Inter Tribal Council of Arizona, Inc.

An application of recommended methods from the Women, Infant, and Children (WIC) Vendor Peer Group Study for an Arizona WIC program

Tribal Epidemiology Center

An Application of Recommended Methods from the Women, Infant, and Children (WIC) Vendor Peer Group Study

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Abstract

Introduction. The Inter Tribal Council of Arizona, Inc. (ITCA), is one of three Arizona (AZ) Women, Infants, and Children (WIC) programs in the state. In 2009, the WIC Vendor Cost Containment Final Rule was instituted, which requires programs to group vendors into vendor peer groups (VPGS). In 2017, national guidance for constructing VPGS was issued. We applied the recommended VPGS to the ITCA WIC vendor data in order to work to improve pricing and WIC services.

Methods. We used ITCA WIC vendor and redemption data to construct composite variables for mean food basket cost (FBC) as the outcome in linear models. The linear model predictors, included: store type business model, SNAP store type, WIC total sales, number of Universal Product Codes (UPC) redeemed, cash register count, and store square footage in linear models, Rural-Urban Commuting Area Codes, 2010 Frontier and Remote (FAR) Area Codes, distance to the closest interstate in miles (mi), and urban or non-urban location. We examined mean child and full FBC and 95% Confidence intervals (CIs) by recommended VPGS and full and reduced linear regression models using ITCA WIC variables.

Results. We found that most of the recommended complete VPGS had statistically different mean FBC. In the regression models, SNAP store type, cash register count, and UPC count were significant. Final complete VPGS for ITCA WIC, included: SNAP store type and cash register count.

Conclusion. The national guidance for VPGS was helpful to determine local VPGS for ITCA WIC. This method can be used by other WIC programs to improve VPGS locally, contain costs, and enhance client services.

Introduction. It has been well documented in the public health literature that there are gaps in access to healthy foods across the United States (US), American Indian Tribes, and US territories [1–3]. Lower-income and communities of color have been largely impacted by a lack of grocery stores with fresh food, or high costs of healthy foods that renders these items unattainable [1,4–6]. This unequal access, largely driven by poverty (urban or rural), has been demonstrated to be a cause of higher chronic disease rates and increased obesity prevalence later in life [4,7(p),8–10]. The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) seeks to provide nutrition and breast feeding education, and improve food access for lower income mothers and children in order to, in part, improve access to healthy food choices at affordable [4,11]. In 1985, Inter Tribal Council of Arizona, Inc. implemented one of three Arizona (AZ) WIC programs [4,11]. ITCA WIC authorizes vendors and they have to include a minimum combination of competitively priced healthy foods (i.e., cereal and bread, fresh dairy products, fresh fruit and vegetables, and meats). Now, the ITCA WIC is examining the local vendor peer grouping system (VPGS) in order to contain costs and ensure clients have access to reasonably priced fresh foods.

In an effort to keep costs competitive, the USDA provided the WIC Vendor Cost Containment Final Rule in 2009 [11]. Grouping vendors in vendor peer groups (VPGS) is one of the strategies used to ensure competitive pricing. The rule states that the system developed must have at least two criteria, including geography [12]. Therefore, VPGS are actually the underpinning of cost containment for WIC. However, guidance to WIC programs has been limited on how to define and assess effective VPGS until recently.

In 2017, guidance for testing local WIC VPGS was provided agencies in selected region. The report indicate that a “one size fits all” statistical approach will not work after examining the data across the four region. It was recommended that two conditions are met. First, vendors need to be grouped on factors that are related to food costs, like business features that may predict the vendors pricing. Second, that there is a minimum overlap of mean food prices between the groups, and that vendors are not overly influential within a group. Using this criteria, ITCA WIC investigated if the national VPGS improved local VPGS. in the WIC Vendor Peer Group study (WIC-VPGS).{Citation} The USDA WIC-VPGS examined four state

