



WIC Vendor Peer Group Study

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WIC Vendor Peer Group Study

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Executive Summary

The U.S. Department of Agriculture's (USDA) Food and Nutrition Service (FNS) contracted with Altarum Institute to conduct the Women, Infants, and Children (WIC) Vendor Peer Group Study, which aims to fill a substantial gap in research related to the design, use, management, and effectiveness of peer grouping systems utilized for WIC cost containment. WIC services are funded through grants to 90 State agencies (SAs), which are required to establish a vendor peer group system as a component of their cost containment program. Grouping vendors with similar characteristics is an essential aspect of monitoring (and subsequently containing) vendor prices to ensure that they are cost competitive. Based on a prior assessment of vendor peer group systems in nine States and a review of WIC State plans for this study, many States are unsure how to develop effective peer groups. The development of a rigorous vendor peer group system is a resource-intensive process that requires considerable statistical analysis support. Because many SAs have limited resources for statistical analysis, the primary aim of this Peer Group Study was to use empirical analysis to identify one or more effective peer group systems that could be applied and adapted to most SAs. In November 2015, Altarum submitted a companion report for this study which summarized the analysis and assessment of six current peer group systems. This Peer Group Study builds upon the findings of the earlier companion analysis and report.

Methodology

In consultation with an advisory panel, the study team conducted a multi-step data acquisition and analysis process to construct and simulate the performance of several peer group models in four SAs that use electronic benefits transfers (EBT). The SAs selected for inclusion in the study vary in terms of FNS Region, total population, number of WIC participants, and number of WIC vendors. Each SA provided administrative and redemption data files, from which data were cleaned and standardized to create an analytic file.

Using the analytic file, the study team completed three key analytic steps to construct peer group systems and simulate their performance in each State:

- ***Development of a WIC food basket cost (FBC) measure from redemption data.*** It is important to consider the cost of a WIC food basket when examining mean prices for the purpose of peer group analysis and construction in EBT. Since this type of measure does not currently exist in EBT, it was necessary to develop one. To do this, mean per-unit prices were calculated for each food category for each vendor using EBT redemption data, and a “complete food basket” that included a variety of WIC food categories in quantities that are typically prescribed to women and children (cheese, eggs, cereal, legumes, whole grains, milk, juice, infant cereal, and infant fruits and vegetables) was defined. Thus, the measure FBC is an unweighted sum of the mean food costs for each of these food categories.
- ***Development and testing of consistently defined vendor characteristics.*** Seven vendor characteristics (WIC annual sale, number of registers present in a store, number of unique Universal Product Codes redeemed, geographic location, store type for Supplemental Nutrition Assistance Program retailers, distance to the interstate, and business model store type) were tested as potential determinants of FBC. Several of these characteristics are currently used by some SAs to define their vendor peer groups, and USDA requires the use of a geographic variable. Only two characteristics were consistently and significantly related to FBC in all four SAs after controlling for other factors: number of registers and store type based on business model.
- ***Development of peer group systems using vendor characteristics identified as determinants of FBC and testing of the constructed peer group systems' effectiveness.*** Next, number of registers, store type based on business model, and geography (because it is a currently required

component of peer group systems) were combined into six alternative peer group systems and tested in each of the four SAs, except when it was not feasible or reasonable to test one or more of the systems due to the limited number of vendors authorized statewide. Optimizing the peer group systems in each State to best account for differences among vendors within a group while maintaining minimum overlap in mean FBC between groups required an iterative process.

Findings

The final specification of each peer group system (e.g., cut points chosen, groups collapsed due to having similar mean FBCs) varied somewhat by State; thus, the study concluded that the number and exact specification of characteristics required to account for differences among vendors within a group while maintaining minimum overlap in mean FBC between groups varied by SA. It was not feasible to test one or more of the alternative peer group systems in the two smaller SAs due to the limited number of vendors that each authorizes statewide. Moreover, none of the systems that were tested in one of these smaller SAs met all of the conditions of an effective system, since each contained at least one peer group with fewer than 30 vendors. This would likely be the outcome regardless of the criteria used to define peer groups, since the State authorizes so few vendors. Two or more of the alternative systems met all of the conditions of an effective peer group system in three of the four SAs. Several alternative peer grouping systems appear to be effective in most of the States.

These findings indicate that effective peer group systems employing the vendor characteristics and methods recommended by this study will necessarily vary by State and might not conform to current peer group requirements. For example, in States with a limited number of vendors or limited diversity among authorized vendors, a peer group system defined by one characteristic might be most effective. Moreover, the study found that peer group systems identified as most effective in three of the four study SAs did not include geography as a criterion. Because at least one effective system was developed in three of the SAs using number of registers, business model store type, and geography, it is reasonable to conclude that an effective peer group system defined by these vendor characteristics may be applicable and adaptable to most SAs.

Recommendations

The findings from the previously referenced companion report revealed that peer grouping systems currently employed by six SAs fall short of being optimally effective in meeting conditions defined for the study. Taken together, the findings from both this and the companion study lead to the following recommendations:

- **Clarify the purpose of vendor peer groups and define “effective” peer group systems.** The Interim Guidance on WIC Vendor Cost Containment¹ does not include specific measures of peer group effectiveness. For SAs to periodically test the effectiveness of their peer group systems as required, a clear definition of “effective” is required. Since specific conditions of an effective peer group system were established and used for this study to assess and compare peer group systems, FNS should consider incorporating these conditions into guidance or further adapting them to meet the needs of the program.
- **Encourage SAs to evaluate and update peer group systems using empirical analysis.** Although addressing the shortcomings of current peer group systems tested during this study may not directly translate into lower food costs, by using empirical analysis to identify more effective peer group systems, SAs will help ensure that the WIC Program pays competitive and fair prices

¹ USDA Food and Nutrition Service. Interim Guidance on WIC Vendor Cost Containment. Accessed March 14, 2016, at <http://www.fns.usda.gov/sites/default/files/InterimCostContainmentGuidance-June2006.pdf>

for supplemental foods. Some of the current peer group systems tested during the study appear to be more complex than they need to be. This suggests that effective peer group systems that were developed and tested by using empirical analysis could reduce administrative burden and improve program efficiency relative to vendor management.

- **Consider revising current vendor peer group requirements and further clarify how SAs can be exempted from using a geography criterion.** Current cost containment rules require that SAs use at least two criteria to define vendor peer groups and that one of these criteria be geography based. This study found that effective peer group systems will vary by State and may not conform to current peer group requirements. In some SAs, the optimal peer group system might comprise a single peer group criterion and might not include geography.
- **Provide SAs with practical guidance on developing an effective peer group system.** Many SAs lack the resources to design and conduct the kind of analysis used in this study. A simplified set of guidelines SAs can use to evaluate their peer group system was developed through this study. FNS should consider making these guidelines available for public consumption.
- **Consider standardizing store type definitions for WIC vendors.** Consistently defining store types across SAs has many advantages beyond those recognized in this particular study. If employed by all SAs, standardized store type definitions could be useful in ongoing reporting, comparison of measures of redemption between SAs, or tracking of trends in vendor authorization and pricing over time. The use of a consistent classification system for store types would also facilitate research to examine factors contributing to differences in food costs among WIC SAs. The business model store type was developed in part through this study. A database of stores classified as mass merchandisers, national and regional chain grocery stores, and pharmacies would be easy to establish and maintain at the national level, making it easier for SAs to determine the store types of their vendors.
- **Consider conducting an analysis of EBT data to identify recommendations for setting maximum allowable reimbursement levels (MARLs).** As part of a comprehensive cost containment strategy, SAs are required to establish and apply MARLs when they process vendor claims for foods purchased with WIC benefits. Data and simulation methods similar to those used for this Peer Group Study could be used to determine the most effective options for setting MARLs when EBT is used for WIC food delivery.

I. Introduction

The purpose of this report is to provide the U.S. Department of Agriculture’s (USDA) Food and Nutrition Service (FNS) with findings from the Women, Infants, and Children (WIC) Vendor Risk Reduction Study, referred to herein as the Peer Group Study.² Motivated by concerns about the effectiveness of peer grouping and cost containment systems, FNS contracted with Altarum Institute to conduct the Peer Group Study which aims to fill a substantial gap in research related to the design, use, management, and effectiveness of peer grouping systems utilized for WIC cost containment. The objectives of the study were to:

- 1) Identify and test at least three currently effective peer grouping systems and
- 2) Develop at least four innovative and effective peer grouping systems that could be applicable and adaptable to most State agencies (SAs).

Moreover, the objectives state that at least two of the four systems developed through the study need to comply with current cost containment rules which require that at least two peer group criteria be used to define peer groups and one of these must be geography-based. For objective #1, results from the analysis and assessment of six current peer group systems were summarized and submitted to FNS in the form of an interim report and are not included in this report. Instead, this report describes the methods employed and simulation analyses performed to identify innovative and effective peer grouping systems as part of objective #2. This report also summarizes findings from the simulation analyses and peer group testing and provides a set of guidelines WIC State agencies can use to ensure that their peer group system is effective and empirically tested.

A. Background on WIC retail delivery

The WIC program provides supplemental nutrition assistance, nutrition education, breastfeeding promotion and support, and referrals to health and social services to low-income and nutritionally at-risk pregnant, breastfeeding, and postpartum women as well as infants and young children up to age 5. The program is funded by FNS, which grants 90 WIC SAs in States, U.S. Territories, and Indian Tribal Organizations (ITOs) the resources to provide nutrition services to eligible program participants. In nearly all SAs, food benefits are provided to participants in the form of paper food instruments (FIs) or electronic benefits transfer (EBT) cards that they can use to purchase nutritious, supplemental foods free of charge.

In Federal Fiscal Year (FY) 2015, WIC SAs received a Nutrition Services and Administration grant amount of \$1.990 billion for providing services to participants and managing program operations.³ The total Federal expenditure for food benefits in WIC was \$4.17 billion after accounting for \$1.8 billion in formula rebates.⁴ Most of this money was spent in retail food stores (“vendors”) authorized by SAs. In FY 2015, there were more than 43,000 vendors nationally.

² Since its inception, the WIC Vendor Risk Reduction Study has been informally referred to as the “Peer Group Study”. This title may help to appropriately brand the study based on its key objectives and differentiate it from another USDA, FNS-sponsored study that was fielded during the same period (*Indicators of High Risk Study*).

³ USDA Food and Nutrition Service. WIC Program and Funding Data. Accessed March 14, 2016, at: <http://www.fns.usda.gov/wic/wic-funding-and-program-data>.

⁴ USDA Food and Nutrition Service. WIC Program Data: National Level Annual Summary. Accessed March 14, 2016, at: <http://www.fns.usda.gov/sites/default/files/pd/wisummary.pdf>.

SAs are accountable for ensuring that funds provided for food benefits are properly spent on WIC-authorized foods, that vendors follow program rules and guidelines when transacting WIC benefits, and that specific measures are in place to help contain food costs incurred by the program. SAs have been required to have food cost containment measures in place since 1989.

B. Understanding of peer groups and other factors related to cost containment

Vendor peer group systems are a key aspect of State WIC vendor management efforts and provide the foundation for many SAs' cost containment efforts. The notion of grouping "similar vendors" was formally introduced to the WIC community as early as 1982. In a report prepared for FNS, principal authors Stephen Stollmack, Ph.D., and Arthur Burger, M.A., define the causes of FI price variation and the role of peer grouping as a means to control for the anticipated variation. Specifically, the authors note, "An individual FI pulled at random may vary markedly from the average redemption for that food package without there being any error or abuse present," because participants' choice of food items and brands, as well as variation in prices for items across vendors, can influence redemption amounts. For this reason, the authors conclude that it is important to monitor prices by grouping vendors with similar characteristics.

Nearly 30 years later, the WIC Vendor Cost Containment Final Rule was published, requiring SAs to establish a vendor peer group system which includes at least two criteria (of which one measures geography) and to periodically assess the effectiveness of their peer group system, at least every three years according to Federal regulations. SAs may receive an exemption from having vendor peer groups if they use another cost containment approach approved by FNS. While most WIC SAs have developed a vendor peer group system, the criteria used to define peer groups, their use in managing vendors and cost containment, and the sophistication with which they are constructed and assessed vary widely between States. SAs most frequently determine their peer groups based on the store location, store type, and number of cash registers.⁵ WIC sales volume, gross food sales volume, square footage of the store, and other criteria are also reportedly used by a smaller proportion of SAs.

Although vendor peer groups are the focus of this study and report, it is important to understand that they are just one part of a State's overall cost containment system. To comply with Program requirements, SAs must:

- Identify and monitor above-50-percent vendors (A50s, vendors that derive more than 50 percent of their annual food sales revenue from WIC food sales) if the State chooses to authorize them.
- Establish competitive price criteria for each vendor peer group and ensure that authorized vendors stay competitively priced unless the vendor is needed to ensure participants have reasonable access to WIC foods in a particular area. If the latter is true, the SA would be willing to pay the higher prices charged by a non-competitive vendor. Federal regulations allow SAs to define participant access criteria, therefore participant access definitions vary.

⁵ Based on findings included in an unpublished report prepared by Altarum Institute for FNS through Contract #AG3198-C-11-0009.

- Establish and apply maximum allowable reimbursement levels (MARLs) to ensure that the SA pays reasonable prices for all supplemental foods. MARLs are the maximum price a SA will pay a vendor for specific food instruments (paper) or food items (EBT). There are a number of ways in which SAs establish and implement MARLs. However, most WIC SAs with paper FIs establish and apply FI-specific MARLs for each peer group, while most SAs with EBT report establishing MARLs or not-to-exceed (NTE) values at the food category or item level.

In addition, to competitive pricing criteria and MARLs, SAs may also choose to limit the types of vendors they authorize or impose restrictions on allowable foods in an effort to keep food costs low. An example of limiting criteria is to only authorize vendors that are full-line grocery stores. Food restrictions imposed by SAs typically limit participants to either the least expensive brand or the store brand for certain WIC foods (e.g., milk, cereal). Other SAs have rebates with food manufacturers for certain WIC foods (e.g., infant foods) and limit participants to the rebate brand for those specific items.

In sum, States can and do employ a variety of approaches aimed at containing their foods costs. However, since competitive pricing and MARLs are both required by the Program and depend on the establishment of vendor peer groups, it is reasonable to think of vendor peer groups as the foundation of a State's cost containment system. Consequently, a poorly constructed peer group system may undermine SA cost containment efforts by failing to identify vendors that are not cost competitive or allowing them to charge high prices for WIC foods. Conversely, establishing MARLs based on peer groups that are not effective may lead to the consistent reduction of payments to vendors that are cost competitive. Since vendors are essential to carrying out the mission of the WIC Program, constructing effective peer groups that help to ensure WIC SAs pay competitive yet fair prices for supplemental foods is in the best interest of all stakeholders.

C. Rationale and purpose of the study

The development of a rigorous vendor peer group system is a resource-intensive process that requires significant statistical analysis support—an asset that many SAs lack. Because many WIC SAs have limited resources, particularly in the area of statistical analysis support, the primary aim of this study was to use empirical analysis to identify one or more effective peer group systems that could be applicable and adaptable to most SAs.

As previously stated, Federal regulations require SAs to assess the effectiveness of their peer grouping system at least every three years. Based on a prior assessment of vendor peer group systems in nine States and a review of WIC State plans for this study, many States are unsure how to define and assess effectiveness⁵. Neither the Child Nutrition and WIC Reauthorization Act of 2004 nor the WIC Vendor Cost Containment Final Rule enacted in 2009 provided specifics regarding how States should approach meeting the requirement. The Interim Guidance on WIC Vendor Cost Containment⁶ reviews the principles of constructing and testing peer groups; however, it does not include specific measures of peer group effectiveness. In order to fill this information gap and accomplish the study objectives, it was necessary to define what peer group systems are supposed to achieve and determine the conditions a peer group system must meet in order to be considered effective, and complete several intermediate and analytic steps which were essential:

⁶ USDA Food and Nutrition Service. Interim Guidance on WIC Vendor Cost Containment. Accessed March 14, 2016, at <http://www.fns.usda.gov/sites/default/files/InterimCostContainmentGuidance-June2006.pdf>

- Develop a measure of food cost that could be used to formulate peer groups and assess their effectiveness;
- Identify vendor characteristics that can be consistently defined across SAs and establish which characteristics are determinants of food cost;
- Construct peer group systems using vendor characteristics identified as determinants of food cost and test the effectiveness of the constructed peer group systems.

Each of these steps is described briefly in the methodology section and then in more detail in report sections that follow. Additionally, this report takes the study conclusions a step further by also providing SAs with guidelines on how to develop and empirically test peer group systems based on the approach employed in this study (see Appendix A).

D. Organization of the report

This report provides a detailed description of study methods and findings relative to the development and assessment of peer group systems for the Peer Group Study in the following sections:

- Chapter II describes the methods used to select SAs for inclusion in the study, data collection from the study SAs, the definition and conditions of an effective peer group system, and both the intermediary and analytic steps taken to develop effective peer group systems. The latter is described at a high level in this chapter with additional detail provided in subsequent chapters.
- Chapter III focuses on the development of a food basket cost (FBC) measure using EBT redemption data. The chapter includes a description of the study approach and compares mean FBCs across the study SAs.
- Chapter IV focuses on the identification and development of vendor characteristics that were tested as potential determinants of FBC. The chapter includes a description of the study approach to developing and testing vendor characteristics and results of this testing.
- Chapter V focuses on peer group system development and testing. The chapter includes a description of the iterative process employed in this study to optimize these systems in each State, the outcomes of this development, and the testing process used.
- Chapter VI describes four key study limitations.
- Chapter VII summarizes conclusions that cross-cut both study phases and all aspects of the peer group development and testing process; it also provides a set of recommendations for FNS' consideration.

