

Accessibility to WIC-authorized ethnic food stores in Washington state:  
implications for serving the needs of immigrant WIC-eligible populations

Kana Ogaki

A thesis

submitted in partial fulfillment of the  
requirements for the degree of

Master of Public Health

University of Washington

2024

Committee:

Pia Chaparro

Edmund Seto

Cristen Harris

Program Authorized to Offer Degree:

Nutritional Sciences

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Kana Ogaki

University of Washington

**Abstract**

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Kana Ogaki

Chair of the Supervisory Committee:  
Dr. Pia Chaparro  
Department of Health Systems and Population Health

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) is a U.S. nutrition assistance program serving pregnant and postpartum women, and children 0-5 years who live in low-income households. WIC provides participants with supplemental foods that can only be purchased in WIC-authorized stores. At least 20% of WIC participants in Washington state are of immigrant background, but information on how many WIC-authorized stores are considered ethnic stores, where immigrant households could access culturally preferred foods, is unknown. This study's purpose is to assess the availability and distribution of WIC-authorized ethnic stores in Washington state in relation to the location of immigrant WIC-eligible populations. To do so, information on WIC-authorized stores in Washington state was obtained from the WIC Shopper cellphone app; stores were categorized as ethnic or non-ethnic based on online store information. Sociodemographic data for Washington state census tracts were obtained from the American Community Survey (ACS) 2017-2021. Using ArcGIS Pro, a map displaying the census tract level percentage of 1) foreign-born individuals and 2) WIC-eligible children as well as 3) the location of WIC-authorized stores (ethnic/non-ethnic) was

generated. The distribution of, and distance to, WIC-authorized ethnic/non-ethnic stores based on the distribution of foreign-born individuals and WIC-eligible children were analyzed in R (using chi-square tests) and ArcGIS Pro (using the “Generate Origin-Destination Link” function).

This study found that 29.1 percent of Washington state census tracts had WIC-authorized stores and only 1.7% had at least one WIC-authorized ethnic store. Census tracts with high proportions of both foreign-born individuals and WIC-eligible children had the highest proportion of WIC-authorized ethnic stores (14.5%) and the shortest distance to the nearest WIC-authorized ethnic store (3.0 km) when compared to census tracts with low proportions of foreign-born individuals and WIC-eligible children (0.5% and 20.3 km, respectively;  $p < 0.001$ ). In conclusion, while census tracts with higher proportions of foreign-born individuals and WIC-eligible children had the greatest accessibility to WIC-authorized ethnic stores, WIC-authorized ethnic stores are rare in Washington state. Future research should focus on investigating the barriers and facilitators for ethnic stores to become WIC-authorized in Washington state, in order to better serve the needs of immigrant WIC-eligible populations.

## Acknowledgment

I would like to thank my thesis committee members for supporting my thesis project. Dr. Pia Chaparro helped me develop my awareness of the problem of the importance of culturally preferred foods in the federal nutrition assistance programs to the population's health and explore the ways to address the problem together. She shared her perspectives, expertise, and passion for serving marginalized populations in the United States through research. This project would not have been possible without her help. I am deeply thankful for her patience and feedback throughout this project. Dr. Edmund Seto shared his time and expertise in retrieving the American Community Survey, writing R scripts, and troubleshooting ArcGIS Pro. He also provided me with indispensable feedback on the discussion section. I appreciate his interest and involvement in this project. Dr. Cristen Harris supported my learning in Maternal and Child Nutrition at the University of Washington Nutritional Sciences Program. She also offered me multiple opportunities to work with professionals in the field of MCH Nutrition as her trainee of the Western MCH Nutrition Partners traineeship. Through the funding of the traineeship, I was able to present my thesis at professional and scientific conferences. I am grateful for her contribution to my learning in MCH Nutrition throughout the program.