Methods. The analysis is recommended to have three main parts, which includes: (1) the development of a composite variable for food basket costs, (2) examining vendor characteristics for inclusion in the VPGS, and (3) designing and testing the VPGS [12]. ITCA WIC vendor and redemption data was used from May 2019 to August 2019. There were a total of n=146 ITCA WIC vendors examined. No redemptions were removed from this analysis, since none fit the removal definition from the USDA WIC-VPGS. The geography data came from several sources. The 2010 Rural-Urban Commuting Area Codes (RUCA) and Frontier and Remote (FAR) Area Codes by zipcode from USDA were examined. The road network was created using the AZ Department of Transportation (ADOT) roads network shape file and StreetMaps using network analyst to determine the closest interstate in miles (mi). We discuss the construction of the WIC dependent, WIC independent, and geography independent variables from these data in the sections that follow.

Dependent Variables. The dependent variables tested are complete FBC and child FBC, which are composite variables constructed using the mean per unit price for each food category. The composite variables complete and child FBCs are unweighted sums for each of the food items mean costs. These food items include: 16 oz. of cheese, dozen eggs, 36 oz. of cereal, 16 oz. of legumes (dried, canned, peanut butter), 4 oz. of infant fruit and vegetables, 16 oz. of whole grain, 1 gallon of reduced fat milk, and 64 oz. of bottled juice). In order to be consistent with the USDA WIC-VPGS WIC annual sales, we removed the following food items to calculate WIC total sales: tofu, goats milk, soy milk, evaporated milk, lactose free milk, Boost, Ensure, Pediasure, frozen juice, canned fish, infant cereal, infant formula, and all fruits and vegetables, since these are rarely purchased or they already have some form of cost containment applied to the purchase prices.[12] There were 44 (30%) vendors that did not have redemptions for the complete FBC and 7 (5%) vendors that did not have redemptions for the child FBC over the ITCA WIC-VPGS study time period and a year beyond. For these FBC the value of the missing food items was imputed using a comparatives stores' pricing for the food items.

Independent Variables. Nine variables were explored as potential independent characteristics that determined complete and child FBCs. The six WIC variables, included: store type business model, SNAP store type, WIC total sales, number of Universal Product Codes (UPCs) redeemed (by food package), cash register count, and store square footage. Four geography variables were considered, including: USDA RUCA codes, USDA FAR codes, urban and non-urban, and the distance to the interstate. The USDA WIC-VPGS did not use USDA FAR codes or urban and non-urban. We examined these additional geographical variables compared to the national

study, since our service area includes remote places and this code is simpler than the RUCA codes.

We examined 3 store type variables. Store type business model was further defined in the report, and has the following 12 levels used in the USDA WIC-VPGS: (1) mass merchandiser, (2) discount and limited assortment chains, (3) national grocery chain, (4) national drug chain, (5) regional grocery chain, (6) local grocery chain, (7) independent grocery, (8) regional or local drug, (9) other, (10) A50, WIC only, (11) commissary, and (12) convenience, liquor, gas stations. We constructed a secondary store type business model variable with the same twelve levels and added an additional category by removing Tribally-owned stores from the “other” variable. Tribal stores may be different in important ways when considering ITCA WIC pricing. Store Tracking and Redemption System (STARS) store type used in the USDA WIC-VPGS is constructed by using self-reported information for store size and variety of items available. The STARS Store type variable, or SNAP store type, was collapsed to include: (1) Super stores, (2) Supermarkets and Large Grocery Stores, (3) Medium Grocery stores, and (4) Small Grocery stores, convenience, and a combination Grocery/Other.

We considered three continuous WIC variables in the models. The number of UPCs redeemed, cash register count, store square footage, and distance to the interstate were included as a continuous variables in the models at first. Cash register count was later collapsed two categories similar to the national report (<10 and 10+). UPCs redeemed was later collapsed into two groups to designate the vendor peer groups (<135 and 135+).

