/12	IHS	HS	Romaine	12	lb	4	4	477	200	143
3/1/12	IHS	HS	Spinach	12	bag	1	1	477	200	143
3/1/12	IHS	HS	Tomatoes	12	lb	1	1	477	200	143
3/1/12	IHS	HS	Cucumbers	12	lb	1	1	477	200	143
3/1/12	IHS	HS	Broccoli florets	12	lb	2.5	2.5	477	200	143
3/1/12	IHS	HS	Corn Confetti	12	can	1	1	477	200	143
3/1/12	IHS	HS	Carrot	12	bag	10	10	477		143
3/1/12	IHS	HS	Celery	12	lb	2	2	477	200	143
3/2/12	IHS	HS	Apples	14	1/2 cup	300	280	498	203	143
3/2/12	IHS	HS	Oven baked pizza bagel	1	1 each	240	235	498	203	143
3/2/12	IHS	HS	Pasta w/ meat sauce	1	2 oz	40	36	498	203	143
3/2/12	IHS	HS	Ellie Krieger's tri color	3	1/4 cup	88	88	498	203	143
3/2/12	IHS	HS	Assorted milk	13	1/2 pt	350	325	498	203	143
3/2/12	IHS	HS	PB&J sandwich	1	1 each	90	54	498	203	143
3/2/12	IHS	HS	Romaine	12	lb	4	4	498	203	143
3/2/12	IHS	HS	Spinach	12	bag	0.5	0.5	498	203	143
3/2/12	IHS	HS	Tomatoes	12	lb	1	1	498	203	143
3/2/12	IHS	HS	Cucumbers	12	lb	1	1	498	203	143
3/2/12	IHS	HS	Celery	12	lb	2	2	498	203	143
3/2/12	IHS	HS	Carrot	12	bag	10	10	498	203	143
3/2/12	IHS	HS	Pickles	12	each	30	30	498	203	143
3/2/12	IHS	HS	Olives	12	can	2	2	498	203	143

Table 2: Example of Notes Entered

Date	School	Notes
3/1/12	I HS	No salad prepared
3/2/12	I HS	Incomplete menu
3/5/12	I HS	Milk totals for breakfast and lunch

Appendix D: IRB Exemption Letter

Office of Research and Sponsored Programs
201J University Hall
3640 Col. Glenn Hwy.
Dayton, OH 45435-0001
(937) 775-2425
(937) 775-3781 (FAX)
e-mail: rsp@wright.edu

DATE: February 11, 2015

TO: Erin Krafka, PI, MPH Student
Center for Global Health
Marietta Orlowski, Ph.D., Faculty Advisor

FROM: Jodi Blackledge
Program Facilitator, IRB-WSU

SUBJECT: SCR 5783
'Validating the Use of Production Records as a Measurement of Food Selection in School Cafeterias'

The above-listed project does not meet the Federal definition for human subjects research, specifically "a systematic investigation designed to contribute to generalizable knowledge". Therefore, the project does not require approval from the Wright State University Institutional Review Board.

If you have any questions or require additional information, please contact me at 775-3974.

Best wishes for a successful project.

Appendix E: List of Public Health Competencies used in CE

Tier 1 Core Public Health Competencies

Domain #1: Analytic/Assessment Skills
Applies ethical principles in accessing, collecting, analyzing, using, maintaining, and disseminating data and information
Uses information technology in accessing, collecting, analyzing, using, maintaining, and disseminating data and information
Selects valid and reliable data
Collects valid and reliable quantitative and qualitative data
Describes public health applications of quantitative and qualitative data
Uses quantitative and qualitative data
Describes assets and resources that can be used for improving the health of a community (e.g., Boys & Girls Clubs, public libraries, hospitals, faith-based organizations, academic institutions, federal grants, fellowship programs)
Domain #2: Policy Development/Program Planning Skills
Gathers information that can inform options for policies, programs, and services (e.g., secondhand smoking policies, data use policies, HR policies, immunization programs, food safety programs
Describes implications of policies, programs, and services
Explains the importance of evaluations for improving policies, programs, and services
Gathers information for evaluating policies, programs, and services (e.g., outputs, outcomes, processes, procedures, return on investment)
Domain #3: Communication Skills
Communicates in writing and orally with linguistic and cultural proficiency (e.g., using age-appropriate materials, incorporating images)
Conveys data and information to professionals and the public using a variety of approaches (e.g., reports, presentations, email, letters)
Domain #5: Community Dimensions of Practice Skills
Describes the programs and services provided by governmental and non-governmental organizations to improve the health of a community
Provides input for developing, implementing, evaluating, and improving policies, programs, and services
Domain #6:Public Health Sciences Skills
Retrieves evidence (e.g., research findings, case reports, community surveys) from print and electronic sources (e.g., PubMed, Journal of Public Health Management and Practice, Morbidity and Mortality Weekly Report, The World Health Report) to support decision making
Recognizes limitations of evidence (e.g., validity, reliability, sample size, bias, generalizability)
Contributes to the public health evidence base (e.g., participating in Public Health Practice-Based Research Networks, community-based participatory research, and academic health departments; authoring articles; making data available to researchers)

Domain #7: Financial Planning and Management Skills
Describes the structures, functions, and authorizations of governmental public health programs and organizations
Describes government agencies with authority to impact the health of a community
Domain #8: Leadership and Systems Thinking Skills
Incorporates ethical standards of practice (e.g., Public Health Code of Ethics) into all interactions with individuals, organizations, and communities
Describes needs for professional development (e.g., training, mentoring, peer advising, coaching)
Describes ways to improve individual and program performance

Concentration Specific Competencies

Health Promotion and Education:	
Area 4: Conduct Evaluation and Research Related to Health Education	
4.1	Create purpose statement
4.2	Develop evaluation/research questions
4.3	Assess the merits and limitations of qualitative and quantitative data collection for research
4.4	Critique existing data collection instruments for research
4.6	Develop data analysis plan for research
4.7	Write new items to be used in data collection for research
4.9	Disseminate research findings through professional conference presentations
Area 5: Manage Health Education Programs	
5.10	Synthesize data for purposes of reporting
Area 6: Serve as a health education resource person	
6.8	Use a variety of resources and strategies