I would like to thank faculty members, everyone at Academic Services in the Nutritional Sciences Program, and the Nutritional Sciences Program Cohort of Autumn 2022 for creating a safe environment where people could share vulnerable experiences in the past and discuss how we can make a more equitable, diverse, and inclusive society through the field of nutrition. They encouraged me to work on my thesis project by consistently showing their interest and support. I appreciate the invaluable time we spent together and the many different perspectives they taught me.

I would like to thank my parents for fostering my love for cooking and eating food, my curiosity to continue to learn new things, and my passion for social justice from a young age. I also would like to thank my parents-in-law and their extended families for warmly welcoming me to the United States in their generous Filipino ways, and for continuing support for my academic exploration. My current perspectives and identity, as an immigrant, could not be formed without them.

I would like to thank my precious children, Hirose and Maharu, for being patient with me especially when they needed me. I hope they will one day appreciate what I would like to value and achieve in the country where they grow, meet someone special, and age.

Lastly, I would like to thank my husband, Josh, for supporting me patiently for the past ten years to complete prerequisite classes for graduate school, to gain professional and volunteer experiences, and to complete all the projects during the Nutritional Sciences Program, while taking care of two small children. I am thankful for his understanding of my passion for social justice and his dedication to our family. This endeavor past ten years would not have been possible without his support and patience.

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## Introduction

In the state of Washington, the proportion of the foreign-born population reached 15% in 2018, with a further 15% having at least one immigrant parent.<sup>1</sup> Immigrant communities are vulnerable to unhealthy eating habits due to average lower income, language and transportation barriers, difficulty navigating an unfamiliar shopping environment, and unavailability and unaffordability of their traditional foods and cooking ingredients, compared to U.S.-born populations.<sup>2-6</sup> As a result, studies show that immigrants transition from their traditional diets to the typical American diet as they spend more time in the United States, and this transition is negatively associated with diet quality and positively associated with energy intake and consumption of processed foods.<sup>4,7-14</sup> This dietary transition, in turn, contributes to the increased risk of various chronic diseases, such as cardiovascular disease, hypertension, diabetes, and cancer.<sup>15-19</sup>

Qualitative research suggests that immigrants desire fresh high-quality produce and cultural foods, and have confidence in cooking and eating healthy using their cultural foods.<sup>3,5,20</sup> The accessibility to foods that support healthy dietary patterns in culturally appropriate ways not only helps immigrants maintain their cultural identity, but also diminish feelings of sadness, stress, and anxiety.<sup>21-23</sup> Research has also found that living in a neighborhood with a high percentage of immigrants where culturally preferred foods are sold in familiar ethnic stores is associated with healthier dietary behaviors, such as less frequent fast food consumption and adequate intake of fruits and vegetables.<sup>16</sup> Despite the benefits of having access to culturally preferred fruits and vegetables, availability and affordability of these fruits and vegetables have been limited due to historical oppression of people of color and sustaining structural barriers, including inaccessibility to financial capital to obtain farmlands and business ownership; non-

inclusive town planning related to where to locate food retailers, public transportation, and affordable housing; and failure of federal nutrition assistance programs to take into consideration the higher price of culturally preferred foods.<sup>3,6,20,24-28</sup>

Federal nutrition assistance programs, particularly the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) – which serves pregnant and postpartum women as well as infants and children up to the age of 5 years who live in low-income households (<185% federal poverty level, FPL) – play an important role in safeguarding food security among immigrant populations.<sup>22,29-31</sup> WIC, unlike other large federal nutrition programs like the Supplemental Nutrition Assistance Program (SNAP), does not have residency/citizenship requirements for participation and, thus, is available for immigrant families who fulfill income eligibility requirements.<sup>29</sup> WIC is funded annually by the United States Department of Agriculture (USDA) and operated through 1900 local agencies.<sup>30,32,33</sup> WIC provides participants with supplemental nutritious foods, nutrition education, and counseling at WIC clinics, as well as screening and referrals to other health, welfare, and social services.<sup>30,32</sup>