Geography Independent Variables. We explored four geography variables for the analysis. For 2010 RUCA, there are ten levels for the variable, which include: (1) Metropolitan area core (urbanized area), (2) Metropolitan area high commuting, (3) Metropolitan area low commuting, (4) Micropolitian area core (urban cluster 10,000 – 49,999), (5) Micropolitian high commuting, (6) Micropolitian low commuting, (7) Small town core (urban cluster 2,500 to 9,999), (8) Small town high commuting, (9) Small town low commuting, and (10) rural areas.[13] The Frontier and Remote Zip Codes for Arizona were included as a binary variable (yes or no).[14] The distance to the nearest interstate was included as a continuous variable (miles).[15,16] Finally, we included urban and non-urban similar to the national report as well.[17]

Data analysis.

Box plots. Using Rv.3.4.2, we constructed box plots using the mean values and quartile range for complete and child mean FBCs for all n=146 vendors from May 2019 to August 2019 (figure 1). We examined outlier prices for the mean complete and child FBCs, but did not remove any vendors, because all needed to be classified. We examined reported and imputed values for the FBCs; there were more outliers for the original values than imputed values.

Modeling. Using SAS 9.4, we used two full linear regression models to examine the complete and child food basket cost constructed composite variables by the independent variables for n=146 ITCA WIC vendors. We did not examine interactions between independent variables, because the vendor sample size is small and grouping vendors on interactions may not make sense. Using the partial t-tests, we excluded variables as independent predictors based on statistical significance (*$p<0.05$)*. Once the

variables for the reduced models were determined, we examined possible outlying stores in the analysis by using regression diagnostics and residual plots. We examined Cook's distance, R studentized residuals (jackknife residuals), and high leverage points (hii) for influential stores on FBC in the analysis. There were several influential vendors. We did not remove these vendors from the analysis, since the information in the dataset for the vendors is correct, and we want to ensure grouping all ITCA WIC vendors.

Vendor Peer Group System. The national USDA WIC VPGS had six VPGS, three that met the current cost containment rules, and three that did not. The USDA WIC VPGS recommends having 30 vendors per each group and using a combination of store type, number of registers, and geography. We started with 146 vendors, so the maximum number of peer groups we could possibly have would be four or five groups in order to meet this criteria.

ITCA TEC and WIC collapsed groups for store type as appropriate based on statistics and what we know about the vendors. The goal was to use the most parsimonious model that explained FBCs and minimize the overlap in the mean FBC between the ITCA WIC VPGS categories. Vendor types with fewer than 30 vendors were combined where possible and based on what local ITCA WIC staff determined was acceptable.

Results.

We included all n=146 ITCA WIC vendors in the analysis. From the box plots, we found that the mean value of complete FBCs were ($29.23, 95% CI: $28.35-30.10) and child FBC ($36.28, 95% CI: $35.23-37.33). Examining the imputed and non-imputed values,

there were vendors that could be considered outliers, but these were all retained for complete categorization into ITCA VPGS (figure 1).

From full linear regression models for complete FBC, cash register count and store square footage were highly correlated (table 1). Cash register count was significant *($p<0.0045$)*, but store square footage was not *($p<0.4210$),* so it was removed. SNAP store type *($p<0.0010$)* performed better than Business model store type *($p<0.9993$).* SNAP store type, cash register count, and USDA FAR codes were the significant predictors explaining complete FBC in reduced models (Adjusted R-squared, 68%).

We examined the child FBC using linear regression partial-t tests for the same independent variables as the complete FBC models. The full model Adjusted R-squared value was very low (Adjusted R-squared, 19%) and a reduced model with USDA FAR Zip code and square footage was minimally improved (Adjusted R-squared, 21%). Since the reduced model did not agree with the WIC-VPGS findings or ITCA knowledge, we decided to only use complete FBC for determining local VPGS.