Supplemental materials and information are provided in the appendices. Appendix A provides guidelines SAs can follow to develop and empirically test peer group systems based on the approach employed in this study. Appendix B includes tables with results from the linear regression models run to identify vendor criteria as determinants of FBC. Appendix C includes tables with the final specification of the alternative peer group models and associated testing results for each State.

II. Study Methodology

This section describes the methods employed to select study SAs as well as the data that was requested and obtained from each. This section also provides a brief overview of key intermediary and analytic steps required to accomplish the second study objective, which was to develop at least four innovative and effective peer grouping systems that could be applicable and adaptable to most SAs. Detailed descriptions, results, and conclusions for each of these steps are provided in subsequent chapters of the report.

During the first year of the study, an advisory panel reviewed the proposed study design. Initially, the study's advisory panel included seven individuals who work for WIC at the State level as either directors or vendor managers, thus offering substantial expertise in WIC program operations, as well as two individuals from other federal agencies and one individual from academia with expertise in federal food assistance and nutrition program policy and economics. Once the study States were selected, each was invited to include a representative on the panel which resulted in the addition of one more panel member. The review process comprised an in-person meeting conducted in April 2014 to provide feedback on the proposed study design and a review of the study plan. However, members of the panel also reviewed the interview guide that was used to select study SAs, an interim report on current peer group systems, and this final report.

A. Study State selection

State agency selection took place during the first phase of the study between April-August 2014. Since the objective of the first study phase was to identify, test, and compare the characteristics of current peer grouping systems, only State agencies employing the most prevalent peer group systems at the time were considered for inclusion in the study. Data obtained through 2013 WIC State plan abstraction (or 2012 if 2013 was not available) or through follow-up with WIC SAs (if State plan documents were not available) were collected for the WIC Vendor Management Study and provided the primary source of information for identifying overall characteristics of peer group systems used across the country. The State plan information was then used to create a typology of peer group systems currently in place across SAs and to identify and summarize the most common components of peer group systems that are currently employed. More detail is included in the Interim Report for this study.⁷

Nine SAs (four SAs with EBT systems and five that use paper FIs) were asked to elaborate on how they define their peer groups and operationalize aspects of their cost containment systems. This information was used to select a group of SAs that were diverse in terms of peer group characteristics, food benefit delivery method, FNS region, size, and cost containment policies (e.g., restrictions on authorized WIC food, calculation of MARLs). A total of six SAs—four EBT and two paper FI—were selected and approved by FNS and then successfully recruited into the study.

For the simulation phase of the study, which is the focus of this report, only the four SAs employing EBT systems were included:

- SA1 is located in the Midwest FNS Region and consists of both urban areas and large but less-populated rural areas. Among the EBT study States, it ranks second in total population, number of WIC participants, and number of WIC vendors;

⁷ Based on findings included in the unpublished Interim Report from the WIC Vendor Risk Reduction Study prepared by Altarum Institute for FNS in August 2015.

- SA2 is located in the Western FNS Region and consists of several urban areas and large but less-populated rural areas. Among the EBT study States, it ranks third in total population, number of WIC participants, and total number of authorized WIC vendors.
- SA3 is located in the Southwest FNS Region. The state consists of both urban areas and large rural areas. Among the EBT study States, it ranks first in total population, number of WIC participants, and total number of authorized WIC vendors.
- SA4 is located in the Mountain Plains FNS Region. The state consists of large but less-populated rural areas and several smaller urban areas. Among the EBT study States, it ranks fourth in total population, number of WIC participants, and total number of authorized WIC vendors.

Exhibit II-1 Data fields included in the WIC SA redemption data request

- EBT card number
- Type and quantity of the food items purchased (e.g., food category, subcategory, unit, Universal Product Code [UPC])
- Redeeming vendor's WIC identification number (including FNS vendor ID)
- Date benefit was redeemed
- Claimed price (amount vendor requested)
- Settled price (amount State paid the vendor)
- MARL for the FI or food item
- Participant identification number
- Family identification number

B. Study data collection

Upon successful recruitment into the study, each SA was asked to provide WIC administrative data that would serve as the primary source of data for the peer group simulation analysis. The four EBT SAs whose data were used for the simulation analyses participated in a State-specific phone meeting to review the data request document; discuss data availability; further define data items; and determine a feasible period, format, and method for data submission. Following these meetings, a customized WIC administrative data request was sent to each WIC SA director. The SAs then provided a test file for review prior to submitting the full data files in order to ensure data quality. Complete data files containing redemption data for each WIC food item purchased by participants between June–August 2014 were received from each study SA in fall 2014. Since one of the SAs is a smaller program relative to the other three study States and thus has a lower volume of WIC sales, redemption data for May–August 2014 was used in the analysis. Exhibit II-1 lists requested variables for the EBT States included in the simulation analysis.

C. Establishment of conditions an effective peer group system must meet

During study implementation, it was necessary to establish a set of conditions that a peer group system would have to meet in order to be deemed optimally effective since specific measures of peer group effectiveness had not previously been defined. The following conditions of an optimally effective peer group system, which are consistent with the principles of the FNS cost containment guidance, were established and used during the study to assess and compare various peer group systems:

- Condition #1. Group stores in terms of characteristics that are known to be correlated with food costs and other business practices and characteristics that ultimately predict vendor prices (or demonstrate a correlation with those costs).
- Condition #2. Minimize both the overlap of mean food prices between peer groups and the influence of individual vendors on mean food prices within a peer group.

In addition to meeting these two conditions, an effective peer groups system must also ensure that the SA can meet its own cost containment objectives, which may give additional consideration to participant access and the costs and benefits related to managing and enforcing cost containment policies. Moreover,

while a simple system may be easier to implement, too few peer groups in a larger State could allow for a wide range of variability in cost within each peer group. The most optimal system is one where groups are constructed using as many variables as needed to adequately account for differences in the composition of vendors within a group while still maintaining minimum overlap in food cost between groups.

D. Intermediary and analytic steps taken to develop effective peer group systems

As previously noted, there were a number of intermediary and analytic steps taken to fully meet the study objectives. The following is a brief summary of the steps with additional detail on the approach, results, and conclusions of each provided in subsequent chapters:

- ***Development of FBC measures.*** Because the price of one food category might be higher among a group of stores compared to another group of stores but another food category might be lower, it is important to consider the cost of a WIC food basket when examining mean prices for the purpose of peer group analysis and construction in EBT. For example, the mean price of milk may be similar in national chains and independent stores while the mean price of cereal in these stores types may be different. Since this type of measure does not currently exist in EBT, it was necessary to develop one. This was accomplished by first reviewing and cleaning the redemption files provided by the study SAs. Next, mean vendor-level per unit prices were calculated for each of the most commonly redeemed food categories (e.g., cereal, eggs, cheese) and subcategories (e.g., gallon of milk, quart of milk). Finally, two FBC measures were developed, each comprising a variety of WIC food categories in quantities that are typically prescribed to women and children. Development of these measures is described in more detail in chapter III.
- ***Development and testing of consistently defined vendor characteristics.*** A number of vendor characteristics were identified, developed, and tested as potential determinants of FBC. Only vendor characteristics that could conceivably be related to a vendor's cost of doing business (operating cost) were considered. Additionally, for simulation analysis purposes, vendor characteristics needed to be readily available and consistently defined across study States. Although several of the vendor characteristics tested in this study are already widely used by SAs to define peer groups, the definition and application of each varies across SAs. Chapter IV provides detail on how each vendor characteristic was developed and how it performed as a determinant of FBC.
- ***Development of peer group systems using vendor characteristics identified as determinants of FBC and testing of the constructed peer group systems' effectiveness.*** Vendor characteristics identified in the prior analytic step as the most significant and consistent predictors of FBC across SAs were used to develop a series of peer group systems. These systems were then adapted for each study SA using an iterative process until optimal conditions of an effective peer group system were met. Chapter V provides more detail about peer group construction, the iterative process used to identify the optimal system in each State, results, and key takeaways.

III. Development of Food Basket Cost Measure

Key Findings

- For the purposes of peer group construction, it is important to group vendors based on the average cost of a basket or variety of WIC foods. When EBT redemption data is used to construct FBC, the measures naturally reflect food choices participants make when shopping at a particular vendor. Alternative strategies for constructing vendor peer groups are less ideal. For example, if peer group construction is based on the average price of each food category, vendor placement into a peer group might vary depending on the category being examined. Likewise, peer groups constructed without regard for a vendor's prices might lead to the erroneous grouping of vendors.
- Variability on average FBC within a State highlights the need to group vendors based on one or more characteristics.
- Complete FBC is preferred over Child FBC as the primary outcome measure since it reflects prices across a wider variety of WIC items.

A. Study approach

Because the price of one food category might be higher among a group of stores compared to another group of stores but then lower for another food category, it is important to consider the cost of a basket of WIC foods when examining mean prices for the purpose of peer group construction and analysis in EBT. Similar to a market basket or commodity bundle, which refers to a fixed list of items used specifically to track the progress of inflation in an economy or specific market over time (e.g., the basket of commodities used to establish the Consumer Price Index), a WIC food basket comprises WIC foods that are commonly redeemed and can be used to compare vendor prices at a point in time or for the duration of their authorization. Since this type of measure did not previously exist for analysis of EBT redemption data, it was necessary to develop one. This process entailed reviewing and cleaning redemption data, calculating mean vendor-level per unit prices for each food category and subcategory, and constructing the outcome measures.

File review and exclusions

After reviewing the three to four months of SA-provided redemption data for completeness and extreme outliers, some claimed prices that appeared extremely high for the type and quantity of food purchased were identified. Redemptions for which the claimed price (the price the vendor requested) was at least five times more than the settled price (the price paid to the vendor by the State) were excluded from the analysis. A total of 58 redemptions were excluded due to large differences in price.⁸ It was not within the scope of the study to determine how these cases arose.

Foods that are typically tailored (e.g., tofu, goat's milk, soy milk, evaporated milk, lactose-free milk) or medically necessary (e.g., Boost, Ensure, Pediasure) to meet individual participant needs or otherwise very rarely issued or purchased (e.g., frozen juice, canned fish, infant cereal) were excluded from the

⁸ Fifty-three redemptions were excluded in SA2 and five redemptions were excluded in SA1. No redemptions were excluded in Study States 3 or 4.

analysis because too few vendors redeemed any of these food items during the period for which redemption data was obtained. Moreover, these foods contribute minimally to the total volume of WIC sales and thus are less important to consider when examining mean prices for cost containment purposes. Infant formula was also excluded from the analysis because SAs negotiate contracts with formula manufacturers and require vendors to stock the contract brand; this likely impacts the price of formula and leads to less variation of price, which is not the case for other WIC foods. As such, including formula would not have helped to assess the appropriateness of the peer grouping systems developed in each State. Finally, redemptions made with fruit and vegetable checks were also excluded. Since the checks have a cash value that the participant cannot exceed, vendor prices on items in this category do not impact Program food costs.

Calculated mean per unit price for food categories and subcategories

The next step in determining vendor-level prices was to calculate the mean cost for each food category (e.g., cereal, eggs, cheese) and subcategory (e.g., gallon of milk, quart of milk) for each vendor. First, the price per unit was calculated for each food item purchased to standardize costs for foods that could be purchased in varying package sizes (for instance, cereal can generally be purchased in boxes ranging from 11 to 36 ounces). To determine the price per unit, the total purchase price for each food item was divided by the number of units purchased. Then, for each vendor, the price per unit was summed and then divided by the total number of units redeemed to calculate the mean per unit price for each food category and subcategory. This step resulted in the creation of one dataset per State with one record per vendor. Each vendor record contained the mean per unit costs for every food category and food subcategory, as well as vendor characteristics provided by the State or merged from The Integrity Profile (TIP) data file.

Developed outcome measures

Once mean per unit prices were calculated for each food category for each vendor, two “food basket” outcome measures were created (see exhibit II-2). The first variable is a “complete food basket” that includes each of the main food categories: cheese, eggs, cereal, legumes, whole grains, milk, juice, infant cereal and infant fruits and vegetables. It is an unweighted sum of the mean food costs for each of these food categories. The mean cost of a child’s food package was also calculated to reflect a typical WIC food prescription for children (per FNS guidelines), which includes eggs, cereal, legumes, whole grains, milk, and juice. Since FBC measures were created using EBT redemption data, they naturally reflect the prices of product choices made by participants when shopping for WIC.

Vendors who did not sell items in one or more food categories included in the outcome measures are excluded from the analysis, as the average per unit cost for the food category was missing, leading to seemingly lower food basket costs.

Exhibit II-2: Food categories and quantities comprising food baskets

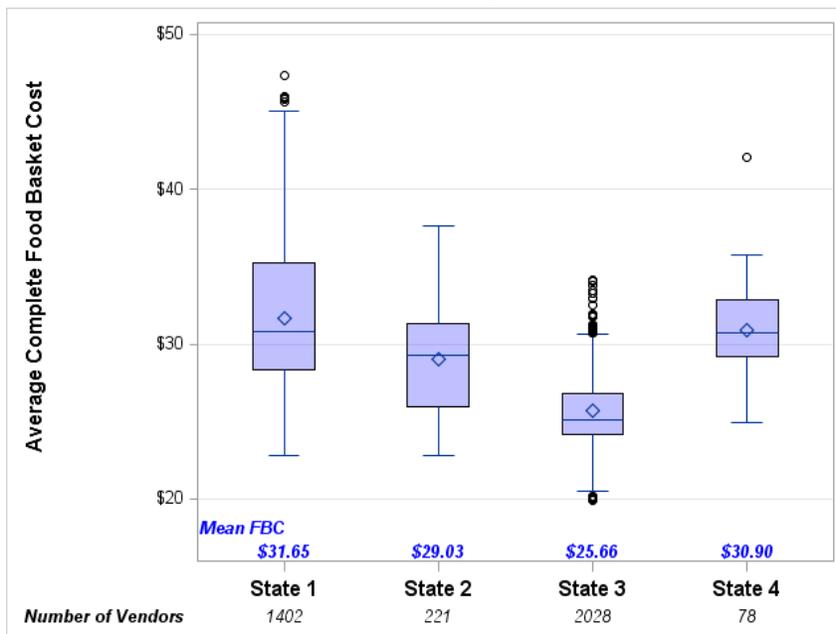
Food basket	Quantity of Cheese	Quantity of Eggs	Quantity of Cereal	Quantity of Legumes	Quantity of Infant fruits/vegetables	Quantity of Whole grains	Quantity of Reduced-fat milk	Quantity of Bottled juice
Complete food basket	16 oz.	dozen	36 oz.	16 oz.	4 oz.	16 oz.	1 gal.	64 oz.
Child food basket		dozen	36 oz.	16 oz.		32 oz.	4 gal.	128 oz.

The complete food baskets included an average per unit price for peanut butter, dry beans, and canned beans. The child food basket included peanut butter only.

B. Results

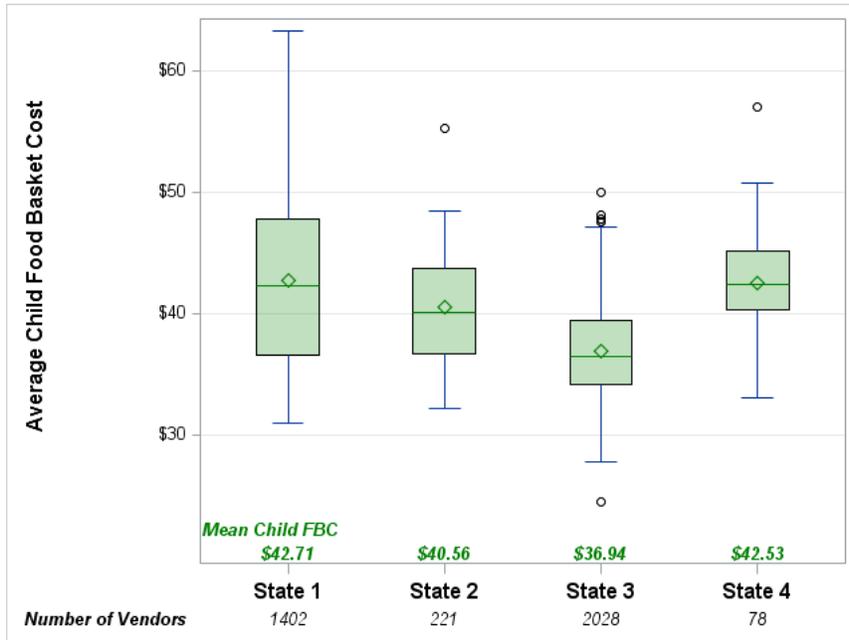
Of the 3,957 vendors included in the data files obtained from the four study SAs, 228 vendors had a missing value for average complete FBC and 191 had a missing value for child FBC due to the vendor not redeeming one or more of the items included in the food basket during the study's data collection period. Vendors excluded from analysis together account for less than 1 percent of total redemptions from the study states. Most vendors that were excluded from the analysis are independent grocers (40 percent) or convenience stores, liquor stores, or gas stations (33 percent). Twelve percent of vendors missing FBC were also missing store type information. For vendors included in the analysis, the mean and distribution of the FBC varies by State as shown in exhibit II-3, with SA1 having the highest mean complete FBC and also the widest distribution, while SA3 has the lowest FBC and the narrowest distribution of values, indicating little variation in price across the State's authorized vendors. Although the mean cost is higher overall, the differences between States are similar for the child FBC (exhibit II-4) with SA1, again, having the highest average and widest distribution while SA3 has the lowest FBC and the narrowest distribution. Within States, however, there appears to be more variation in the child FBC compared to the complete FBC.