WIC has been evolving in response to changes in demographics among their target populations.<sup>34</sup> In 2020, it was estimated that 38.4% of WIC participants were Hispanic/Latino, 29.1% non-Hispanic (NH) White, 21.1% NH Black, 6.2% NH Multiple Races, 4.1% NH Asian and Pacific Islander, and 1.2% NH American Indian, in comparison to 1992 when 45% WIC participants were NH white.<sup>34,35</sup> As WIC participants have become more culturally diverse and accumulated research has revealed that some components of the WIC food packages were not culturally accepted, WIC has made efforts to include more culturally suitable whole grains such as soft corn or whole wheat tortillas, brown rice, and bulgur.<sup>34,35</sup> In 2009, WIC food packages were changed to better align with the 2005 Dietary Guidelines for Americans. This included the

addition of culturally appropriate replacements for dairy, for example, including soy beverages and tofu as substitutes for milk.<sup>34,36-38</sup>

The 2009 WIC food package change also introduced a cash-value voucher (CVV) of \$6-10 monthly per participant to purchase fresh fruits and vegetables at WIC-authorized stores.<sup>36</sup> The CVV has been well accepted by WIC participants, having a redemption rate of 77 % in five states in 2013-2014 and an average of 80.6% in non-tribal WIC clinics in Washington state in 2011.<sup>36,39-41</sup> During the COVID-19 pandemic, WIC temporarily increased the amount of CVV to \$24/month for children, \$43/month for pregnant women, and \$47/month for postpartum women.<sup>42-45</sup> Several qualitative studies reported that WIC participants perceived the increase in CVV as beneficial and that the increased CVV benefit led to increased frequency and variety of purchase and consumption of fruits and vegetables.<sup>42-45</sup> The CVV introduction also led to improved availability of fruits and vegetables at WIC-authorized stores, due to WIC minimal stocking requirements.<sup>46-49</sup> Nevertheless, a quasi-experimental study pre/post implementation of the 2009 WIC food package change in Illinois suggested that there was an improvement in the availability and selection of culturally specific African-American fruits and vegetables at WIC-authorized stores, but not so for culturally specific Latino fruits and vegetables.<sup>46</sup> This result suggests that WIC-authorized stores may not provide sufficient culturally preferred fruits and vegetables for specific subgroups of immigrant populations.

A way to ensure that immigrant WIC participants have access to their culturally preferred foods, for example, fruits and vegetables, could be by increasing the number of ethnic stores that are authorized to accept WIC benefits. Therefore, this study aimed to evaluate the extent to which Washington WIC is serving the needs of the immigrant WIC-eligible population by providing accessibility to culturally preferred foods through WIC-authorized ethnic stores. In

support of this aim, this study assessed 1) the geographic distribution of immigrant WIC-eligible children in the state of Washington; 2) the geographic distribution of WIC-authorized stores across the state of Washington, including ethnic and non-ethnic stores; and 3) the accessibility (by distance) of WIC-authorized ethnic stores by immigrant WIC-eligible children.

## **Methods**

### **a. Study Design and Setting**

This study is a secondary analysis of cross-sectional data on all WIC-authorized stores in the state of Washington, extracted from the WIC Shopper cell phone app, and the American Community Survey (ACS) 2017-2021.

### **b. Data Sources**

Data on all WIC-authorized stores in the state of Washington were extracted from the WIC Shopper cell phone app on May 7<sup>th</sup>, 2023 by accessing the app's Application Programming Interface (API) and downloading the list of stores into Microsoft Excel. The list contained a total of 665 entries including the stores' names, addresses, and coordinates (i.e., longitude and latitude). Six of these stores were located outside of Washington state and one store was a duplicate; thus, 7 stores were eliminated for a total sample size of 658 WIC-authorized stores in Washington state.