We applied the six VPGS found in the WIC-VPGS using SNAP store type rather than Business store type, cash register count, and USDA FAR rather than USDA RUCA codes (table 3). Small grocery stores had a statistically higher mean FBC, respectively ($38.98, $35.33 - $42.63) than the larger vendors. When we stratified on more than one variable, we did get groups with no vendors. The most practical grouping that agreed with WIC-VPGS and local findings was the SNAP store type, cash register count, and USDA Far Remote and Not Remote geography combination (table 3).

Discussion.

In linear regression models, we found that the SNAP store type, cash register count, and USDA FAR codes were independent predictors of complete food basket costs examining ITCA WIC vendor information (Adjusted R-squared, 68%). In contrasts, none of the independent variables tested were necessarily highly important for predicting child FBCs (Adjusted R-squared, 21%). Geography is currently a required vendor grouping variable by USDA. We found that remote or not remote geography was important to explain FBC mean differences among WIC vendors in Arizona (AZ) (Altarum Institute, 2017). Using ITCA knowledge of the WIC program and significant variables from linear modelling, we found a workable VPGS that largely explained differences in mean complete FBC that will function as a cost containment method for ITCA WIC vendors in AZ.

The national study team compiled a set of variables to form VPGS using WIC characteristics, geography variables, and expert program knowledge for four state WIC programs (Altarum Institute, 2017). The simulations were reviewed by an advisory panel of WIC experts across the country in 2015 and they found that the only consistent significant characteristics related to FBCs were the number of cash registers and store type business model (Altarum Institute, 2017). Three of the groups met the cost containment rules, including: (1) store type Business model and geography (urban vs. non-urban), (2) number of registers and geography (urban vs. non-urban), (3) store type, number of registers, geography (urban vs. non-urban) and three did not, including: (4) store type only, (5) number of registers only, and (6) store type and number of

registers (Altarum Institute, 2017). Our results were fairly consistent with the WIC-VPGS, but there were some differences in our models.

The Business model store type was not significant in ITCA WIC models; it was the SNAP store type that was significant. We suspect the difference in our findings compared to the WIC-VPGS is that we have a smaller sample size, so the 4 categories of SNAP store type was a better fit than the 12 levels in Business model store type to explain the local vendors. In simple linear models (WIC-VPGS peer group system 4), SNAP store type explained 38% of the variation in mean FBC. Interestingly, SNAP store type groups vendors inherently on a variety of items, like UPC counts and store size, which may explain why square footage was not significant. While SNAP store type does not account for store ownership, the different operational cost structures between chain and independent stores appeared less important to predict the FBC ($p<0.9891$). We kept SNAP store type in the final local VPGS.

At the moment, USDA requires that geography is included in the WIC VPGS, although a waiver can be requested. The WIC-VPGS recommended determining whether or not geography is an important variable for each state agency (Altarum Institute, 2017). We examined four geography variables and found that only USDA Remote and Not Remote Areas were significant predictors of complete FBC. From a state with many rural and remote communities, we were not surprised by the findings that the geography variable persisted and influenced food costs. New Mexico analyses considered USDA food deserts, which was different from the WIC-VPGS methodology and beyond the scope of this analysis (State of New Mexico, 2018). Given these findings, ITCA WIC is moving

forward to keep geography in the local VPGS and may examine USDA food deserts as a variable in the future as well (State of New Mexico, 2018).

This analysis of ITCA WIC peer groups has several strengths. We used a tested and recommended WIC-VPGS methodology for selecting VPGS and found largely similar results (table 3). Although our sample size of vendors was small (n=146), state 2 and state 3 in the WIC-VPGS had a small number of vendors as well, respectively (n=221 and n=78).

This application has several limitations. The data used in the WIC-VPGS was from 2014, and we used the most recent data from 2019, because we did not have similar information from 2014. Using a later year may impact food pricing, RUCA codes, and WIC annual sales, and findings may not be directly comparable to the WIC-VPGS. We did not remove stores based on missing values for food basket items, and we imputed the cost from competitive stores nearby, which may not be totally accurate. However, our box plots indicate that the imputed values are not largely different from those that are not imputed. The WIC-VPGS grouping recommends that each VPGS have at least 30 stores, and we did not achieve that due to our sample size and store types, which was similar to the WIC-VPGS.