Exhibit II-3 Distribution of Complete FBC by State.



Note: The box ranges from the first to the third quartile of the distribution and represents the interquartile range (IQR). The line across the box indicates the median. The whiskers are lines extending from Q1 and Q3 to end points and each outlier outside the whiskers is represented by an individual mark.

Exhibit II-4 Distribution of Child FBC by State



Note: The box ranges from the first to the third quartile of the distribution and represents the interquartile range (IQR). The line across the box indicates the median. The whiskers are lines extending from Q1 and Q3 to end points and each outlier outside the whiskers is represented by an individual mark.

IV. Testing of Vendor Characteristics as Determinants of Food Basket Cost

Key Findings

- Seven vendor characteristics were explored in this analysis as potential peer group criteria. Only two characteristics were consistently and significantly related to FBC in all four study States after controlling for other factors, thus are recommended as a potential peer group criteria: number of registers and store type based on business model.
- Number of registers showed a strong and consistent linear relationship with FBC across all study States indicating that having more registers is associated with lower FBC; therefore, it was preferred over WIC annual sales as a measure of store size for use in peer group development and testing.
- Store type based on business model was also a strong and consistent determinant of FBC across all study States. Moreover, this characteristic was developed based on industry standards using mutually exclusive criteria that do not rely on self-reported information from vendors and it can be applied consistently across SAs making it preferable to the Store Tracking and Redemption System (STARS) store type characteristic.
- Because the objective of the Peer Group Study is to identify effective peer group systems that could be applicable and adaptable to most State agencies, number of registers and store type based on business model were identified as best fit for inclusion in peer group development and testing. Since geography was a determinant of FBC in the larger study States even after controlling for other factors and because at least one of the effective peer group systems developed through this study needs to comply with current regulations, it was also included in peer group development and testing which is described in section V.

A. Study approach

During this intermediary step in the simulation analysis phase, vendor characteristics were selected and tested to determine which characteristics are determinants of FBC and should be further considered as a peer group criteria. Peer groups comprised of characteristics that are determinants of FBC would be in compliance with Condition 1 which states that an effective system should group stores in terms of characteristics that are known to be correlated with food costs and other business practices and characteristics that ultimately predict vendor prices (or demonstrate a correlation with those prices).

Identification of vendor characteristics

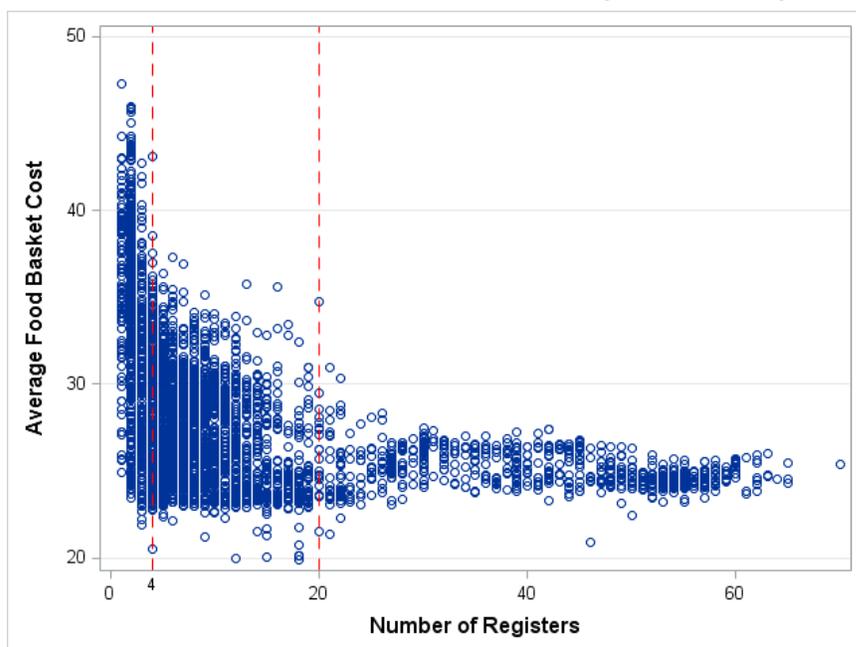
An initial set of vendor characteristics to be explored as potential peer group criteria was compiled by the study team, including its expert consultants, during the simulation phase of the study. The list was refined and informed by multiple sources, including information gleaned from WIC State plans, experience working with the SAs on peer group construction, input from the Advisory Panel, and SA representatives who attended the webinar and provided feedback on the simulation analysis findings. Only vendor characteristics that were readily available or could be easily developed using existing data and that could be consistently defined across study States were considered for the simulation analysis. Although this was a stipulation imposed by the study, these considerations are also relevant for the practical application of a

peer group system since the vendor characteristics SAs use for their peer groups need to be readily available or easy to develop. Once the list of vendor characteristics was compiled, it was shared with representatives from the peer advisory panel through a facilitated “brainstorming” session in June 2015 and finalized shortly thereafter. Several of the criteria were available or could be developed using only WIC administrative data (data obtained directly from the SAs) and, consequently, these were easy to consistently define across SAs:

- **WIC annual sales.** WIC annual sales is used as a vendor peer group criterion by numerous SAs and it may serve as a proxy for store size or be associated with a vendor’s operating costs through other mechanisms. For example, in 2004, King et al. found that operating costs of stores with a higher proportion of SNAP redemptions were not different from stores with a lower proportion of total revenue coming from SNAP.⁹ Although revenues from SNAP were examined by King et al. in relative terms (proportion of total sales), and it is a leap to assume that the same is true of vendors with a higher proportion of WIC revenues, it is plausible that vendors with a high proportion of WIC sales may have different operating cost structures than vendors with a lower volume of WIC sales, thus WIC annual sales was examined as a potential determinant of FBC.
- **Number of registers.** The number of registers present in a store is an indicator of store size and it is commonly used by SAs as a peer group criterion. It is reasonable to believe that a vendor’s size may be indicative of its operating costs and may correlate to its prices. To examine the relationship of registers to prices and determine whether it was linear, number of registers was plotted against FBC. The resulting scatter plots also helped to determine meaningful cut points for number of register groupings by allowing for the identification of distinct changes in mean FBC or variability about the mean (see exhibit IV-1). The number of register groupings were then examined using analysis of variance (ANOVA) to ensure that FBC differed significantly between the groups within each SA. Both the continuous and the categorical register characteristics were included in the regression models to account for both the overall linear relationship between number of registers and FBC, and any differences that exist in the relationship between FBC and registers within each number of register grouping.
- **Number of UPCs.** The number of unique UPCs redeemed by a vendor was explored as a potential proxy for variety of products available since offering a larger variety of products may result in higher fixed costs of operation such as for increasing shelf space and improving distribution systems. Number of UPCs was explored for each food category, for only those food categories included in the FBC, and for all food categories combined.

⁹ King, Robert P., Ephraim S. Leibtag, and Ajay S. Behl (2004). “Supermarket Characteristics and Operating Costs in Low-Income Areas,” U.S. Department of Agriculture, Economic Research Service, Agricultural Economic Report No. 839.

Exhibit IV-1 Relationship between FBC and number of registers, all Study SAs.



Two additional vendor characteristic were already consistently defined and **available through sources that can easily be merged with WIC administrative data**:

- **Geography.** Geographic location was determined using Rural Urban Commuting Area (RUCA) codes which utilize standardized definitions of urbanicity in combination with work commuting information to characterize all of the nation's Census tracts regarding their rural and urban status and relationships.¹⁰ RUCA data, which is readily available online, was downloaded and merged with the analytic file based on vendor ZIP code, and used to assign each vendor to one of four commonly used geographic classifications: urban, large rural, small rural, and isolated rural¹¹. Most SAs currently using a geographic peer group criterion employ a county-level measure of urban versus non-urban, which is different than the RUCA approach.
- **Store type for SNAP Retailers.** Store type was obtained from the Store Tracking and Redemption System (STARS) which is a database of SNAP-authorized retailers. Retailers are classified into a store type based on information that is self-reported on their program application. The STARS criteria for store type is designed for SNAP retailers and categorizes stores based on size and variety of items available. A limitation of the STARS store type criterion is that it does not account for whether a vendor is independently owned or part of a larger chain. This is an important consideration in WIC and when constructing peer groups because smaller stores that are part of a chain may have different operational cost structures thus lower prices than their independent counterparts.

¹⁰ WWAMI Rural Health Research Center. Rural Urban Commuting Areas. Accessed March 14, 2016, at: <http://depts.washington.edu/uwruca/ruca-codes.php>

¹¹For the purposes of this study, urban includes urbanized area cores with 50,000 or greater population; large rural includes large rural cities/towns with populations from 10,000-49,999; small rural includes small towns with populations from 2,500 through 9,999; and isolated rural includes rural areas with populations less than 2500.

The final two vendor characteristics included in the list of potential determinants of FBC were **available through sources that can be merged with or applied to WIC administrative data**. Since these vendor characteristics did not previously exist, substantial effort and progress was made through the study to define and develop them.

- **Distance to the interstate.** Based on “economies of agglomeration” or clustering which describes the benefit (lower operating cost) realized by stores located near one another due to economies of scale and network effects, such as access to roads and distribution systems, distance to the nearest interstate was explored as a potential determinant of FBC. To develop this characteristic, ArcGIS Desktop 10.3 was used to calculate distance in miles from each vendor to the nearest interstate, highway ramp (entrance and exit ramps to major highways), or major road (interstate or highway).
- **Business model store type.** Store type is commonly used by SAs to define peer groups; however, based on the interviews conducted with study SAs, there is great variation across States in terms of how store type is defined and operationalized. As noted previously, SNAP uses standardized store type definitions that can be applied across States for that program; however, these definitions do not account for whether a vendor is independently owned or part of a larger chain which limits their use for WIC. A new option, store type based on business model, evolved from the conduct of two current USDA FNS studies and ongoing fieldwork conducted by expert consultant Art Burger. This characteristic employs industry definitions of store business models and distinguishes between mass merchandisers, grocery chains, pharmacy chains, independents, and a number of other store types. This model considers the variety and type of products offered, number of States in which the store owner operates, and the number of outlets operated by the owner. The classifications and their definitions are shown in Exhibit IV-2. For this study, information gleaned from the Progressive Grocer’s Marketing Guidebook (annual) was used to verify ownership, banners (specific store names), number of outlets, and States in which a vendor’s owner operates and to assign vendors to a business model store type category.

Exhibit IV-2 Store Type Based on Business Model

CATEGORY	STORE NAMES / CRITERIA FOR CATEGORIZING STORES
Mass Merchandiser*	Retailer that sells a wide variety of merchandise but also carries groceries and has outlets in most or all States.
Discount and Limited-Assortment Chains†	Retailer that primarily sells a limited variety of low-cost merchandise but also carries a limited variety of food items
National Grocery Chain	Retailer that primarily sells groceries with outlets in most or all States (>30)
National Drug Chain‡	Pharmacy retailer that sells a limited variety of food items with outlets in most or all States (>30)
Regional Grocery Chain	Retailer that primarily sells groceries with at least 11 outlets and operates in 2 or more States
Local Grocery Chain	Retailer that primarily sells groceries with at least 11 outlets and operates in only one State
Independent Grocery	Retailer that primarily sells groceries with less than 11 outlets
Regional or Local Drug	Pharmacy retailer that sells a limited variety of food and is not a national drug chain
Other	Island stores, remote location stores, tribal-owned stores, general stores, specialty markets (meat, kosher, deli)
A50, WIC Only	Store that derives more than 50 percent of its total annual food sales revenue from WIC food instruments
Commissary	Grocery store operated by the U.S. Defense Commissary Agency within the confines of a military installation; it can fit within any of the grocery formats
Convenience, liquor, gas stations	Retailer with a limited assortment of grocery items

* As of January 2016, only Target, K-Mart, and Wal-Mart stores were included in this category. †As of January 2016, only Dollar General and Dollar Tree stores were included in this category. ‡ As of January 2016, only CVS, Walgreens, Kroger Drug, and Rite Aid stores were included in this category.

Testing of vendor characteristics as determinants of FBC

The relationships between potential peer grouping criteria and FBC were first examined using bivariate analyses. Pearson correlations were conducted to measure the linear correlation between each continuous vendor characteristic (WIC annual sales, number of registers, number of UPCs and distance to the interstate) and FBC. The Pearson correlation coefficient (or Pearson's r) can be any value between 1 and -1. A value of 1 indicates total positive correlation, which in this case would mean that FBC increases as the value of the vendor characteristic increases and at the exact same rate. For a value of -1 the opposite would be true; FBC decreases as the value of the vendor characteristic increases. A value of zero indicates that there is no correlation between FBC and the vendor characteristic. Thus the closer r is to 1, the stronger the correlation between a vendor characteristic and FBC.

For categorical vendor characteristics (RUCA and store types), ANOVA and Tukey's pairwise comparisons were used to determine the relationship with FBC. Tukey's method is a single-step multiple comparison procedure that is used to test for differences in means between one level of a vendor characteristic, in this case, and all other levels of the characteristics. For example, when run for FBC and geography, Tukey's method returns results that indicate whether mean FBC is statistically significantly different between vendors in urban and large rural areas, urban and small rural areas, urban and isolated rural areas, large and small rural areas, and so on until all possible pairs are compared. Tukey's test is favored over conducting numerous t-tests because it appropriately adjusts for multiple comparisons.

Vendor characteristics identified as being statistically significantly associated with FBC through this exploratory analysis were then included in a series of linear regression models which were run for each of the four study SAs. The models included mean FBC as the dependent variable and the vendor characteristics as independent variables to identify vendor characteristics that are significantly related to FBC while controlling for other factors. Some models also included interactions between WIC annual sales and store type or number of UPCs and store type. These models were examined, discussed and refined to best account for FBC variation and the results were used to determine which vendor characteristics are determinants of FBC and should be eliminated or further considered as a potential peer group criterion.

B. Results

Based on results of exploratory bivariate analyses, each vendor characteristic was statistically significantly related to FBC in all four States with two exceptions: distance to interstate and geography. As shown in Exhibit IV-3, distance to interstate was not significantly associated with FBC in SA4 and the relationship between this variable and FBC was somewhat inconsistent across States, with increased distance in miles leading to increased FBC in SA1 but decreased FBC in States 2 and 3. Additionally, the strength of the association as indicated by the absolute value of the correlation coefficient was considerably less than that of other vendor characteristics.

Geography was only statistically significantly related to FBC in three of the four States (States 1, 3, and 4). While two-thirds of the pairwise comparisons for geography were different in the larger states (1 and 3), only 17 percent of them were in SA4 which is relatively small, ranking fourth in total population, number of WIC participants, and total number of authorized WIC vendors among the four study States. Geography was not statistically significantly related to FBC in SA2 which ranked third in terms of size (total population, WIC population, WIC vendors) among the study States.

WIC annual sales, number of registers, and number of UPCs were statistically significantly and negatively correlated with mean FBC in all four States. Although both store type vendor characteristics (STARS and business model) were associated with FBC, store type based on business model had a greater proportion of pairwise comparisons that were statistically significantly different in terms of mean FBC, indicating that the business model store type may be more appropriate for use in analysis of WIC data than the STARS classification.

Exhibit IV-3 Bivariate association between vendor characteristics and FBC

Vendor characteristics	SA1 n=1402	SA2 n=221	SA3 n=2028	SA4 n=78
Pearson Correlation	Correlation coefficient	Correlation coefficient	Correlation coefficient	Correlation coefficient
WIC annual sales	-0.23	-0.55	-0.36	-0.60
Number of registers	-0.55	-0.65	-0.29	-0.55
Number of UPCs	-0.59	-0.61	-0.32	-0.66
Distance to the interstate	-0.12	0.18	0.12	NS
Tukey's Pairwise¹	% of Sig Diff Pairs			
Geography (RUCA)	67%	NS	67%	17%
STARS store type	47%	17%	48%	20%
Business model store types	66%	67%	48%	67%

¹ The total number of pairs compared in each State was 6 for geography but varied for the store type characteristics as not all States had every store type represented among its authorized vendors.

Note: The correlation coefficient (or Pearson's *r*) can be any value between 1 and -1. A value of 1 indicates total positive correlation and a value of -1 indicates total negative correlation. A value of zero indicates that there is no correlation between FBC and the vendor characteristic. Thus the closer *r* is to 1, the stronger the correlation between a vendor characteristic and FBC.

All associations are significant ($p < 0.05$) except where indicated by "NS".

Because of their significant relationship with FBC, all of the vendor characteristics described in the previous section were included in multivariate linear regression models for each State (see appendix B for complete regression models by State). Once other vendor characteristics were controlled for (held constant through modeling), distance to the interstate was no longer a significant determinant of FBC. Four other vendor **characteristics remained significant in the models, but the results were inconsistent across States:**

- **WIC annual sales** was a significant predictor of FBC in all States, however, after controlling for other vendor characteristics the association was inconsistent with increased sales related to increased FBC in one State and related to decreased FBC in the other States. Upon further examination, including the analysis of scatter plots, it appears WIC annual sales is an inconsistent predictor of FBC across the study SAs.
- **STARS store type** continued to demonstrate an overall significant relationship with FBC in the two larger study States, although when comparing FBC between each pair of store type classifications, only about 50 percent of the pairs were statistically significantly different. The STARS store type variable was not a significant determinant of FBC in the two smaller study states after controlling for other factors. Additionally, the definitions for the STARS store type classifications do not account for economies of firm size that may exist among stores that are operated by the same owner. As a result, some stores with the same name and owner are grouped into different store type classifications because they differ in terms of size and product offerings. For example, within the same State, different vendors from the same chain were categorized under the STARS model as supermarket, superstore, large grocery store, and combination grocery/other even though their operating costs and food prices may be similar since they are under the same ownership. As noted previously, this limits the usefulness of the STARS store type classifications for WIC.