Data on Washington census tracts' sociodemographic information were obtained from the American Community Survey (ACS) 2017-2021.<sup>50</sup> Data extracted at the census tract level include: 1) percent of foreign-born individuals, defined as the percent of individuals born outside of the United States ( $[\text{No. individuals in the census tract born outside of the United States}]/[\text{total}$

number of individuals in the census tract]\*100%); 2) percent of WIC-eligible children, defined as the percent of children under 6 years old living in a households with an income-to-poverty ratio (IPR)<1.85 in the previous 12 months ( $[\text{No. children under 6 years old living in a household with IPR} < 1.85 \text{ in the previous 12 months in the census tract}] / [\text{total number of children under 6 years old in the census tract}] * 100\%$ ); 3) median age (in years); 4) median household income in the previous 12 months (in 2022 inflation-adjusted dollars); 5) percent individuals 25 years and over with a Bachelor's degree or higher ( $[\text{No. individuals 25 years and over with Bachelor's degree or higher}] / [\text{total number of individuals 25 years and over}] * 100\%$ ); and 6) population size (No. inhabitants). The first two variables, the percent of foreign-born individuals and the percent of WIC-eligible children were used to estimate the proportion of immigrant WIC-eligible children at the census tract level.

The following layers for mapping in ArcGIS Pro were obtained from Esri Basemaps shared in ArcGIS Hub and TIGER/Line® Shapefiles on the United States: 1) USA Census tract boundaries, 2) world water bodies, and 3) 2022 water layer of all counties in Washington state.<sup>51,52</sup>

### c. Defining and Identifying WIC-Authorized Ethnic Stores

WIC-authorized stores were categorized as ethnic stores based on the following criteria, obtained from previous literature:<sup>53-58</sup>

1. (Self-Identification) Stores identify themselves as international, or as serving a specific ethnicity or race in their name. Examples include those containing the words “Mexican” or “Asian” in their names.

OR

2. (Language) Language of signages in the stores, and/or language used to advertise online, and/or language in the store name is a language other than English.

AND

3. (Product Assortment) Any type of non-chain grocery store that sells a substantial amount of food items that are distinctly cultural for one or more ethnicities. The stores typically specialize in catering to specific ethnic cuisines and may have a wide range of culturally specific ingredients, spices, and traditional foods. The stores may also carry products and brands that cater to the preferences and dietary needs of those ethnicities.

The criteria above were assessed qualitatively through store information available online. When the self-identification criterion was not met, both the second and third criteria needed to be met for a store to be categorized as an ethnic store. The first criterion was assessed through Yelp Fusion API by examining stores' self-reported business category in all zip codes in Washington State and within a maximum radius of 40,000 meters (about 25 miles) from each zip code, on July 11th, 2023.<sup>59</sup> A total of 299 stores within Washington state self-categorized as "International Grocery." This list of 299 stores was manually compared with the WIC-authorized store list from Washington state, obtained from the WIC Shopper app. Eight stores that were self-categorized as "International Grocery" on Yelp Fusion were identified in the WIC-approved store list. Additionally, self-identification as an ethnic store was also assessed through stores' websites and customer photos on Facebook, Google reviews, Instagram, and Yelp. Through this process, 8 additional WIC-authorized stores were categorized as ethnic stores.

The second and third criteria were also assessed through information available on stores' websites and by customer photos and reviews on, Facebook, Instagram, Yelp, and Google. Based on the second and third criteria, 16 additional WIC-authorized stores are categorized as ethnic stores, for a total of 32 WIC-authorized stores are categorized as ethnic stores.

#### d. Data Analysis and Statistical Methods

The obtained shapefiles and the Excel files containing the census tracts' sociodemographic information and the list of WIC-authorized stores were imported into ArcGIS Pro. Based on this information, a map displaying the percentage of foreign-born individuals and the percentage of WIC-eligible children at the census tract level was generated to illustrate the range of immigrant WIC-eligible children in each census tract in Washington state. To generate this map, the "bivariate colors" function in ArcGIS Pro's symbology pane was used, applying the 4x4 grid size. The location (latitude and longitude) of WIC-authorized stores, categorized as either ethnic or non-ethnic, were added as a layer to the map. The areas with a high density of WIC-authorized stores were magnified to create area maps in addition to a Washington state map. The magnified map areas include the Greater Seattle area, the City of Spokane, the City of Vancouver, and the City of Yakima.