In conclusion, the recommended WIC-VPGS VPGS criteria were helpful for ITCA WIC to determine the new ITCA VPGS. We plan to use SNAP store type, cash register count, and USDA FAR codes to group vendors into VPGS based on this analysis. This analysis can assist other WIC programs across the US with applying the WIC-VPGS methods and making decisions with state data to form the local VPGS for cost containment.

Table 1. Food Quantities and Mean Price (in dollars) with corresponding 95% Confidence Intervals (95% CI) for Complete and Child Food Basket Items used to construct composite outcome variables, 2019[a]

Food Quantities for Complete Food Basket Composite variable	**Complete Food Basket Mean Price ($) 95% Confidence Interval** [b]	**Food Quantities for Child Food Basket Composite variable**	**Child Food Basket Mean Price ($) 95% Confidence Interval** [b]
Cheese, 16 ounces	$4.38 ($4.25 - $4.51)	Cheese, 0 ounces	-
Eggs, 1 dozen	$1.55 ($1.46 - $1.66)	Eggs, 1 dozen	$1.55 ($1.45 - $1.66)
Cereal, 36 ounces	$8.81 ($8.50 - $9.12)	Cereal, 36 ounces	$8.81 ($8.50 - $9.12)
Legumes		Legumes	
16 ounces dried	$1.49 ($1.44 - $1.55)	0 ounces dried	-
15.5 – 16 ounces canned	$1.13 ($0.96 - $1.29)	0 ounces canned	-
16-18 ounces peanut butter	$2.80 ($2.70 - $2.89)	16-18 ounces peanut butter	$2.80 ($2.70 - $2.89)
Infant Fruits and Vegetables, 4 ounces	$0.18 ($0.18 – $0.19)	Infant Fruits and Vegetables, 0 ounces	-
Whole Grains, 16 ounces	$2.79 ($2.71 - $2.87)	Whole Grains, 32 ounces	$5.59 ($5.42 - $5.75)
Reduced Fat Milk, 1 gallon	$2.68 ($2.58 – $2.79)	Reduced Fat Milk, 4 gallons	$10.74 ($10.32 - $11.16)
Bottled Juice, 64 ounces	$3.38 ($3.29 – $3.48)	Bottled Juice, 128 ounces	$6.78 ($6.59 - $6.97)

[a] Inter Tribal Council of Arizona, Inc., Women, Infant, and Children redemption data pricing information from 2019;
[b] Price was imputed for n = 70 food items for Complete Food Basket mean price and n=9 food items Child Food Basket Mean Price

Figure 1. Inter Tribal Council of Arizona, Inc. Women, Infant and Children (ITCA WIC) Mean Complete and Child Food Basket Costs using reported and imputed values, 2019