- **Geography** was included in the models as a dichotomous variable (urban versus non-urban). Because most vendors were in urban areas, the remaining vendors were combined in a non-urban group because it was not necessary to divide them across three rural classifications (large, small, isolated). After controlling for other vendor characteristics, FBC varied by geographic location in two of the four study SAs. The two States for which geography was a significant determinant of FBC were large in terms of area, population, and total number of authorized vendors (more than 1,000), whereas the two States for which geography was not a significant factor were large in terms of area but have fewer densely populated areas and relatively few vendors (less than 200).
- **Number of UPCs** were examined both in terms of total number of unique UPCs redeemed and total number of unique UPCs redeemed within each food category that was included in the FBC measure (e.g., total number of unique UPCs for peanut butter). Total number of UPCs remained a significant predictor of FBC, but the results for the individual food categories were mixed. For example, in one State, more UPCs for peanut butter indicated higher FBC while more UPCs for cereal were related to lower FBC. Given the inconsistency in results using food category-level number of UPCs, total number UPCs was less compelling as a determinant of FBC. This vendor characteristic might have been confounded by food brand and size restrictions in each State since it was based on the total number of unique UPCs redeemed, not the total number of unique UPCs available at a given vendor.

Only two vendor **characteristics remained significant in the models and had similar effects across States:**

- **Number of registers** showed a strong and consistent linear relationship with FBC indicating that having more registers is associated with lower FBC.
- **Business model store type** was consistently applied across all study States and was determined to be a significant determinant of FBC in each. More than half of all pairwise comparisons between business model store type classifications were statistically significantly different in all of the study States, ranging from 55 percent of the pairs in one State to 100 percent in another.

V. Peer Group System Construction and Testing

Key Findings

- Six alternative peer group systems were developed and tested in each State, except when it was not feasible or reasonable to test one or more of the systems in a given State due to the limited number of vendors it authorizes statewide.
- Optimizing the peer group systems in each State to best account for differences among vendors within a group while still maintaining minimum overlap in mean FBC between groups required an iterative process. This is undoubtedly due to the unique attributes of each State, such as the total number of vendors authorized, type of vendors present in the State or authorized by the State agency, geographic considerations, and overall food cost or variability within the State.
- The final specification of each peer group system (e.g., cut points chosen, groups collapsed due to having similar mean FBCs) varied somewhat by State which was expected and is also consistent with the objective to identify peer group systems that “could be applicable and adaptable to most SAs.”

A. Study approach

Store type using the business model approach and number of registers were the strongest and most consistent predictors of FBC; therefore, they were the vendor characteristics upon which the alternative peer group systems were based. The Peer Group Study tested six separate models. Models (a) and (b) of Peer Group System 1 test for the effectiveness of store type and number of registers with geography. Model (c) tests all three criteria together. Models a, b, and c of Peer Group System 2 test combinations of store type and number or registers, with geography excluded (see exhibit V-1). To optimize the models, it was necessary to tailor them for each SA. This section describes the process employed to tailor the models in each State and test them against Condition #2, which states that an effective system should minimize both the overlap of mean food prices between peer groups and the influence of individual vendors on mean food prices within a peer group. To address the latter, peer groups should contain at least 30 vendors since, based on the central limit theorem, this increases the likelihood that the prices of the vendors in the group will approximate a normal distribution.

Exhibit V-1. Description of six alternative peer group systems

Peer Group System 1: Meets current cost containment rules
PG1a. Store type, geography (urban vs. non-urban)
PG1b. Number of registers, geography (urban vs. non-urban)
PG1c. Store type, number of registers, geography (urban vs. non-urban)
Peer Group System 2: Does not meet current cost containment rules
PG2a. Store type only
PG2b. Number of registers only
PG2c. Store type, number of registers

To start, we developed and tested the simplest peer group model which was based solely on store type (PG2a). Initially, this system comprised each store type category as a separate peer group and descriptive statistics similar to those presented in exhibit V-2 for SA1 were reviewed.

Exhibit V-2. Initial specification of Peer Group 2a for SA1.

Store category	Number of vendors	Mean FBC	SD
Mass merchandiser	87	\$25.70	\$1.08
National grocery	200	\$27.54	\$2.33
Regional grocery chain	258	\$28.38	\$2.20
Local chains	21	\$28.63	\$3.02
Independent pharmacy	4	\$32.72	\$1.74
Independent grocers	539	\$33.46	\$3.62
Other, Specialty stores	31	\$34.83	\$3.25
Discount and limited-assortment chains	3	\$35.02	\$0.89
Convenience, liquor, gas stations	196	\$37.26	\$3.16

Next, based on results of the ANOVA and Tukey’s pairwise significance tests, store type classifications with similar mean FBCs were combined, resulting in a more effective specification of PG2a. For example, in SA1, Tukey’s pairwise tests revealed that national, regional, and local grocery chains did not have significantly different mean FBCs. Likewise, discount and limited-assortment chains, regional and local drug stores, convenience stores, and other store types were similar in terms of mean FBC. For this reason, these groups were collapsed to create the revised and more effective PG2a which is presented in exhibit V-3. This process was repeated for each study SA.

Exhibit V-3. Revised specification of PG2a for SA1 after testing.

Peer group number	Description	N	Mean FBC	SD
1	Mass merchandiser	87	\$25.70	\$1.08
2	National, regional, local grocery chains	479	\$28.04	\$2.33
3	Independent grocers	539	\$33.46	\$3.62
4	Discount, other, pharmacy, convenience	234	\$36.83	\$3.28

The final specification of PG2a served as the starting point for development of peer group systems 2c, 1a, and 1c, all of which include store type plus one or two additional vendor characteristics. When incorporating a second or third vendor characteristic into the peer group system, it was necessary to first determine whether there were enough authorized vendors in a particular category to consider further dissection of the group. For example, if the second criterion was comprised of two levels, there would need to be a minimum of 60 vendors in a particular store type group to ensure that subgroups could conceivably include at least 30 vendors which is one condition of an effective peer group system.

Where the number of vendors was sufficient, we tested for differences in mean FBC by a second criterion (e.g., number of registers) within each category of the first criterion (e.g., store type) using t-tests or ANOVA depending on the number of classifications comprising the second criterion (see appendix C for State-specific groupings). For example, to create PG2c for SA1, which is comprised of store type and number of registers, only those store type classifications from PG2a that had enough vendors in each group (>30) and differences in mean FBC between number of register classifications were divided into separate peer groups. To demonstrate this further, t-tests conducted with independent grocers in SA1 revealed a statistically significant difference in mean FBC between register classifications (less than 10 versus 10 or more). However, once segmented based on number of registers, there were too few independent grocers with 10 or more registers; thus, independent grocers were not separated based on number of registers in the final specification of PG2c in SA1 (see exhibit V-4).

Exhibit V-4 Examination of number of registers within store type classifications to create PG2c for SA1.

Examination of number of registers within store type classifications (PG2a)

PG2a	Description	Register Groups	N	FBC Mean
1	Mass merchandiser	<10	1	25.73
		10+	86	25.70
2	Regional /National /Local chains	<10	282	28.24
		10+	197	27.76
3	Independent Grocer	<10	517	33.61
		10+	22	29.86
4	Discount/Other/ Pharmacy/ convenience	<10	234	36.83
		10+	0	-

BOLD indicates groups are significantly different ($p < 0.05$), based on t-test.

*Not divided due to <30 vendors in a group

Proposed PG2c based on TTEST results

PG2c	Description	N
1	Mass merchandiser	87
2	Regional/National/ Local chain, < 10 registers	282
3	Regional/National/ Local chain, 10+ registers	197
4	Independent Grocer*	539
5	Discount/Other/Pharmacy/convenience	234

A similar process was employed to create the six alternative peer group systems in each State. Once each peer group system was created, they were tested again using ANOVA with Tukey’s pairwise significance tests to determine if the peer groups had significantly different mean FBC. If there were still groups with similar FBCs, these groups were collapsed as long as combining the groups seemed logical and had no obvious negative practical implications. For example, it may make sense to combine national chains with 10 or more registers with mass merchandisers if their average FBCs are not statistically different. However, it would be somewhat illogical to combine mass merchandisers with convenience stores, even if their average FBCs are similar since the business models of these store types are clearly different. The revised peer group system was then tested again and this process was repeated until an optimal specification of each peer group system was identified. Continuing with SA1 as an example, Tukey’s pairwise testing on the model specified in exhibit V-4 revealed that mean FBC was similar between the two number of register groupings within the previously combined “regional/national/local chains” group. For this reason, it was necessary to test differences based on number of registers within each of the original store type classifications instead of the collapsed groups that comprised PG2a. The resulting system is presented in exhibit V-5 and the Tukey’s pairwise testing results are shown in exhibit V-6. Only national chains with less than 10 registers and regional and local chains with more than 10 registers do not differ significantly in terms of mean FBC. These groups were not combined because it did not seem logical to do so. State agencies know their vendor population and are in the best position to make decisions regarding whether combining groups makes sense when testing shows that two groups are not statistically different. Complete peer group systems and the Tukey’s pairwise testing results for each State can be found in appendix C.

Exhibit V-5 Peer group 2c for SA1.

Peer group	Description	N
1	All Mass merchandiser, National, 10+ registers	89
2	National, less than 10 registers	198
3	Regional/local, less than 10 registers	84
4	Regional/local, 10+ registers	195
5	Independent Grocer	539
6	Discount/Other/Pharmacy/convenience	234

Exhibit V-6 Peer group 2c Tukey pairwise testing results for SA1.

Dependent variable: Mean Complete FBC

Peer2c comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-1.76	-2.85	-0.67	***
1 v 3	-4.14	-5.44	-2.84	***
1 v 4	-1.98	-3.07	-0.89	***
1 v 5	-7.69	-8.67	-6.72	***
1 v 6	-11.06	-12.13	-10.00	***
2 v 3	-2.38	-3.49	-1.27	***
2 v 4	-0.22	-1.08	0.64	
2 v 5	-5.93	-6.64	-5.22	***
2 v 6	-9.30	-10.13	-8.48	***
3 v 4	2.16	1.05	3.28	***
3 v 5	-3.55	-4.55	-2.55	***
3 v 6	-6.92	-8.01	-5.84	***
4 v 5	-5.71	-6.43	-5.00	***
4 v 6	-9.08	-9.91	-8.26	***
5 v 6	-3.37	-4.04	-2.70	***

B. Results

Three of the alternative peer group systems developed and tested in the study comply with the Final Cost Containment Rule which indicates that State agencies must use at least two criteria, one of which must be geography, to develop vendor peer groups (peer group systems 1a, 1b, and 1c). The remaining three alternative peer group systems that were developed and tested in the study do not comply with the Final Rule because they do not include geography. Two of these three systems also do not include at least two criteria.

Peer Group System 1

As summarized below and in exhibit V-7, the results relative to Peer Group System 1 were mixed:

- For SA1, both PG1a and PG1c comprised a total of six peer groups and had little overlap in mean FBC. When tested using Tukey’s method, both systems had only 1 peer group pair out of 21 with mean FBCs that were not statistically significantly different.
- In SA2, it was not feasible or reasonable to develop peer group systems 1a and 1c because there were not significant differences between urban and non-urban vendors. Although, PG1b was developed for SA2, some of the groups did not include at least 30 vendors, making it a less than optimal system.
- In SA3, PG1b, comprised of number of registers and geography, was identified as the most optimal when compared with results of PG1a and PG1c, since only one peer group pair had similar mean FBCs.
- In SA4, the smallest State in terms of total number of authorized vendors, it was not feasible to develop an effective peer group system that included geography.

Exhibit V-7 Summary of Peer Group System 1 simulation testing.

State: SA1

Peer group system	# of peer groups	# peer group pairs compared	All peer group pairs significantly different (# not different)	All peer groups have 30+ vendors
PG1a	6	15	No (1)	Yes
PG1b	4	6	Yes	Yes
PG1c	6	15	No (1)	Yes

State: SA2

PG1b	3	3	Yes	No
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State: SA3

PG1a	7	21	No (4)	Yes
PG1b	5	10	No (1)	Yes
PG1c	8	28	No (12)	Yes

Peer Group System 2

As summarized below and in exhibit V-8, the results relative to Peer Group System 2 were also mixed. However, overall, Peer Group System 2 demonstrated less overlap in mean FBCs compared to Peer Group System 1:

- For SA1, grouping by either store type (PG2a) or by number of registers (PG2b) resulted in peer groups that had minimal overlap in mean FBC (all peer group pairs were statistically significantly different). Once these characteristics were combined, however, some overlap in mean FBCs did exist among one pair of peer groups.
- In SA2, there were not a sufficient number of vendors to allow for separation by both store type and number of registers; therefore, store type alone was identified as most effective of the three alternative systems, providing the greatest number of peer groups without overlap in mean FBCs.
- Overlap in mean FBCs was significant for one of the three systems in SA3. PG2b, which comprised number of register groupings only and store type combined with number of registers, showed no overlap in mean FBC; however, the combined store type and register grouping was condensed into three categories to ensure no overlap in mean FBCs.
- Again, SA4 authorizes less than 80 vendors statewide and only ten of these are mass merchandisers. However, since mass merchandisers are vastly different in terms of FBC compared to other store types, they were kept separate even though there are fewer than 30 vendors in this group. In fact, because there are so few vendors authorized statewide, none of alternative peer group systems tested in SA4 met the study condition, which requires a minimum of 30 vendors in each group, although PG2b and PG2c both came close.

Exhibit V-8 Summary of Peer Group System 2 simulation testing.

State: SA1

Peer group system	# of peer groups	# peer group pairs compared	All peer group pairs significantly different (# not different)	All peer groups have 30+ vendors
PG2a	4	6	Yes	Yes
PG2b	3	3	Yes	Yes
PG2c	6	15	No (1)	Yes

State: SA2

Peer group system	# of peer groups	# peer group pairs compared	All peer group pairs significantly different (# not different)	All peer groups have 30+ vendors
PG2a	3	3	Yes	Yes
PG2b	2	1	Yes	Yes

State: SA3

PG2a	5	10	No (3)	Yes
PG2b	3	3	Yes	Yes
PG2c	3	3	Yes	Yes

State: SA4

PG2a	2	1	Yes	No
PG2b	2	1	Yes	No
PG2c	3	3	Yes	No

Overall

While systems with only one criterion may be effective, as described in Chapter II, the most optimal system is one where groups are constructed using as many vendor characteristics as needed to adequately account for differences in the composition of vendors within a group while still maintaining minimum overlap in mean FBC between groups. Overall, several alternative peer grouping systems appear to be effective in most of the States.

- In SA1, a system that combines store type, number of registers, and geography (PG1a) was identified as the optimal system. In this case, geography proved to be an important criterion to include, but was only needed to distinguish between small vendors that had larger variation in mean FBC.
- For SA2, there were not enough authorized vendors nor was there enough diversity in the types of vendors authorized to apply multiple peer grouping criteria; therefore, a system comprised of only one vendor characteristic (store type) appears to be most effective (PG2a).
- In SA3, which has the least variation in FBC statewide compared to the other States, number of registers alone (PG2b) and store type combined with number of registers (PG2c) were identified as the most effective peer grouping systems, although due to little variation in pricing across all vendors throughout the State, several categories were combined to minimize overlap in FBCs between peer groups.
- SA4 includes the fewest number of authorized vendors of the study States; therefore, none of the systems met the criterion of at least 30 vendors in each peer group. Since mass merchandisers are vastly different in terms of FBC compared to other store types, they were kept separate even though there are fewer than 30 vendors in this group. Despite the fact that some peer groups comprised fewer than 30 vendors, a system that incorporates both store type and number of registers seems to be the most optimal in SA4 since it demonstrated no overlap in mean FBCs between groups.

Full simulation results for each State are provided in appendix C. Exhibit V-9 presents mean FBCs for the peer group system that was identified for each State as optimal or most effective among those tested in this phase of the analysis.

Exhibit V-9 Descriptive statistics for select peer group systems identified as being effective in each State

STATE 1

PG1c: Store type, number of registers, geography

#	Peer group description	N	Mean Complete FBC	SD	Min	Max
1	Mass merchandiser	87	25.70	1.08	24.22	30.94
2	Regional/National/Local chain, Independent Grocer, 10+ registers	501	28.12	2.34	22.83	41.25
3	Independent Grocer, less than 10 registers, Urban	392	34.31	3.67	26.01	45.79
4	Independent Grocer, less than 10 registers, non-Urban	125	31.45	2.23	26.92	39.27
5	Discount/Other/Pharmacy/convenience, Urban	201	37.30	3.14	29.25	47.33
6	Discount/Other/Pharmacy/convenience, non-Urban	33	33.95	2.61	30.02	41.04

STATE 2

PG2a. Store type only

1	Mass merchandiser	40	25.31	0.34	24.64	26.20
2	National chain	102	29.55	2.22	25.03	33.92
3	Regional chains and Independent grocers	66	30.65	2.69	22.76	37.62

STATE 3

PG2c: Store type and number of registers

1	Mass merchandiser and Regional/Local chains with 10+ registers	839	24.68	1.67	19.89	31.27
2	National /Independent grocery	663	26.62	2.05	21.91	34.14
3	Other/Convenience and Regional/Local chains with less than 10 registers	495	26.07	2.05	20.53	31.77

STATE 4

PG2c: Store type and number of registers

1	Mass merchandiser	10	25.75	0.44	24.93	26.20
2	Independent/regional/national, less than 5 registers	27	32.98	2.46	29.16	42.03
3	Independent/regional/national, 5+ registers	40	30.77	2.05	27.03	35.59

VI. Limitations

A few limitations should be considered when interpreting the results of the Peer Group Study. First, as described in the methodology chapter (chapter II), only vendor characteristics that were readily available and could be consistently defined across the four study States were examined as potential peer group criteria. Although this was a stipulation imposed by the study, these considerations are also relevant for the practical application of a peer group system. The data and vendor characteristics SAs used to develop peer groups also need to be readily available or easy to develop. Still, it is possible that additional vendor characteristics are available to SAs but were not available for this study or across all SAs included in this study (e.g., square footage). To the extent that there are additional characteristics that help explain cost variation between vendors in a State, the findings from this study will be limited due to their exclusion from the analysis.