From the 4x4 grid illustrating the range of immigrant WIC-eligible children in each census tract, Washington state census tracts were grouped into four categories (**Figure 1**):

Category 1 (**Low/Low**): Defined as a low proportion of foreign-born individuals ( $\leq 29.8\%$ ) and a low proportion of WIC-eligible children ( $\leq 50\%$ ).

Category 2 (**Low/High**): Defined as a low proportion of foreign-born individuals ( $\leq 29.8\%$ ) and a high proportion of WIC-eligible children ( $> 50\%$ ).

Category 3 (**High/Low**): Defined by a high proportion of foreign-born individuals (>29.8%) and a low proportion of WIC-eligible children ( $\leq 50\%$ ).

Category 4 (**High/High**): Defined by a high proportion of foreign-born individuals (>29.8%) and a high proportion of WIC-eligible children (>50%).

The cut-off points to define census tracts as 'low' or 'high' were based on the distribution of foreign-born individuals and WIC-eligible children in Washington state census tracts.

Using ACS data, Washington state census tracts were characterized based on median age, household income, percent of individuals 25 years and over with Bachelor's degree or higher, population density, percent of foreign-born, and percent of WIC-eligible children; census tracts were characterized for Washington state as a whole and for each of the four foreign-born/WIC-eligible children categories above (i.e., low/low, low/high, high/low, high/high). Additionally, the distance between the centroid of each census tract and the nearest WIC-authorized ethnic store was obtained through the "Generate Origin-Destination Link" function in ArcGIS Pro's analysis toolbox pane. The median distance for all Washington state census tracts and within each of the four foreign-born/WIC-eligible children categories was estimated. Further, the distribution of ethnic and non-ethnic WIC-authorized stores was assessed for Washington state as a whole and for each of the four foreign-born/WIC-eligible children categories. To assess differences in census tract characteristics by foreign-born/WIC-eligible children categories, Pearson's Chi-squared tests (continuous) and chi-square analysis (categorical) were conducted in R Studio.

## Results

**Figure 1** displays the distribution of foreign-born individuals and WIC-eligible children at the census tract level, as well as the location of WIC-authorized stores, categorized as ethnic

vs. non-ethnic, in Washington state and its major cities. Census tracts with a high proportion (>50%) of WIC-eligible children were evenly distributed across Washington state. On the other hand, census tracts with a high proportion of foreign-born (>29.8%) and census tracts with a high proportion of both foreign-born and WIC-eligible children were concentrated in the Greater Seattle Area and the City of Yakima. WIC-authorized stores, regardless of ethnic categorization, were mostly clustered in the Greater Seattle Area and other major cities, while WIC-authorized ethnic stores were clustered in the Greater Seattle Area and the City of Yakima.

**Table 1** displays the socio-demographic characteristics of Washington state census tracts, by foreign-born/WIC-eligible children categories. Census tracts classified as “High/High” had the lowest mean age, the lowest median household income, the lowest proportion of educated individuals, and the lowest population density. Census tracts classified as “High/Low” – with a high proportion of foreign-born individuals and a low proportion of WIC-eligible children – had the highest household income and the highest percentage of individuals 25 years or older with bachelor’s degree or higher. Census tracts classified as “High/High”, followed by “High/Low,” had the shortest median distance between their census tracts’ centroids and the nearest WIC-authorized ethnic stores, when compared to census tracts classified as “Low/Low” and “Low/High”.