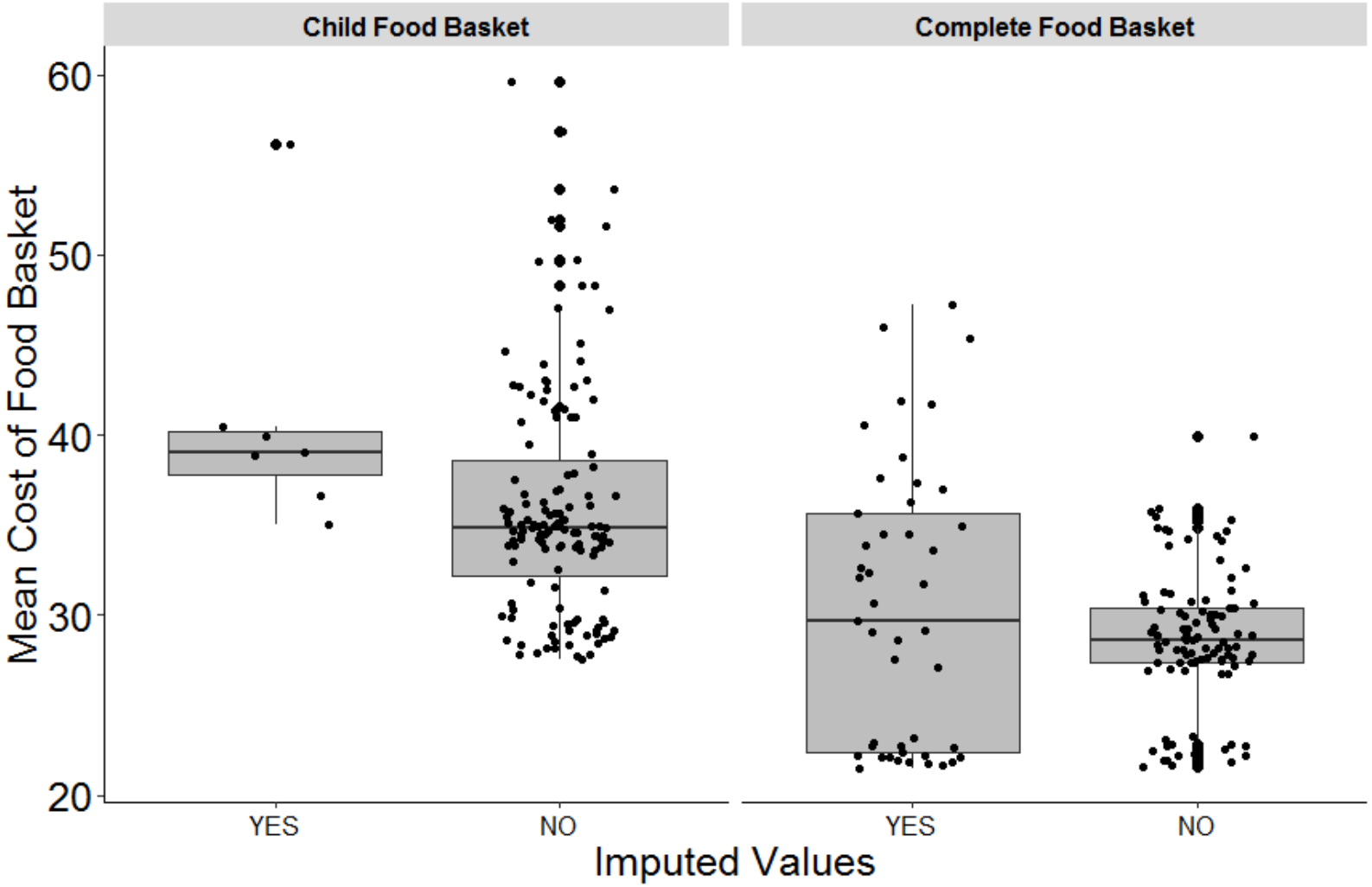

Table 2. Full and Reduced[a] Linear Regression Models and Independent Variables for Predicting Complete Food Basket Prices, 2019

Independent variables	**Parameter Estimate**	**Standard Error (SE)**	**Partial t-test (*pr> t*)**	**Variance inflation factor (VIF)**
SNAP Store type				
Independent or Chain [a]	0.35	1.61	*0.8269*	4.4
SNAP Store type (full model)[a, b]	2.01	0.59	*0.0010*	3.8
SNAP Store type (reduced model)[a, b]	2.03	0.52	*0.0002*	
Business Model store type[a]	<0.01	0.13	*0.9993*	2.9
Geography				
2010 Far Zip codes [c]	2.42	1.88	*0.2017*	5.2
2010 Far Zip codes (reduced model)[b,c]	3.43	1.42	*0.0173*	3.0
RUCA codes [c]	0.15	0.17	*0.3847*	4.1
Distance to the interstate in miles[d]	<0.01	0.01	*0.7039*	2.1
Urban or Non-urban [e]	-0.31	0.41	*0.4377*	2.2
Store characteristics				
Square footage [a]	<-0.01	<0.01	*0.4210*	12.4
Number of cash registers (full model)[a]	-0.11	0.04	*0.0045*	10.1
Number of cash registers (reduced model)[a, b]	-0.14	0.01	*<0.0001*	1.0
WIC total sales [a]	<0.01	<0.01	*0.8812*	1.2