Second, since the study used EBT redemption data for analysis, the findings and the guidelines, in particular, are less applicable to paper FIs. Although some of the study methods, such as the tests used to compare mean FBC between peer groups, are relevant for paper FI States, additional consideration would need to be given to partially redeemed FIs before SAs with paper FIs could apply this type of analysis.

Third, the reliance by some SAs on more restrictive MARLs and limiting allowable foods to contain costs has the effect of reducing the variability in a vendor's FBC measure. When testing alternative peer group criteria, the reduced variability resulted in often non-significant differences in the FBC between peer groups.

Finally, although vendor peer groups are the focus of this study and report, they are just one part of a State's overall cost containment strategy. For example, to comply with Program requirements, SAs must establish competitive price criteria for each peer group and use these criteria to assess prices of new vendor applicants and vendors that are applying for continued authorization. SAs must also establish maximum allowable reimbursement levels for WIC foods. In addition to these requirements, SAs may also choose to limit the types of vendors they authorize or impose restrictions on allowable foods as part of their cost containment system. It was outside the scope of the study to evaluate these practices or the extent to which they contribute to containing costs. The use of an effective peer group system is paramount for effective cost containment, along with establishing and applying competitive pricing criteria and appropriate MARLs.

VII. Conclusions and recommendations

During the first phase of the study, peer group systems currently in use in six SAs were evaluated for effectiveness using the conditions described in section II.C, and several shortcomings were identified. Specifically, average FBCs varied widely within some peer groups and many groups had overlapping distributions of average FBC. Additionally, each State had one or more peer groups containing only a small number of vendors (less than 30), making these groups susceptible to price distortions. These results underscored the importance of the second study phase, which employed empirical analysis to develop more optimal systems that could be applicable and adaptable to most SAs. This section includes a summary of key conclusions and recommendations gleaned from this second phase of the study.

A. Conclusions

EBT redemption data provided by four study SAs served as the primary source of data for this analysis. Because a vendor might have higher prices for one food category but lower prices for another relative to its peers, it was important to develop and use the average cost of a basket or variety of WIC foods when comparing vendors and constructing peer groups. One of the many advantages of using EBT redemption data to construct the FBC is that the data naturally reflects food choices participants make when shopping at a particular vendor. An examination of FBC across all vendors in each study State revealed substantial within-State variation (e.g., wide range in average price and large standard deviations) and affirmed the need to group vendors based on one or more characteristics.

Altogether, seven vendor characteristics were explored as potential peer group criteria during the second phase of the study; however, only two emerged as strong and consistent determinants of FBC across the four SAs. These two characteristics, number of registers and business model store type, were used to develop the systems tested in this study phase. Since geography was also a determinant of FBC in the two larger study SAs even after controlling for other factors, and because at least one of the effective peer group systems developed through this study needed to comply with current regulations, it was also included in peer group development and testing.

Six alternative peer group systems comprised of these three vendor characteristics were tested during this study phase. An iterative process was used to tailor these systems in each State. Based on this process, the study team concluded that the number and exact specification of characteristics required to account for differences among vendors, while still maintaining minimum overlap in mean FBC between groups, varied by State. It was not feasible to test one or more of the alternative peer group systems in the two smaller States due to the limited number of vendors each authorizes statewide. Moreover, none of the systems tested in one of these smaller States met all of the conditions of an effective system since each contained at least one peer group with less than 30 vendors. This would likely be the outcome regardless of the criteria used to define peer groups since the State authorizes so few vendors. Still, in three States, two or more of the alternative systems met all of the conditions of an effective peer group system.

Findings from the study clearly indicate that a “one size fits all” approach will not work when it comes to developing an effective peer group system. Instead, effective peer group systems employing the vendor characteristics and methods recommended by this study will necessarily vary by State and might not conform to current peer group requirements. For example, in States with a limited number of vendors or limited diversity among authorized vendors, a peer group system defined by one characteristic, i.e. one peer group criterion, might be most effective. An example of this is with SA2, where the criterion of business model store type was found to be adequate. Moreover, the study found that peer group systems identified as most effective in three of the four study SAs did not include geography as a criterion. Because at least one effective system was developed in three of the SAs using number of registers, business model store type, and geography, it is reasonable to conclude that an effective peer group system defined by these vendor characteristics may be applicable and adaptable to most SAs.

B. Recommendations

As previously noted, the first phase of the Peer Group Study revealed that peer grouping systems currently employed by six SAs fall short of being optimally effective in meeting conditions defined for the study. The reasons for these shortcomings are not clear, but it is possible that these systems were not sufficiently informed by appropriate empirical techniques which may be due to limited resources available to SAs for conducting data analysis. Another reason may be that SAs are not clear on the purpose of or what constitutes an effective peer group system since standards or criteria for “effective” had not been defined prior to this study. The following recommendations may help to address these issues.

Clarify the purpose of vendor peer groups and define “effective” peer group systems

The Interim Guidance on WIC Vendor Cost Containment¹² reviews the principles of constructing and testing peer groups; however, it does not include specific measures of peer group effectiveness. For SAs to periodically test the effectiveness of their peer group systems, a clear definition of what “effective” means is warranted. Specific conditions of an effective peer group system that are consistent with the principles of the FNS cost containment guidance were established and used for this study to assess and compare peer group systems. If FNS agrees that the primary purpose of vendor peer group systems is to 1) ensure WIC SAs pay competitive yet fair prices for supplemental foods and 2) limit the influence individual or a small number of vendors have on average prices, it might consider incorporating these conditions into guidance or further adapting them to meet the needs of the Program.

Encourage SAs to evaluate and update peer group systems using empirical analysis

Addressing the shortcomings of current peer group systems tested during the first phase of this study may not directly translate into lower food costs—especially since peer groups are only one component of each SA’s cost containment system. However, by using empirical analysis to identify more effective peer group systems, SAs will help ensure that the WIC Program pays competitive and fair prices for supplemental foods. Moreover, some of the current peer group systems tested during the first phase of the study appear to be more complex than they need to be. For example, one of the current peer group systems includes more than 70 vendor groups. The second study phase identified alternative effective systems with less than 10 peer groups. This indicates that effective peer group systems developed and tested using empirical analysis could potentially reduce administrative burden and improved program efficiency relative to vendor management.

Consider revising current vendor peer group requirements

Current cost containment rules require that SAs use at least two criteria to define vendor peer groups and that one of these criteria must be geography-based. A key conclusion of this study is that effective peer group systems will vary by State and may not conform to current peer group requirements. The study findings indicate that, in some SAs, the optimal peer group system might comprise a single peer group criterion and might not include geography. FNS already allow SAs to request an exemption from the geography requirement.

¹² USDA Food and Nutrition Service. Interim Guidance on WIC Vendor Cost Containment. Accessed March 14, 2016, at <http://www.fns.usda.gov/sites/default/files/InterimCostContainmentGuidance-June2006.pdf>

Provide SAs with practical guidance on developing an effective peer group system

Many SAs lack the resources to design and conduct the kind of analysis used in this study. A simplified set of guidelines SAs can use to evaluate their peer group system once they have EBT redemption data available, and periodically thereafter, may help them revise their systems to be more effective. Three vendor characteristics—number of registers, business model store type, and geography (based on RUCAs)—were identified as determinants of FBC and effectively used to optimize peer group systems in each study State. Therefore, focusing on these three characteristics is an appropriate starting point, especially for SAs that lack the resources needed for more in-depth analysis or collection of additional vendor characteristics.

Consider standardizing store type definitions for WIC vendors

Consistently defining store type across SAs has many advantages beyond those recognized in this particular study. If employed by all SAs, standardized store type definitions could be useful in ongoing reporting, to compare measures of redemption between SAs, or tracking trends in vendor authorization and pricing over time. The use of a consistent classification system for store type would also facilitate research to examine factors contributing to differences in food costs among WIC SAs. Business model store type was developed in part through this study. It is based on industry standards using mutually exclusive criteria that do not rely on self-reported data and that can be applied consistently across SAs. A database of stores classified as mass merchandisers, national and regional chain grocery stores and pharmacies would be easy to establish and maintain at the national level, making it easier for SAs to determine the store type of their vendors.

Consider conducting an analysis of EBT data to identify recommendations for setting MARLs

As part of a comprehensive cost containment strategy, SAs are required to establish and apply MARLs when they process vendor claims for foods purchased with WIC benefits. SAs that use EBT reportedly establish MARLs for each peer group at the food category or UPC level with varying approaches for calculating the MARL. Some SAs report using a specific percentage over the average redemption amount for the food category or item to calculate the MARL, while others calculate the MARL by applying a standard deviation amount over the average redemption amount or use some other means. To the study team's knowledge, there have been no studies to assess and compare the effectiveness of these approaches nor has guidance been provided to SAs on developing and applying MARLs for food purchased with EBT. Data and simulation methods similar to those used for this Peer Group Study could be used to determine the most effective options for setting MARLs when EBT is used for WIC food delivery.

Appendix A: State Agency Guidelines for Developing an Effective Peer Group System

State Agency Guidelines for Developing an Effective Peer Group System

Findings from the U.S. Department of Agriculture’s (USDA) Food and Nutrition Service’s (FNS) Women, Infants, and Children (WIC) Peer Group Study clearly indicate that a “one size fits all” approach will not work when it comes to developing an effective peer group system for WIC State agencies (SA). Instead, effective peer group systems employing the vendor characteristics and methods recommended by this study will necessarily vary by State and might not conform to current peer group requirements. To be effective, peer group systems must:

- Condition #1. Group stores in terms of characteristics that are known to be correlated with food costs and other business practices and characteristics that ultimately predict vendor prices (or demonstrate a correlation with those costs).
- Condition #2. Minimize both the overlap of mean food prices between peer groups and the influence of individual vendors on mean food prices within a peer group.

In addition to meeting these two conditions, an effective peer groups system must also ensure that the SA can meet its own cost containment objectives, which may give additional consideration to participant access and the costs and benefits related to managing and enforcing cost containment policies. Moreover, while a simple system may be easier to implement, too few peer groups in a larger State could allow for a wide range of variability in cost within each peer group. The most optimal system is one where groups are constructed using as many variables as needed to adequately account for differences in the composition of vendors within a group while still maintaining minimum overlap in food cost between groups.

Many SAs lack the resources to design and conduct the kind of analysis used in this study. A simplified set of guidelines SAs can use to evaluate their peer group system once they have electronic benefit transfer (EBT) redemption data available, and periodically thereafter, may help them revise their systems to be more effective. Three vendor characteristics—number of registers, business model store type, and geography (based on Rural Urban Commuting Areas (RUCAs))—were identified as determinants of average WIC food basket costs (FBC) and effectively used to optimize peer group systems in each study State. Therefore, focusing on these three characteristics is an appropriate starting point, especially for SAs that lack the resources needed for more in-depth analysis or collection of additional vendor characteristics.

This appendix document provides guidelines SAs can use to develop and empirically test peer group systems based on the approach employed in this study. As described in the full study report, the process entails three key steps: development of a FBC measure, development of vendor characteristics to use as peer group criteria, and development and testing of a peer group system using these characteristics.

A. Developing a FBC measure using EBT redemption data

The rationale for creating the FBC is based, in part, on the observation that retail food stores do not typically price foods exactly the same as their competitors. Rather, some item prices may be higher than competitors, while other item prices may be lower. Pricing strategies vary by retailer, in part due to local market conditions. For example, some retailers might use a mix of high prices for some items and relatively low prices for others (a “high-low” pricing strategy), whereas other retailers may promote an “everyday low price” or deep discount price strategy. The FBC method addresses these differences by creating a measure of cost comprised of a representative basket of WIC foods that can be compared between vendors.

When calculated for each vendor using EBT redemption data, the FBC accounts for both the prices charged by the vendor for authorized WIC foods and the frequency with which available products are selected by WIC participants within a vendor.

Two food baskets were developed during this Peer Group Study for analysis and construction of peer grouping systems (see Exhibit 1). While these FBCs differ in the WIC foods included, when used as outcome variables in the study analysis, results and conclusions were similar. Wherever possible, it is recommended that SAs use the complete food basket due to its greater coverage of foods than the child food basket. This section describes the steps SAs would need to follow to develop a FBC measure using their EBT redemption data.

Exhibit 1: Food categories and quantities comprising food baskets

Food basket	Quantity of Cheese	Quantity of Eggs	Quantity of Cereal	Quantity of Legumes	Quantity of Infant fruits/vegetables	Quantity of Whole grains	Quantity of Reduced-fat milk	Quantity of Bottled juice
Complete food basket	16 oz.	dozen	36 oz.	16 oz.	4 oz.	16 oz.	1 gal.	64 oz.
Child food basket		dozen	36 oz.	16 oz.		32 oz.	4 gal.	128 oz.

The complete food baskets included an average per unit price for peanut butter, dry beans, and canned beans. The child food basket included peanut butter only.

1. Identify the redemption data to be analyzed.

To develop a FBC measure similar to the one developed for the Peer Group Study, the following information is required for each item redeemed: claimed price, settled price, food category, food subcategory (if applicable), number of units purchased, and vendor submitting the claim (e.g., vendor ID). It is important to use *claimed amount* (amount requested by the vendor) when constructing the FBC since it represents the vendor’s “shelf price”. The *paid amount* (amount the SA paid to the vendor) would reflect reductions made by the SA if the vendor’s claimed amount exceeded the MARL.

When constructing a data file for peer group analysis, SAs should include the most recent three months of redemption data. However, SAs also need to consider whether most authorized vendors will have at least 30 redemptions per food category and sub-category¹³ during this time period as this is essential to ensuring representativeness and integrity of redemption data. Using fewer than 30 redemptions for a food item can lead to an average cost that is not sufficiently representative of a vendor’s prices and is influenced by extreme high and low prices. Moreover, the reliability of subsequent statistical tests assumes a normal distribution of observations. When a vendor’s FBC is based on fewer than 30 redemptions per food category or sub-category, the assumption of a normal distribution of observations may not be valid. The Peer Group Study used three months of redemption data for three of the study SAs but four months of data for one of the SAs because many vendors would have been excluded from the analysis if only three months were used.

To determine whether three or four months of data is needed to ensure most vendors meet the minimum number of observations requirement, SAs can determine the total number of items redeemed within each food category and subcategory by each vendor during a one month period and extrapolate this information to determine how many months of redemption data will be needed to ensure most vendors meet the minimum value of 30 observations (items purchased in each category). For example, the one

¹³ Generally, sub-categories are used when there are substantial differences in the product or package size (and ultimately the cost per unit) within a food category. Both differences in product type or package size may require the use of one or more sub-categories. Cereal (hot and cold), and milk (gallons, half-gallons, and quarts) are examples of these.

month values can be multiplied by three to estimate how many items within each category vendors will redeem in a three month period. If many vendors will not meet the minimums using three months of data, SAs should consider including four months of redemption data.

It is likely that some vendors will be excluded from the analysis as a result the requirement for a minimum of 30 redemptions per food category, even if the redemption period is extended. However, in total, the redemptions made by excluded vendors will likely account for a small share of total redemptions made by all authorized vendors, thereby limiting the potential for bias or error in peer group testing and analysis.

2. Determine the completeness and accuracy of a vendor's FBC redemptions.

Once the redemption data file is compiled, it is critical to review each vendor's redemptions for completeness and accuracy. One method of reviewing vendor redemptions for potential errors is to compare a vendor's claimed price with the settled amount (amount paid by the SA). The Peer Group Study used a factor of five times the claimed versus settled amount as a maximum valid redemption. Redemptions with claimed prices greater than five times the settled price were excluded from study analysis since it was outside the scope of the study to understand the reason for these extreme values and these redemptions may have resulted in an inaccurate vendor FBC. Since SAs will be more familiar with their data and vendors, they might devise an alternative strategy for handling extreme values. For the exercise of constructing peer groups, however, it may be sufficient to simply exclude extreme values in a manner similar to what was used for this study.

3. Calculate vendor average costs for food categories and subcategories

To construct the FBC measures, the SA will first need to calculate the per unit price for each redeemed item with consideration that the unit (e.g., ounce, pound) will vary by food category. For food categories that contain mixed package sizes, such as milk, the SA should establish per unit prices at the subcategory level (gallons, half-gallons, and quarts of milk, for example). The cereal category includes both cold and hot cereal product forms, where package size also differs greatly. In this case, per unit price should be based on ounce. To determine the price per unit, the total purchase price for each food item should be divided by the number of units purchased. For example, if two gallons of milk are purchased during a transaction and the redemption record indicates that the total price for milk gallons was \$6.00, the price per unit would be \$3.00 per gallon.