**Table 2** summarizes the distribution of WIC-authorized stores, including any, ethnic, and non-ethnic, by census tract category based on the proportion of foreign-born individuals and WIC-eligible children. Out of 1784 census tracts in Washington state, 520 census tracts (29.1%) had at least one WIC-authorized store. Census tracts classified as “High/High” and “Low/High” had higher proportions of any WIC-authorized store, compared to census tracts classified as “Low/Low” and “High/Low.” This tendency also applies to WIC-authorized ethnic and non-

ethnic stores. Only 31 (1.7%) census tracts in Washington state had at least one WIC-authorized ethnic store. Census tracts categorized as “High/High” had the highest frequency (14.5%) of having at least one WIC-authorized ethnic store. However, 47 out of 55 (85.5%) census tracts categorized as “High/High” – with high concentrations of both foreign-born individuals and WIC-eligible children – did not have a WIC-authorized ethnic store.

## **Discussion**

### **a. Key Findings and Implications of Findings**

This study sought to describe 1) the geographic distribution of immigrant WIC-eligible children in the state of Washington; 2) the geographic distribution of WIC-authorized stores across the state of Washington, including ethnic and non-ethnic stores; and 3) the accessibility (by distance) of WIC-authorized ethnic stores by immigrant WIC-eligible children.

This study found that WIC-authorized stores were evenly distributed across the state of Washington, but WIC-authorized ethnic stores were highly clustered in census tracts with high proportions of foreign-born individuals and WIC-eligible children (i.e., those classified as “High/High”). Similarly, the median distance between census tracts’ centroids and the nearest WIC-authorized ethnic store was shorter for census tracts with high proportions of foreign-born individuals (i.e., those classified as “High/High” and “High/Low”).

The concentration and proximity of WIC-authorized ethnic stores in areas with high proportions of foreign-born individuals are consistent with previous findings of ethnic enclave economy studies. These studies suggest that ethnic businesses, including ethnic grocery stores, historically concentrate in areas where many immigrants reside.<sup>16,20,23,55,60</sup> Ethnic businesses are important for immigrant populations’ health in terms of 1) providing easy access to ethnic foods

via ethnic grocery stores and restaurants; 2) creating ethnically familiar social and physical environments where immigrants can make connections and exchange information; 3) providing fertile grounds for community organization and civic institutions; and 4) helping reduce discriminatory exposure and corresponding stress.<sup>23</sup> These economic, cultural, and social connections in ethnic enclave economies provide immigrants with essential resources for survival in a foreign country.<sup>23</sup> In the case of Washington state, the cities of Spokane and Vancouver did not have any WIC-authorized ethnic stores, and therefore, immigrant WIC participants in these cities may have limited access to their culturally preferred fruits and vegetables.

This study also found that only 32 out of 658 WIC-authorized stores in Washington state were classified as ethnic stores, representing 4.9% of all WIC-authorized stores. These 32 WIC-authorized ethnic stores were located in 31 census tracts out of 1784 census tracts in Washington state. One of the reasons for the small proportion of WIC-authorized stores being ethnic stores in Washington state may be due to Washington WIC's strict minimum inventory requirements. The minimum inventory requirements mandate WIC-eligible stores to stock minimum amounts and varieties of healthy staple foods and beverages as a condition for WIC authorization, so that authorized retailers have enough consistency and variety of stock to serve the needs of program beneficiaries.<sup>61</sup> At the federal level, the minimum inventory requires only two varieties of fruits, two varieties of vegetables, and one variety of whole grain cereal.<sup>61</sup> State and local agencies can add further requirements to the federal ones.<sup>61</sup> Washington state has a comparatively higher standard for minimum inventory requirements than the national median in terms of variety and quantity of each food group stocked.<sup>61</sup> For example, Washington state requires a minimum stocking of 5 varieties of fruits and 5 varieties of vegetables.<sup>61</sup> These additional requirements are

universally applied regardless of the vendor size, type (e.g., superstores, supermarkets, grocery stores, convenience stores vs. pharmacies), and location (urban vs. rural).<sup>61</sup> Thus, it would be easier for supermarkets and larger grocery stores to fulfill the Washington state minimum stocking requirements than for smaller grocery stores, including ethnic stores. In comparison to Washington state, 24 states had established different minimum inventory requirements based on vendor size, type, and location by 2017.<sup>61</sup> Future studies should investigate whether modifying minimum inventory requirements based on store size, type, and location, in order to serve the various needs of WIC participants, including immigrant families, would facilitate the application of ethnic stores to become WIC-authorized.