[a] Inter Tribal Council of Arizona, Inc., Women, Infant and Children vendor redemption data, 2019;
[b] Variable remained in the reduced models as significant;
[c] United States Department of Agriculture: Frontier and Remote (FAR) Zipcodes, 2010; Rural-Urban Commuting Area Codes (RUCA) 2010;
[d] Arizona Department of Transportation (ADOT) Roads Geodatabase2018;
[e] United States Census data, 2010;

Table 3. Application of six alternative vendor peer group systems[a] from the WIC-VPGS Women, Infant, and Children (WIC) peer group study using Inter Tribal Council of Arizona, Inc. Women, Infant and Children vendor data (n=146) 2019 and United States Department of Agriculture geography data, 2010

Alternative vendor peer group systems	**N**	**Mean complete food basket cost (dollars $)**	**95% Confidence Interval (CI) (dollars $)**
SNAP Store Type			
Super Stores	102	$27.49	($26.80 - $28.19)
Super Markets & Large Super Stores	30	$30.59	($28.53 - $32.64)
Medium Grocery Stores	5	$38.95	($31.99 - $45.91)
Small Grocery Stores	9	$38.98	($35.33 - $42.63)
Geography[b]			
Not Remote	131	$28.15	($27.42 - $28.88)
Remote	15	$38.64	($35.87 - $41.41)
Number of Cash Registers			
≤10	94	$31.57	($30.64 - $32.51)
+10	52	$25.00	($23.92 - $26.07)
SNAP Store Type and Number of Cash Registers			
Super Stores			
≤10	61	$29.23	($28.69 - $29.77)
+10	41	$24.91	($23.75 - $26.07)
Super Markets & Large Super Stores			
≤10	19	$33.64	($32.11 - $35.17)
+10	11	$25.32	($22.21 - $28.43)
Medium Grocery Stores			
≤10	5	$38.95	($31.99 - $45.91)
+10	0	-	NA[c]
Small Grocery Stores			
≤10	9	$38.98	($35.33 - $42.63)
+10	0	-	NA[c]
SNAP Store Type and Geography			

Super Stores			
Not Remote	102	$27.49	($26.80 - $28.19)
Remote	0	-	NA[c]
Super Markets & Large Stores			
Not Remote	28	$30.36	($28.20 - $32.52)
Remote	2	$33.78	($-6.31 - $73.88)
Medium Grocery Stores			
Not Remote	1	$33.58	NA[c]
Remote	4	$40.29	($31.60 - $48.99)
Small Grocery Stores			
Not Remote	0	-	NA[c]
Remote	9	$38.98	($35.33 - $42.63)
SNAP Store Type, Number of Cash Registers, and Geography			
Super Stores			
≤10 Cash Registers			
Not Remote	61	$29.23	($28.69 - $29.77)
Remote	0	-	NA[c]
+10 Cash Registers			
Not Remote	41	$24.91	($23.75 - $26.07)
Remote	0	-	NA[c]
Super Markets & Large Stores			
≤10 Cash Registers			
Not Remote	17	$33.62	($31.99 - $35.26)
Remote	2	$33.78	($-6.31 - $73.88)
+10 Cash Registers			
Not Remote	11	$25.32	($22.21 - $28.43)
Remote	0	-	NA[c]
Medium Grocery Stores			
≤10 Cash Registers			
Not Remote	1	$33.58	NA[c]
Remote	4	$40.29	($31.60 - $48.99)

+10 Cash Registers			
Not Remote	0	-	NA[c]
Remote	0	-	NA[c]
Small Grocery Stores			
≤10 Cash Registers			
Not Remote	0	-	NA[c]
Remote	9	$38.98	($35.33 - $42.63)
+10 Cash Registers			
Not Remote	0	-	NA[c]
Remote	0	-	NA[c]

[a] The WIC-VPGS used the Business type to define store type and we used SNAP store type, since it was significant in ITCA WIC linear models;
[b] Geography was significant in reduced models using United States Department of Agriculture, Remote and Not Remote;
[c] NA = not applicable, because there were not any stores that met this definition;

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References.