Next, average per unit costs for each food category and sub-category need to be computed for each vendor.

- This can be accomplished by summing the price per unit and then dividing by the total number of units redeemed within each food category and sub-category.
 - For example, if there were 55 ounces of cereal redeemed for a total of \$13.62, \$13.62 divided by 55 equals an average cost for cereal of \$0.25 per ounce.
- When multiple sub-categories comprise a food category that is included in the FBC, a weighted average of the sub-categories should be used to establish an average per unit cost for the food category.
 - For example, a category weighted average price for cereals would require combining the average per unit costs for the two sub-categories (cold and hot cereal). To create a weighted average price for cereal, SAs would need to determine the percentage of cereal that is redeemed in each sub-category, apply these percentages to the per unit prices for cold and hot cereal, and then sum the weighted per unit prices. This step will result in the

creation of a dataset with only one record per vendor which includes the average per unit costs for each food category.

- If cold cereal represents 85 percent of redemptions at a per unit cost of \$0.25 and hot cereal represents 15 percent of redemptions at a per unit cost of \$0.20, the overall average per unit cost for cereal will be $(0.85 \times 0.25) + (0.15 \times 0.20) = \0.24 .

4. Calculate the standardized cost of a food basket

Once the average per unit cost for each FBC category has been computed, the total cost for a standard issued quantity of the food can be also be determined. For example, the complete FBC measure specifies 36 ounces of cereal which is the quantity issued in food packages for women and children. To determine a vendor's average cost for 36 ounces of cereal, its average per-ounce price for cereal is multiplied by 36 ounces. This step is completed for each food category comprising the FBC and the resulting values are summed to calculate a vendor's average FBC.

Developing a FBC measure for paper food instrument (FI) SAs

SAs with paper FIs may also calculate a representative FBC, however, some modifications are needed:

1. The SA should select one or more FI types that account for a significant share of total redemptions. When developing an FI-based FBC, the SA applies the rule of 30 or more FIs for each FI type, by vendor, resulting in some vendors being excluded from the analysis. The SA should also review the *submitted* or *claimed* FI redemption amounts for outliers, such as values exceeding 4.0 SD above the vendor mean for each FI.¹ The SA should also exclude from the redemption data those FIs that are less than fully redeemed. Not doing so would result in lower food costs for an FI compared to those that are fully redeemed. SAs can use the following steps to identify FIs that were most likely partially redeemed:
 - a. Standardize each vendor's shelf prices by calculating a per unit (ounces, pounds, gallons) value for each shelf price and convert the calculated per unit prices into standard package sizes, such as 36 ounces of cereal.
 - b. To estimate the value of a fully redeemed FI, the SA would then sum the values of each standardized item contained in the FI type. When multiple shelf prices are collected for the same food category, the SA should use the lowest per unit priced item within a category for estimating the value of a fully redeemed FI. Doing so will ensure that the value of any fully redeemed FI will be equal to or greater than the calculated FI type value. The resulting dataset will have one record per vendor per FI type.
 - c. For each vendor, the redeemed values of the selected FI types should be compared to the value(s) calculated in Step 1b which, again, represent the lowest possible cost of the FI type if it was fully redeemed. FIs with lower redemption amounts should be flagged as likely partial redemptions. Vendors who did not report all shelf price data should also be excluded from the analysis, since it is not possible to calculate likely partial redemptions for these vendors.
2. Finally, for all FIs comprising the FBC (if more than one FI type is used), the average value of each FI type is then summed to obtain a vendor's average FBC.

It is important to note that although shelf prices may be used to determine which FIs were fully redeemed, redeemed FI values should be used when developing the FBC measure. Once the FI-based FBC measure is developed, SAs with paper FIs can follow the remaining analytic steps as described in these guidelines.

B. Development of vendor characteristics to use as peer group criterion

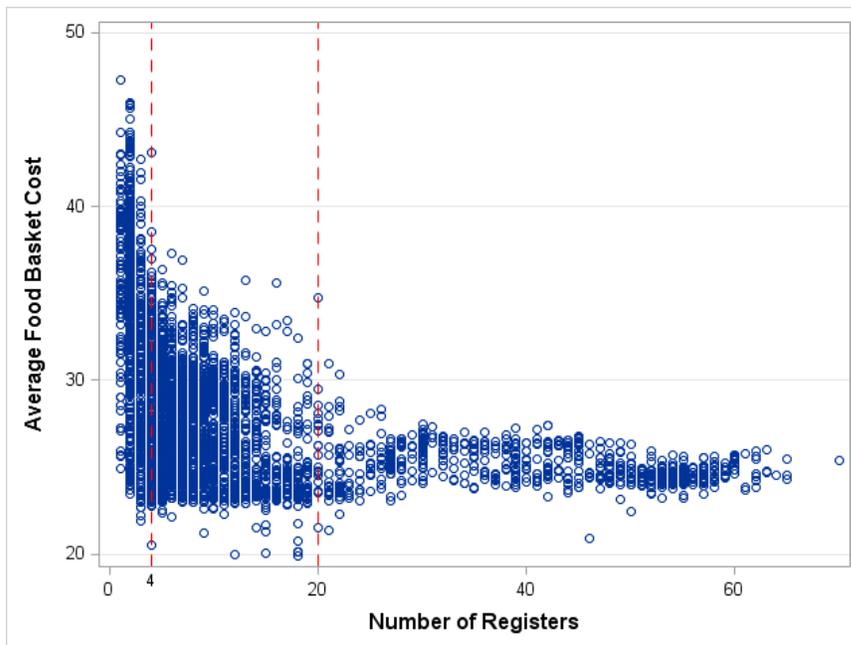
Two vendor characteristics tested during this phase of the study were identified as consistent determinants of FBC in each of the four study SAs: business model store type and number of registers. A third criterion, geography (defined at the Census-tract level using RUCAs), was a determinant in two of the four study SAs. Because SAs are required to use geography as a peer group criterion under current regulations, it is recommended for use in developing and testing peer group systems (described in the Section C). SAs interested in revising their current peer group system could simplify the peer group development process by focusing on these three vendor characteristics. This section provides guidelines SAs can follow to develop these characteristics in their State.

Number of registers

Many SAs already collect information on the number of registers present in an authorized vendor through their vendor applications. Before using number of registers as a peer group criterion, however, SAs should confirm that number of registers has been clearly defined thus consistently collected from all vendors. SAs may need to clarify which devices vendors should include in this count. For example, SAs may want to clarify that all cash registers, including those at the pharmacy, customer service, and self-checkout area should be counted.

Next, SAs will need to group vendors based on number of registers. Although the number of register groupings were fairly consistent across SAs included in the Peer Group Study, these may vary by State due to differences in vendor populations. To examine the relationship of registers to prices and determine appropriate cut points for the number of registers (which values for number of registers will be grouped together), it may be helpful to create a scatter plot of number of registers by mean FBC. By examining the scatter plot, SAs may be able to identify distinct changes in mean FBC or variability about the mean as was done in the Peer Group Study as depicted by the dotted red lines in the scatter plot in exhibit 2.

Exhibit 2. Relationship between FBC and number of registers, all Study SAs.



Next, ANOVA and Tukey's pairwise test can be used to determine whether mean FBC is statistically significantly different between the register groups. It may be necessary to test several different register groups to identify the optimal cut points. SAs with limited capacity to perform statistical analysis can instead compare 95% confidence intervals around the mean for each register group to determine whether the intervals overlap. No overlap between confidence intervals indicates that the groups are significantly different. The following equation can be used to approximate a 95% confidence interval for FBC means.

$$95\% \text{ Confidence Interval} = \text{Group average} \pm 1.96 \left(\frac{SD}{\sqrt{n}} \right)$$

Where:

- *SD=Standard deviation of the group*
- *n= number of vendors in the group*
- *1.96 is the constant value to be used for 95% confidence.*

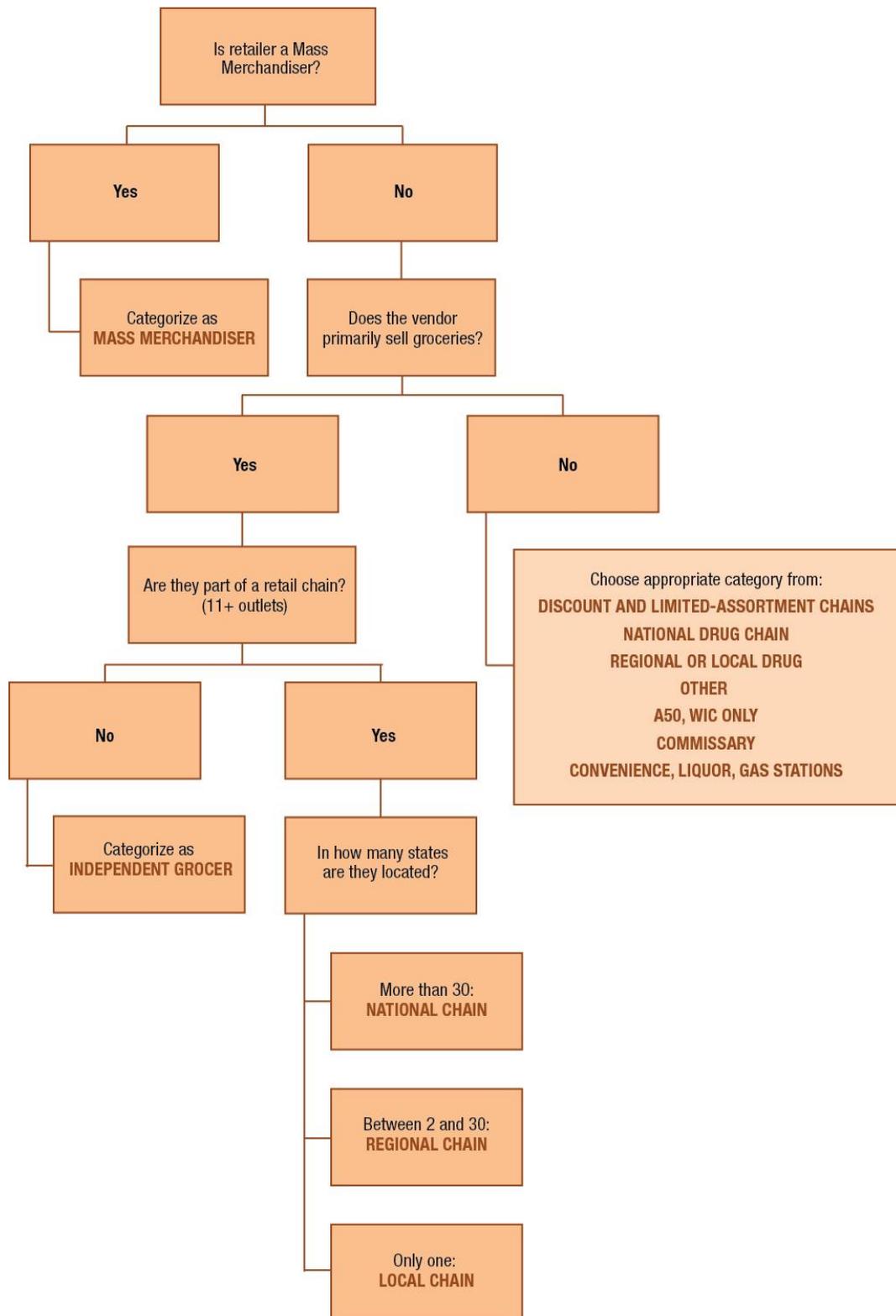
Note: Findings based on using this formula will be more conservative because the difference in means between groups can be statistically significant even if the confidence intervals do overlap slightly, which is why ANOVA and Tukey's test is the preferred method.

Business model store type

Store type based on business model can be applied consistently across States and takes into consideration a vendor's ownership status (e.g., the number of outlets operated by the same owner, including all banners under the parent company and the number of States in which these outlets are operated). Although classifying vendors will require some up front work, the store type to which a vendor is assigned should remain fairly constant over time. To begin classifying vendors, SAs will need to obtain information about each vendor's parent company, if applicable, the number of outlets operating under the same owner or parent company, and in the number of State in which the owner or parent company has outlets. These data points can be obtained through a subscription to the Progressive Grocer Marketing Guidebook¹⁴ or potentially added to SA vendor application forms. SAs can then use the flow chart in exhibit 3 to classify vendors into store types.

¹⁴ <http://directory.marketingguidebook.com/search.html>

Exhibit 3. Flowchart for assigning vendors to store type based on business model classifications



SAs will first need to determine whether the vendor is a mass merchandiser (Walmart, Target, Super K-Mart). If the vendor is a retail outlet that primarily sells groceries but is not identified as a mass merchandiser, the SA can use the Progressive Grocer’s Marketing Guidebook or similar reference to determine whether the vendor’s parent company owns and operates 11 or more outlets and thus qualifies as a chain.¹⁵ If a vendor does not qualify as a chain, it would be considered an independent grocer. For vendors that qualify as a chain, the number of States in which they operate will be used to further classify them as national, regional, or local:

- Local grocery chains operate in only one State;
- Regional grocery chains operate in at least two States; and
- National grocery chains operate in 30 or more States.

Vendors that do not fall into any of the previously mentioned classifications (mass merchandiser, national, regional, or local grocery chain, or independent grocer) need to be classified into one of the following groups using exhibit 4 as a guide: national drug chain; regional or local drug; discount and limited-assortment chains; above-50-percent or WIC only; commissary; convenience, liquor, gas stations, or other (if a vendor does not fit into any of these classifications).

Exhibit 4. Store type based on business model classifications

CATEGORY	STORE NAMES / CRITERIA FOR CATEGORIZING STORES
Mass Merchandiser*	Retailer that sells a wide variety of merchandise but also carries groceries and has outlets in most or all States
Discount and Limited-Assortment Chains†	Retailer that primarily sells a limited variety of low-cost merchandise but also carries a limited variety of food items
National Grocery Chain	Retailer that primarily sells groceries with outlets in most or all States (>30)
National Drug Chain‡	Pharmacy retailer that sells a limited variety of food items with outlets in most or all States (>30)
Regional Grocery Chain	Retailer that primarily sells groceries with at least 11 outlets and operates in 2 or more States
Local Grocery Chain	Retailer that primarily sells groceries with at least 11 outlets and operates in only one State
Independent Grocery	Retailer that primarily sells groceries with less than 11 outlets
Regional or Local Drug	Pharmacy retailer that sells a limited variety of food and is not a national drug chain
Other	Island stores, remote location stores, tribal-owned stores, general stores, specialty markets (meat, kosher, deli)
A50, WIC Only	Store that derives more than 50 percent of its total annual food sales revenue from WIC food instruments
Commissary	Grocery store operated by the U.S. Defense Commissary Agency within the confines of a military installation; it can fit within any of the grocery formats
Convenience, liquor, gas stations	Retailer with a limited assortment of grocery items

* As of January 2016, only Target, K-Mart, and Wal-Mart stores were included in this category. †As of January 2016, only Dollar General and Dollar Tree stores were included in this category. ‡ As of January 2016, only CVS, Walgreens, Kroger Drug, and Rite Aid stores were included in this category.

¹⁵ Alternatively, SAs could collect the information needed to classify vendors into a store type category by adding specific questions or fields to their vendor application (e.g., vendor name, name of parent company, number of States in which the parent company operates, number of outlets operated by the parent company).

Geography defined at the Census-tract level

While most SAs currently use a geography criterion, there is substantial variation in the way geography is defined and applied. For example, some SAs use city or regional designations, while others define rural and urban areas at the county level or identify specific economic areas (e.g., remote areas with higher costs) that are relevant in their State. The Peer Group Study found that RUCA-based urban and rural areas were associated with vendor FBC among SAs that were large in terms of geographic area, total population, WIC participation, and total number of authorized vendors. In one of these States, urban areas had statistically significant different mean FBC compared to all other areas and in the other State, urban areas were different than small rural and isolated areas, but not large rural areas. The study found that the direction of the association was different between these States (i.e., in one State, urban vendors had higher costs than the other areas) while in the other State the urban vendor costs were lowest. In addition to being associated with FBC in some study States, using RUCA as a potential geographical criterion has the advantage of being easy to determine since it is based on the ZIP code of the vendor location, can be applied consistently across SAs for testing, and identifies urban, large rural, small rural, and isolated areas at the Census-tract level.

To develop a RUCA census-tract based geography criterion similar to the one tested in this study, SAs will need to do the following:

- Go to the USDA-ERS web site for the Rural-Urban Commuting Area (RUCA) overview and documentation at: <http://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes.aspx>
- At the web page, select the link to Center for Rural Health for additional documentation and to download RUCA codes by ZIP code.
- Determine the RUCA code for each authorized vendor's ZIP code. (Note: this can be accomplished by merging the file of RUCA codes with a datafile of authorized vendors by ZIP code.)
- The RUCA codes include 10 overall classifications and multiple subclassifications within each based on commuting distance. For vendor peer grouping purposes, a four-category level geographic characteristic may be most useful and can be developed by collapsing the various classifications as follows: urban (categories 1-3), large rural (categories 4-6), small rural (categories 7-9), and isolated (category 10)¹⁶.

To the extent that number of registers and business model store type can sufficiently limit FBC variation within peer groups and overlap in mean FBC between peer groups, the use of a RUCA geographic criterion may not contribute to the effectiveness of the peer group system. This is likely to be the case in States with smaller WIC and vendor populations. Methods that can be used to assess the need or use of multiple peer group criteria, including geography, are described in the next section. If an SA determines through this type of analysis that including geography as a peer group criterion does not add value to the system, it can request an exemption from the geography requirement.

¹⁶ For the purposes of this study, urban includes urbanized area cores with 50,000 or greater population; large rural includes large rural cities/towns with populations from 10,000-49,999; small rural includes small towns with populations from 2,500 through 9,999; and isolated rural includes rural areas with populations less than 2500. It should be noted that there are multiple ways to collapse RUCA codes into geographic categories. More examples can be found at <http://depts.washington.edu/uwruca/ruca-uses.php>

C. Constructing and testing a peer group system

Once the vendor characteristics have been developed, SAs will need to construct and test one or more peer group systems comprised of these characteristics. Similar to the Peer Group Study, SAs will need to use an iterative process—that is, establish peer groups based on results of initial statistical tests but then refine groups (e.g., collapse groups that are not significantly different on average FBC) to ensure the resulting peer group system is effective for its own use. The first step in this process is to further examine the characteristics that will be used for peer group construction.

1. Constructing peer group systems

Initially SAs should consider both systems that comply with current cost containment rules and systems that do not because they exclude geography. Although geography is currently required as a peer group criterion, SAs can request an exemption from this requirement. To do so, SAs must be able to demonstrate that use of a geography criterion does not account for significant differences in vendor food costs.

To begin the process of peer group construction, SAs should first examine a peer group system comprised only of store type based on business model classifications (model PG2a from the Peer Group Study). This model serves as the starting point for testing peer groups that consist of store type in combination with other criteria. Once authorized vendor have been assigned to one of the 10 vendor store types following the guidelines presented in section B, SAs should test all possible store type pairs for significant FBC differences using the t-test. When t-tests reveal that store type pairs are not significantly different on mean FBC, the vendors in those store type classes should be combined. The resulting store types are then used for all other models that include the store type criteria in combination with other criteria¹⁷. For example, when added as a criterion, geography would result in the identified store type classes being subdivided into urban and rural classes¹⁸.

An overriding principle of the analysis requires that each peer group contain 30 or more vendors to ensure validity of the statistical tests and to limit the influence of one or more FBC outliers (extreme values) that could unduly influence the peer group average.¹⁹ This additional requirement necessarily influences both the number and types of classes that can be specified for each criterion. For example, when assigning vendors to store type classes, the SA may find that some classes have no vendors, while other classes have fewer than 30 vendors.

¹⁷ Not all models include store type as a criterion. For such models, a similar procedure is needed to test the criterion for significant differences among all possible peer group pairs.

¹⁸ As many as four RUCA classes may be used; however, in the study SAs, only two classes (rural and urban) were found to have a meaningful effect on the FBC.

¹⁹ A peer group comprised of close to 30 vendors may be sufficient if the average FBC of vendors in the group approximates a normal distribution. If it does not, or an SA cannot conform to this important recommendation, the SA should use other means to closely monitor the prices in peer groups comprised of less than 30 vendors.

While store type classes with no vendors would not be included in testing, store type classes that have fewer than 30 vendors should be combined with related classes or classes that are similar in terms of mean FBC. For example, where both mass merchandisers and discount and limited-assortment stores have fewer than 30 vendors, by combining the classes into a single peer group, the minimum number of vendors may be reached. Judgement and empirical data are needed when combining store types. Although the two classes may be expected to have similar pricing, a comparison of the vendor FBCs should be used to validate this hypothesis. It would not be appropriate to combine two store type classes that are not similar in terms of FBC as some of these vendors may have legitimately higher operating costs, and thus will be unfairly restricted by maximum allowable reimbursement levels that are based on a group-wide average.

The minimum number of vendor's condition also extends to multiple-criteria models. When store type classes are combined with geography, for example, the resulting classes, such as urban and rural local grocery chains, may contain less than 30 vendors each. As a result, the geography criteria should not be applied in combination with local chain vendors. For store type classes that meet the minimum number of vendors when further subdivided by urban and rural geography, it is recommended that mean FBCs for those store types be first compared. The use of t-tests (for pairs) or ANOVA (for three or more criteria) should be used to determine if geographic differences in FBCs for those store types are significantly different. If not, it would not be advisable to apply a geography criterion to those store types.

This iterative process of combining criteria for peer group testing results in models that are tailored to each SA and take into account the unique composition of a State's authorized vendors, as well as geographic and other criteria, to the extent they influence FBC. Although a SA may identify several possible criteria for testing, the iterative process may result in some criteria classes being excluded, either due to fewer than 30 vendors, or lack of significant differences in the FBC when comparing criteria classes. The resulting models represent those most likely to be superior when tested for effectiveness as a peer grouping system.

In developing peer grouping systems that are potentially more optimal than those currently in use and proposing new vendor characteristics to include, feasibility of SA implementation including the SA's ability to update or add new characteristics to its vendor database is an important consideration.

2. Testing peer group systems for effectiveness

The most effective peer grouping system is one that is constructed using as many variables as needed to adequately account for differences in the composition of vendors within a group while still minimizing overlap in food cost between groups. The Peer Group Study examined a number of statistical methods that could be used to determine effectiveness of peer group systems. After reviewing alternative statistical methods, the Peer Group Study concluded that ANOVA with Tukey's post hoc pairwise tests of significance is the preferred method for measuring and comparing the effectiveness of peer group system models²⁰.

Once the ANOVA and Tukey's post hoc pairwise tests have been completed for each constructed peer group model, results should be reviewed to determine the effectiveness of each model and compared to identify the optimal model. Exhibit 5 summarizes the results of pairwise tests conducted for SA1 during the Peer Group Study. This example reveals that the peer group models vary in terms of the total number of peer groups specified and the number of peer group pairs whose mean FBCs are significantly different.

²⁰ To perform the analysis, the SAS Proc GLM was used, specifying one-way, single factor analysis with unbalanced groups. From these results, the Tukey procedure was used to conduct post hoc pairwise significance tests of peer group means.

The results also reveal that some peer groups have fewer than 30 vendors. A similar table should be constructed from the results of system testing performed by a SA. In general, any model meeting the previously specified conditions (at least 30 vendors in each group and all peer group pairs are statistically significantly different on mean FBC) can be considered effective. For example, among PG1 models, which include geography, only PG1b (number of registers and geography) had all possible pairs of peer groups significantly different from each other, and all groups have at least 30 vendors. Both PG1a and PG1c had some peer group pairs that, when tested, were not significantly different in their mean FBC. Vendors in these peer groups may need to be combined with vendors in other peer groups, and after re-assigning, the resulting peer groups should maintain their statistical significance. Whether or not to pursue these additional steps is a decision for the SA.

Exhibit 5. Summary of peer group model testing in SA1

Peer group system	Criteria	# of peer groups	# peer group pairs compared	All peer group pairs significantly different (# not different)	All peer groups have 30+ vendors
PG1a	Store type, geography	6	15	No (1)	Yes
PG1b	Registers, geography	4	6	Yes	Yes
PG1c	Store type, registers, geography	6	15	No (1)	Yes
PG2a	Store type	4	6	Yes	Yes
PG2b	Registers	3	3	Yes	Yes
PG2c	Store type, registers	6	15	No (1)	Yes

Among PG2 models tested in SA1, PG2a (store type only) and PG2b (number of registers only) had peer group pairs that were all significantly different from each other and all groups had at least 30 vendors; thus, both models meet the conditions of an effective peer group system. PG2c (number of registers and store type) had one peer group pair that was not significantly different on mean FBC.

As previously described, where possible, it is desirable to define peer groups by more than one criterion, all else being equal. The use of multiple criteria to define peer groups draws the greatest distinctions between vendors that differ in mean FBC. In the example of SA1, PG1b is considered most effective since it not only meets the conditions of an effective peer group system but it also includes two peer group criteria, unlike PG2a and PG2b which are comprised of only one criterion each.

One additional consideration when comparing peer group model results is the extent of overlap in mean FBC between peer groups. For each effective peer group model, the extent of separation between peer group FBCs can be assessed by first adding and subtracting the standard deviation from the mean for each peer group (+/-1 SD of the FBC mean). The resulting range of mean values for each peer group can then be used to assess the extent of separation or overlap in mean FBC between peer groups (see exhibit 6). Minimum and maximum values can also be compared between peer groups, although at those extremes, some overlap is expected. A peer group system is considered *optimal* if it is both effective and has the least extent of overlap within +/-1 standard deviation (SD) of the mean FBC of each peer group in the model, compared with other effective models.

Exhibit 6. Descriptive statistics for assessing peer group overlap, SA1, model PG2c

#	Peer group description	Number of vendors 30 or more?	Mean Complete FBC	SD	Min	Max	Peer group overlap
1	All Mass Merchandisers and Regional and National chains with 10+ registers	Yes	26.19	0.98	24.22	30.94	n/a
2	Regional and National chains with <10 registers	Yes	27.76	2.66	22.83	40.98	2.07
3	All Local chains and Independent grocers with 10+ registers	Yes	29.69	1.78	24.89	41.25	2.51
4	Independent Grocers with <10 registers	Yes	33.55	3.63	26.01	45.79	1.55
5	Discount stores, Pharmacies, Convenience and Other/Specialty stores	Yes	35.81	4.27	23.87	47.33	5.64

Although SA1 of the four study States was used as an example throughout the guidelines, other SAs are likely to differ somewhat from this SA due to a number of factors. Number and type of authorized vendors, urban versus rural population and geography, and number of register classes are important characteristics of a State that should be taken into account when developing peer group criteria. SAs that have fewer and less diverse vendors, or that have a larger rural geography compared to SA1 may be limited or vary in their application of the described methods. These factors influence peer group construction and testing; thus the choice of models tested in each State must be tailored with consideration of these unique features to ensure the effectiveness of the resulting peer group system.

Appendix B: Regression Model Results

Regression Models Examining Significant Factors Related to Food Basket Cost

Table A-1. Regression results for SA1, Complete FBC

DEPENDENT VARIABLE: Mean Complete FBC	Results		
Independent Variables	<i>Parameter Estimate</i>	SE	p
RUCA			
Urban	REF	.	.
Large Rural	-1.2697	0.2328	<.0001
Small Rural	-1.4136	0.2910	<.0001
Isolated	-2.1543	0.2609	<.0001
Store Type			
Mass merchandiser	REF	.	.
Discount and limited-assortment chains	1.1998	1.5310	0.4334
National grocery	-2.2187	0.4518	<.0001
Regional grocery chain	0.2531	0.3658	0.4891
Local chains	-0.9420	0.6747	0.1629
Independent grocers	1.9102	0.4298	<.0001
Independent pharmacy	0.8553	1.3379	0.5228
Other, Specialty stores	2.4401	0.6214	<.0001
Convenience, liquor, gas stations	3.6793	0.4758	<.0001
Unknown	1.4456	0.5084	0.0045
Number of registers, continuous	-0.0288	0.0131	0.0285
Number of registers, categorical			
1-3	6.5837	0.5334	<.0001
4-19	2.7607	0.4635	<.0001
20+	REF	.	.
R-square: 0.7184			
F value: 235.5, p<0.0001			

Significant factors at the 0.05 confidence level or less are highlighted in bold.

Table A-2. Regression results for SA1, Child FBC

DEPENDENT VARIABLE: Mean Child FBC	Results		
Independent Variables	Parameter Estimate	SE	p
RUCA			
Urban	REF		
Large Rural	-0.5056	0.2823	0.0735
Small Rural	-0.7696	0.3462	0.0264
Isolated	-1.8803	0.3042	<.0001
Store Type			
Mass merchandiser	REF		
Discount and limited-assortment chains	-0.6504	1.8952	0.7315
National grocery	-4.8629	0.5580	<.0001
Regional grocery chain	-1.2193	0.4528	0.0072
Local chains	-3.0481	0.8345	0.0003
Independent grocers	1.7434	0.5305	0.0010
Independent pharmacy	2.3493	1.6562	0.1563
Other, Specialty stores	2.3974	0.7681	0.0018
Convenience, liquor, gas stations	3.5773	0.5838	<.0001
Unknown	0.4479	0.6244	0.4733
Number of registers, continuous	-0.0441	0.0162	0.0067
Number of registers, categorical			
1-3	8.5169	0.6591	<.0001
4-19	3.2801	0.5731	<.0001
20+	REF		
R-square: 0.7520			
F value: 289.2, p<0.0001			

Significant factors at the 0.05 confidence level or less are highlighted in bold.

Table A-3. Regression results for SA2, Complete FBC

DEPENDENT VARIABLE: Mean Complete FBC	Results		
Independent Variables	Parameter Estimate	SE	p
RUCA			
Urban	REF		
Large Rural	0.4010	0.4681	0.3926
Small Rural	-0.1926	0.8786	0.8267
Isolated	1.0139	1.4310	0.4794
Store Type			
Mass merchandiser	REF		
National grocery	-3.7783	1.4254	0.0087
Regional grocery chain	-1.4765	1.2156	0.2259
Independent grocers	-2.8708	1.4570	0.0501
Unknown	-7.5740	1.7157	<.0001
Number of registers, continuous	-0.4255	0.0730	<.0001
Number of registers, categorical			
1-3	-0.5201	0.8788	0.5546
4-19	0.0000		
20+	REF		
R-square: 0.5486			
F value: 27.8, p<0.0001			

Significant factors at the 0.05 confidence level or less are highlighted in bold.

Table A-4. Regression results for SA2, Child FBC

DEPENDENT VARIABLE: Mean Child FBC	Results		
Independent Variables	Parameter Estimate	SE	p
RUCA			
Urban	REF		
Large Rural	-0.0130	0.5910	0.9825
Small Rural	-1.9825	1.1321	0.0814
Isolated	0.0799	1.8438	0.9655
Store Type			
Mass merchandiser	REF	.	.
National grocery	-7.2521	1.8341	0.0001
Regional grocery chain	-2.1355	1.5662	0.1742
Independent grocers	-4.0099	1.8749	0.0336
Unknown	-10.5810	2.2084	<.0001
Number of registers, continuous	-0.6230	0.0939	<.0001
Number of registers, categorical			
1-3	-0.8689	1.1317	0.4435
4-19	0.0000	.	.
20+	REF		
R-square: 0.5892			
F value: 33.0, p<0.0001			

Significant factors at the 0.05 confidence level or less are highlighted in bold.

Table A-5. Regression results for SA3, Complete FBC

DEPENDENT VARIABLE: Mean Complete FBC	Results		
Independent Variables	Parameter Estimate	SE	p
RUCA			
Urban	REF		
Large Rural	0.2255	0.1455	0.1213
Small Rural	0.8323	0.1653	<.0001
Isolated	1.6444	0.2406	<.0001
Store Type			
Mass merchandiser	REF		
National grocery	1.3165	0.2094	<.0001
Regional grocery chain	-0.1689	0.1997	0.3977
Local chains	0.2419	0.2418	0.3173
Independent grocers	0.6038	0.2375	0.0111
Other, Specialty stores	0.0143	0.7519	0.9848
Convenience, liquor, gas stations	-1.3711	0.4018	0.0007
Unknown	1.3225	0.7991	0.0981
Number of registers, continuous	-0.0254	0.0069	0.0002
Number of registers, categorical			
1-3	0.7255	0.3051	0.0175
4-19	-0.1391	0.2313	0.5476
20+	REF		
R-square: 0.1829			
F value: 34.6, p<0.0001			

Significant factors at the 0.05 confidence level or less are highlighted in bold.

Table A-6. Regression results for SA3, Child FBC

DEPENDENT VARIABLE: Mean Child FBC	Results		
Independent Variables	Parameter Estimate	SE	p
RUCA			
Urban	REF		
Large Rural	0.6807	0.2461	0.0057
Small Rural	1.9913	0.2812	<.0001
Isolated	3.2387	0.4034	<.0001
Store Type			
Mass merchandiser	REF		
National grocery	1.3689	0.3578	0.0001
Regional grocery chain	-0.8977	0.3403	0.0084
Local chains	0.4042	0.4114	0.3261
Independent grocers	1.3836	0.4045	0.0006
Other, Specialty stores	0.2731	1.2786	0.8309
Convenience, liquor, gas stations	-0.6960	0.7167	0.3316
Unknown	2.2009	1.2645	0.0819
Number of registers, continuous	-0.0677	0.0118	<.0001
Number of registers, categorical			
1-3	1.1204	0.5215	0.0318
4-19	-0.8254	0.3964	0.0375
20+	REF		
R-square: 0.2306			
F value: 46.1, p<0.0001			

Significant factors at the 0.05 confidence level or less are highlighted in bold.

Table A-7. Regression results for SA4, Complete FBC

DEPENDENT VARIABLE: Mean Complete FBC	Results		
Independent Variables	<i>Parameter Estimate</i>	<i>SE</i>	<i>p</i>
RUCA			
Urban	REF	.	.
Large Rural	-0.6561	0.7775	0.4017
Small Rural	0.1249	0.9560	0.8964
Isolated	-0.1014	1.0124	0.9205
Store Type			
Mass merchandiser	REF	.	.
National grocery	6.501	1.3167	<.0001
Independent grocers	7.002	1.5600	<.0001
Number of registers, continuous	0.0241	0.0643	0.7088
Number of registers, categorical			
1-3	0.9162	1.7221	0.5964
4-19	-1.3706	1.4124	0.3353
20+	REF		
R-square: 0.5393			
F value: 9.95, p<0.0001			

Significant factors at the 0.05 confidence level or less are highlighted in bold.