1. Walker RE, Keane CR, Burke JG. Disparities and access to healthy food in the United States: A review of food deserts literature. *Health and Place*. 2010;16(5):876-884. doi:10.1016/j.healthplace.2010.04.013

2. McKenzie BS. Access to supermarkets among poorer neighborhoods: a comparison of time and distance measures. *Urban Geography*. 2014;35(1):133-151. doi:10.1080/02723638.2013.856195

3. Kaufman PR. Rural Poor have less Access to Supermarkets, Large Grocery Stores. *Rural Development Perspectives*. 1999;13(3):19-25.

4. United Stated Department of Agriculture. Access to Affordable and Nutritious Food-Measuring and Understanding Food Deserts and Their Consequences: Report to Congress. Published online June 2009.

5. Zenk SN, Schulz AJ, Israel BA, James SA, Bao S, Wilson ML. Fruit and Vegetable Access differes by Community Racial Composition and Socioeconomic Position in Detroit, Michigan. *American Journal of Public Health*. 2005;95(4):660-667.

6. Chung C, Myers SL. Do the Poor Pay More For Food? An Analysis of Grocery Store Availability and Food Price Dipsarities. *The Journal of Consumer Affairs*. 1999;33(2):276-296.

7. Cooksey-Stowers K, Schwartz M, Brownell K. Food Swamps Predict Obesity Rates Better Than Food Deserts in the United States. *International Journal of Environmental Research and Public Health*. 2017;14(11):1366.

8. Drewnowski A, Specter SE. Poverty and Obesity: The Role of Energy Density and Energy Costs. *American Journal of Clinical Nutrition*. 2004;79(1):6-16.

9. Papas MA, Alber AJ, Ewing R, Heizisouer KJ, Gary TL, A.C. Klassen. The Built Environment and Obesity. *Epidemiologic Reviews*. 2007;29:129-143.

10. Shannon J. Beyond the Supermarket Solution: Linking Food Deserts, Neighborhood Context, and Everyday Mobility. *Annals of the American Association of Geographers*. 2016;106(1):186-202. doi:10.1080/00045608.2015.1095059

11. USDA. WIC at a Glance. Published online 2015.

12. Altarum Institute. *WIC Vendor Peer Group Study Contract Number AG-3198-D-13-0071*. United States Department of Agriculture; 2017:73.

13. United Stated Department of Agriculture ERS. *2010 Rural-Urban Commuting Area (RUCA) Codes*. United States Department of Agriculture; 2010. https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/

14. United Stated Department of Agriculture ERS. *2010 Frontier and Remote Area Codes*. United States Department of Agriculture; 2010. https://www.ers.usda.gov/data-products/frontier-and-remote-area-codes/

15. Bader M, Marnie P, Yousefzadeh P, Neckerman K. Disparities in Local Food Environments: Implications of Measurement Strategies. *Economic Geography*. 2010;86(4):409-430.

16. Jiao J, Moudon A, Ulmer J, Hurvitz P, Drewnowski A. How to identify Food Deserts: measuring Physical and Economic Access to Supermarkets in King County, Washington. *American Journal of Public health*. 2012;102(10):32-39.

17. Ratcliffe M, Burd C, Holder K, Fields A. *Defining Rural at the U.S. Census Bureau: American Community Survey and Geography Brief*. United States Census Bureau; 2016:8. Accessed July 1, 2018. https://www.census.gov/geo/reference/urban-rural.html