Table A-8. Regression results for SA4, Child FBC

DEPENDENT VARIABLE: Mean Child FBC	Results		
Independent Variables	Parameter Estimate	SE	p
RUCA			
Urban	REF		
Large Rural	-0.5597	0.9828	0.5709
Small Rural	0.4496	1.1577	0.6989
Isolated	-1.0395	1.2602	0.4123
Store Type			
Mass merchandiser	REF	.	.
National grocery	7.6243	1.6523	<.0001
Independent grocers	8.3576	1.9720	<.0001
Unknown	-2.4578	3.4736	0.4816
Number of registers, continuous	-0.0249	0.0807	0.7587
Number of registers, categorical			
1-3	2.7533	2.1690	0.2086
4-19	-2.2701	1.7848	0.2077
20+	REF		
R-square: 0.6143			
F value: 12.2, p<0.0001			

Significant factors at the 0.05 confidence level or less are highlighted in bold.

Appendix C: Peer Group Simulation Testing Results

Peer Group Simulation Testing Results

PG1a: Store type and Geography

Table C-1. Description of PG1a in SA1

Peer group	Description	N
1	Mass merchandiser	87
2	Regional/National/Local chains	479
3	Independent grocers, Urban	403
4	Independent grocers, non-Urban	136
5	Discount/Other/Pharmacy/convenience, Urban	201
6	Discount/Other/Pharmacy/convenience, non-Urban	33

Table C-2. Results of Tukey's pairwise comparisons for PG1a in SA1

Dependent variable: *Average Complete FBC*

PG1a comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-2.34	-3.30	-1.38	***
1 v 3	-8.48	-9.45	-7.51	***
1 v 4	-5.62	-6.75	-4.49	***
1 v 5	-11.60	-12.66	-10.54	***
1 v 6	-8.25	-9.93	-6.56	***
2 v 3	-6.14	-6.70	-5.58	***
2 v 4	-3.29	-4.09	-2.49	***
2 v 5	-9.26	-9.96	-8.57	***
2 v 6	-5.91	-7.39	-4.43	***
3 v 4	2.86	2.04	3.67	***
3 v 5	-3.12	-3.83	-2.41	***
3 v 6	0.23	-1.26	1.72	
4 v 5	-5.98	-6.89	-5.06	***
4 v 6	-2.63	-4.22	-1.03	***
5 v 6	3.35	1.81	4.90	***

Table C-3. Description of PG1a in SA2

Peer group	Description	N
1	Mass merchandiser	40
2	National chain	102
3	Regional chain/ Independent grocers	66

Table C-4. Results of Tukey's pairwise comparisons for PG1a in SA2

Dependent variable: *Average Complete FBC*

PG1a comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-4.24	-5.20	-3.28	***
1 v 3	-5.35	-6.38	-4.32	***
2 v 3	-1.10	-1.92	-0.29	***

Table C-5. Description of PG1a in SA3

Peer group	Description	N
1	Mass merchandiser	467
2	National grocery	401
3	Regional/local chain, Urban	604
4	Regional/local chain, non-Urban	224
5	Independent grocers, Urban	190
6	Independent grocers, non-Urban	72
7	Other/Convenience	39

Table C-6. Results of Tukey's pairwise comparisons for PG1a in SA3

Dependent variable: *Average Complete FBC*

PG1a comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-1.97	-2.36	-1.58	***
1 v 3	-0.48	-0.83	-0.13	***
1 v 4	-1.64	-2.10	-1.18	***
1 v 5	-1.66	-2.15	-1.17	***
1 v 6	-2.49	-3.21	-1.77	***
1 v 7	-0.66	-1.60	0.29	
2 v 3	1.49	1.12	1.85	***
2 v 4	0.33	-0.15	0.80	
2 v 5	0.31	-0.19	0.81	
2 v 6	-0.52	-1.24	0.21	
2 v 7	1.31	0.36	2.26	***
3 v 4	-1.16	-1.61	-0.72	***
3 v 5	-1.18	-1.65	-0.70	***
3 v 6	-2.01	-2.71	-1.30	***
3 v 7	-0.18	-1.11	0.76	
4 v 5	-0.01	-0.57	0.54	
4 v 6	-0.84	-1.61	-0.08	***
4 v 7	0.99	0.00	1.97	***
5 v 6	-0.83	-1.61	-0.05	***
5 v 7	1.00	0.00	2.00	***
6 v 7	1.83	0.70	2.96	***

Table C-7. Description of PG1a in SA4

Peer group	Description	N
1	Mass merchandiser	10
2	Independent/regional/national	67

Table C-8. Results of T-test for PG1a in SA4

Dependent variable: *Average Complete FBC*

PG1a comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-5.91	-6.57	-5.25	***

PG1b. Number of registers and Geography

Table C-9. Description of PG1b in SA1

Peer group	Description	N
1	1-3 registers, Urban	441
2	1-3 registers, non-Urban	94
3	4-19 registers	616
4	20+ registers	188

Table C-10. Results of Tukey's pairwise comparisons for PG1b in SA1

Dependent variable: *Average Complete FBC*

PG1b comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	3.65	2.84	4.45	***
1 v 3	7.03	6.58	7.47	***
1 v 4	10.53	9.91	11.15	***
2 v 3	3.38	2.59	4.16	***
2 v 4	6.88	5.99	7.78	***
3 v 4	3.50	2.91	4.09	***

Table C-11. Description of PG1b in SA2

Peer group	Description	N
1	1-19 registers, Urban	140
2	1-19 registers, non-Urban	22
3	20+ registers	37

Table C-12. Results of Tukey's pairwise comparisons for PG1b in SA2

Dependent variable: *Average Complete FBC*

PG1b comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-1.12	-2.24	0.00	***
1 v 3	4.52	3.62	5.42	***
2 v 3	5.64	4.33	6.95	***

Table C-13. Description of PG1b in SA3

Peer group	Description	N
1	1-3 registers, Urban	128
2	1-3 registers, non-Urban	60
3	4-19 registers, Urban	1081
4	4-19 registers, non-Urban	277
5	20+ registers	451

Table C-14. Results of Tukey’s pairwise comparisons for PG1b in SA3

Dependent variable: Average Complete FBC

Peer1b comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-0.91	-1.76	-0.06	***
1 v 3	0.77	0.26	1.27	***
1 v 4	0.08	-0.50	0.66	
1 v 5	1.76	1.21	2.30	***
2 v 3	1.68	0.96	2.40	***
2 v 4	0.99	0.22	1.77	***
2 v 5	2.67	1.92	3.41	***
3 v 4	-0.68	-1.05	-0.32	***
3 v 5	0.99	0.69	1.30	***
4 v 5	1.67	1.26	2.09	***

Table C-15. Description of PG1b in SA4

Peer group	Description	N
1	1-9 registers	51
2	10+ registers	26

Table C-16. Results of Tukey’s pairwise comparisons for PG1b in SA4

Dependent variable: Average Complete FBC

PG1b comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	2.29	0.92	3.67	***

PG1c. Store type, number of registers, and Geography

Table C-17. Description of PG1c in SA1

Peer group	Description	N
1	Mass merchandiser	87
2	Regional/National/Local chain, Independent Grocer, 10+ registers	501
3	Independent Grocer, less than 10 registers, Urban	392
4	Independent Grocer, less than 10 registers, non-Urban	125
5	Discount/Other/Pharmacy/convenience, Urban	201
6	Discount/Other/Pharmacy/convenience, non-Urban	33

Table C-18. Results of Tukey's pairwise comparisons for PG1c in SA1

Dependent variable: *Average Complete FBC*

PG1c comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-2.42	-3.37	-1.47	***
1 v 3	-8.60	-9.57	-7.63	***
1 v 4	-5.75	-6.89	-4.60	***
1 v 5	-11.60	-12.65	-10.55	***
1 v 6	-8.25	-9.92	-6.58	***
2 v 3	-6.19	-6.74	-5.63	***
2 v 4	-3.33	-4.14	-2.51	***
2 v 5	-9.18	-9.87	-8.50	***
2 v 6	-5.83	-7.30	-4.36	***
3 v 4	2.86	2.02	3.70	***
3 v 5	-3.00	-3.71	-2.29	***
3 v 6	0.35	-1.13	1.84	
4 v 5	-5.86	-6.79	-4.93	***
4 v 6	-2.50	-4.10	-0.90	***
5 v 6	3.35	1.82	4.89	***

Table C-19. Description of PG1c in SA2

Peer group	Description	N
1	Mass merchandiser	40
2	National chain	102
3	Regional chain/ Independent grocers	66

Table C-20. Results of Tukey's pairwise comparisons for PG1c in SA2

Dependent variable: *Average Complete FBC*

Peer comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-4.24	-5.20	-3.28	***
1 v 3	-5.35	-6.38	-4.32	***
2 v 3	-1.10	-1.92	-0.29	***

Table C-21. Description of PG1c in SA3

Peer group	Description	N
1	Mass merchandiser	467
2	National grocery	401
3	Regional/Local chain, less than 10 registers	456
4	Regional/Local chain, 10+ registers, Urban	322
5	Regional/Local chain, 10+ registers, non-urban	50
6	Independent grocers, Urban	190
7	Independent grocers, non-Urban	72
8	Other/Convenience	39

Table C-22. Results of Tukey's pairwise comparisons for PG1c in SA3

Dependent variable: *Average Complete FBC*

PG1c comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-1.97	-2.36	-1.58	***
1 v 3	-1.45	-1.82	-1.07	***
1 v 4	0.26	-0.15	0.67	
1 v 5	-1.66	-2.51	-0.82	***
1 v 6	-1.66	-2.15	-1.17	***
1 v 7	-2.49	-3.21	-1.77	***
1 v 8	-0.66	-1.60	0.29	
2 v 3	0.52	0.13	0.91	***
2 v 4	2.23	1.81	2.66	***

PG1c comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
2 v 5	0.31	-0.55	1.16	
2 v 6	0.31	-0.19	0.81	
2 v 7	-0.52	-1.24	0.21	
2 v 8	1.31	0.36	2.27	***
3 v 4	1.71	1.30	2.12	***
3 v 5	-0.22	-1.06	0.63	
3 v 6	-0.21	-0.70	0.28	
3 v 7	-1.04	-1.76	-0.32	***
3 v 8	0.79	-0.16	1.74	
4 v 5	-1.92	-2.79	-1.06	***
4 v 6	-1.92	-2.44	-1.40	***
4 v 7	-2.75	-3.49	-2.01	***
4 v 8	-0.92	-1.88	0.04	
5 v 6	0.01	-0.90	0.91	
5 v 7	-0.82	-1.87	0.22	
5 v 8	1.01	-0.21	2.22	
6 v 7	-0.83	-1.62	-0.04	***
6 v 8	1.00	0.00	2.00	***
7 v 8	1.83	0.70	2.96	***

Table C-23. Description of PG1c in SA4

Peer group	Description	N
1	Mass merchandiser	10
2	Independent/regional/national, less than 5 registers	27
3	Independent/regional/national, 5+ registers	40

Table C-24. Results of Tukey's pairwise comparisons for PG1c in SA4

Dependent variable: *Average Complete FBC*

PG1c comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-7.23	-9.08	-5.38	***
1 v 3	-5.01	-6.78	-3.25	***
2 v 3	2.22	0.97	3.46	***

PG2a: Store type only

Table C-25. Description of PG2a in SA1

Peer group	Description	N
1	Mass merchandiser	87
2	Regional/National/Local chains	479
3	Independent grocers	539
4	Discount/Other/Pharmacy/convenience	234

Table C-26. Results of Tukey's pairwise comparisons for PG2a in SA1

Dependent variable: *Average Complete FBC*

PG2a comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-2.34	-3.25	-1.43	***
1 v 3	-7.76	-8.66	-6.86	***
1 v 4	-11.13	-12.11	-10.15	***
2 v 3	-5.42	-5.91	-4.93	***
2 v 4	-8.79	-9.41	-8.17	***
3 v 4	-3.37	-3.98	-2.76	***

Table C-27. Description of PG2a in SA2

Peer group	Description	N
1	Mass merchandiser	40
2	National chain	102
3	Regional chain/ Independent grocers	66

Table C-28. Results of Tukey's pairwise comparisons for PG2a in SA2

Dependent variable: *Average Complete FBC*

PG2a comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-4.24	-5.20	-3.28	***
1 v 3	-5.35	-6.38	-4.32	***
2 v 3	-1.10	-1.92	-0.29	***

Table C-29. Description of PG2a in SA3

Peer group	Description	N
1	Mass merchandiser	467
2	National grocery	401
3	Regional/Local grocery chains	828
4	Independent grocers	262
5	Other/Convenience	39

Table C-30. Results of Tukey's pairwise comparisons for PG2a in SA3

Dependent variable: *Average Complete FBC*

PG2a comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-1.97	-2.33	-1.61	***
1 v 3	-0.80	-1.10	-0.49	***
1 v 4	-1.89	-2.30	-1.47	***
1 v 5	-0.66	-1.55	0.23	
2 v 3	1.17	0.85	1.50	***
2 v 4	0.08	-0.34	0.51	
2 v 5	1.31	0.42	2.21	***
3 v 4	-1.09	-1.47	-0.71	***
3 v 5	0.14	-0.74	1.01	
4 v 5	1.23	0.31	2.14	***

Table C-31. Description of PG2a in SA4

Peer group	Description	N
1	Mass merchandiser	10
2	Independent/regional/national	67

Table C-32. Results of Tukey's pairwise comparisons for PG2a in SA4

Dependent variable: *Average Complete FBC*

PG2a comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-5.91	-6.57	-5.25	***

PG2b: Number of Registers only

Table C-33. Description of PG2b in SA1

Peer group	Description	N
1	01-03 registers	535
2	04-19 registers	616
3	20 or more registers	188

Table C-34. Results of Tukey's pairwise comparisons for PG2b in SA1

Dependent variable: *Average Complete FBC*

PG2b comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	6.38	5.98	6.79	***
1 v 3	9.89	9.31	10.46	***
2 v 3	3.50	2.94	4.07	***

Table C-35. Description of PG2b in SA2

Peer group	Description	N
1	01-19 registers	168
2	20 or more registers	40

Table C-36. Results of Tukey's pairwise comparisons for PG2b in SA2

Dependent variable: *Average Complete FBC*

PG2b comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	4.68	4.29	5.07	***

Table C-37. Description of PG2b in SA3

Peer group	Description	N
1	01-03 registers	188
2	04-19 registers	1358
3	20 or more registers	451

Table C-38. Results of Tukey's pairwise comparisons for PG2b in SA3

Dependent variable: *Average Complete FBC*

PG2b comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	0.92	0.55	1.28	***
1 v 3	2.05	1.64	2.46	***
2 v 3	1.13	0.88	1.39	***

Table C-39. Description of PG2b in SA4

Peer group	Description	N
1	1-9 registers	51
2	10+ registers	26

Table C-40. Results of Tukey's pairwise comparisons for PG2b in SA4

Dependent variable: *Average Complete FBC*

PG2b comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	2.29	0.92	3.67	***

PG2c: Store type and Number of Registers

Table C-41. Description of PG2c in SA1

Peer group	Description	N
1	All Mass merchandiser, National, 10+ registers	89
2	National, less than 10 registers	198
3	Regional/local, less than 10 registers	84
4	Regional/local, 10+ registers	195
5	Independent Grocer	539
6	Discount/Other/Pharmacy/convenience	234

Table C-42. Results of Tukey's pairwise comparisons for PG2c in SA1

Dependent variable: *Average Complete FBC*

PG2c comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-1.76	-2.85	-0.67	***
1 v 3	-4.14	-5.44	-2.84	***
1 v 4	-1.98	-3.07	-0.89	***
1 v 5	-7.69	-8.67	-6.72	***
1 v 6	-11.06	-12.13	-10.00	***
2 v 3	-2.38	-3.49	-1.27	***
2 v 4	-0.22	-1.08	0.64	
2 v 5	-5.93	-6.64	-5.22	***
2 v 6	-9.30	-10.13	-8.48	***
3 v 4	2.16	1.05	3.28	***
3 v 5	-3.55	-4.55	-2.55	***
3 v 6	-6.92	-8.01	-5.84	***
4 v 5	-5.71	-6.43	-5.00	***
4 v 6	-9.08	-9.91	-8.26	***
5 v 6	-3.37	-4.04	-2.70	***

Table C-43. Description of PG2c in SA2

Peer group	Description	N
1	Mass merchandiser/Discount	40
2	National chain	102
3	Regional chain/ Independent grocers	66

Table C-44. Results of Tukey's pairwise comparisons for PG2c in SA2

Dependent variable: *Average Complete FBC*

PG2c comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 3	-4.24	-5.20	-3.28	***
1 v 2	-5.35	-6.38	-4.32	***
2 v 3	-1.10	-1.92	-0.29	***

Table C-45. Description of PG2c in SA3

Peer group	Description	N
1	Mass merchandiser and Regional/Local chains with 10+ registers	839
2	National /Independent grocery	663
3	Other/Convenience and Regional/Local chains with less than 10 registers	495

Table C-46. Results of Tukey's pairwise comparisons for PG2c in SA3

Dependent variable: *Average Complete FBC*

PG2c comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-1.94	-2.17	-1.71	***
1 v 3	-1.39	-1.64	-1.13	***
2 v 3	0.55	0.29	0.82	***

Table C-47. Description of PG2c in SA4

Peer group	Description	N
1	Mass merchandiser	10
2	Independent/regional/national, less than 5 registers	27
3	Independent/regional/national, 5+ registers	40

Table C-48. Results of Tukey's pairwise comparisons for PG2c in SA4

Dependent variable: *Average Complete FBC*

PG2c comparison	Difference between means	Lower 95% Confidence Limit	Upper 95% Confidence Limit	p<0.05 (***)
1 v 2	-7.23	-9.08	-5.38	***
1 v 3	-5.01	-6.78	-3.25	***
2 v 3	2.22	0.97	3.46	***