Other barriers for small stores, including ethnic stores, to become WIC-authorized were reported to be confusion regarding the application process and issues with record-keeping and auditing procedures.<sup>35,63</sup> These barriers were further complicated by language barriers experienced by ethnic store owners.<sup>37</sup> The Washington State Department of Health currently only has WIC vendor application instructions on its webpage in English and Spanish.<sup>64</sup> Thus, burdensome applications not in the ethnic store owners' preferred language may have contributed to the limited number of WIC-authorized ethnic stores in Washington state. To provide immigrant WIC-eligible populations with equitable access to their culturally preferred fruits and vegetables, further research should focus on identifying the barriers and facilitators for ethnic stores to become WIC-authorized in Washington state. In this process, it would be important to involve immigrant WIC participants in identifying ethnic stores that operate as social centers, cultural consultants, language translators, and centers of safe and comfortable foods and to understand, based on their lived experience, how WIC can serve them better.

## b. Strengths and Limitations

To the best of our knowledge, this study is the first to examine the accessibility of WIC-eligible immigrant groups to culturally preferred foods, especially fruits and vegetables, through WIC-authorized ethnic stores. Ethnic stores play a vital role in providing immigrants with culturally preferred foods and guidance for new food environments, but barriers exist within WIC to authorize more ethnic food stores. Despite the limitations described below, this study will help inform the Washington WIC program to better serve WIC-eligible immigrant populations.

Several limitations are identified for this study. First, this study focused on assessing the distribution of, and distance to, WIC-authorized ethnic stores in Washington state in relation to areas where immigrant WIC-eligible children reside. A study reported that immigrants are mobile, and not necessarily shop in their closest food store.<sup>65</sup> Immigrants have shown to implement several strategies to acquire their culturally preferred foods, including utilizing public transportation to travel far to multiple ethnic grocery stores and charity donation sites that provide culturally preferred foods and utilizing the community, family, and friends to share foods and transportation to their preferred food outlets.<sup>65</sup>

The second limitation refers to the accuracy of immigrant WIC-eligible children estimation at the census tract level. The percentage of WIC-eligible children at the census tract level in this study may be overestimated because the census data used to estimate the percentage of WIC-eligible children included children under 6 years old with less than 1.85 ratios to the federal poverty level. The actual WIC eligibility for children is up to one month after the children's 5th birthday. Additionally, the percentage of foreign-born individuals regardless of age at the census tract level was used in this study to estimate a range of immigrant WIC-eligible

children for two reasons. There were no census data available that could connect either individual household income or age to the number of children who had at least one foreign-born parent or who were foreign-born themselves.

Another limitation comes from the categorization of ethnic stores. In this study, access to culturally preferred fruits and vegetables among immigrants was assumed to be achieved only through ethnic stores. Some mainstream grocery supermarkets and grocery stores adapt to customers' demands and carry ethnic products and produce, based on the population they serve in the community. However, previous literature revealed that immigrant populations prefer smaller ethnic stores for several reasons. Language spoken and written at ethnic stores was one of the most significant factors for use among immigrant populations, who may have difficulty communicating in English <sup>3,4,6,23,37</sup> There was also potential for misclassifying stores as ethnic or non-ethnic. This risk arose from relying solely on online information without on-the-ground verification when the self-identification criterion was not met.

Lastly, the groups of immigrants each ethnic store caters to were not well depicted in the data, thus preventing ethnic stratification in our study. This study acknowledges the difference in food insecurity prevalence among different immigrant groups and the need to prioritize those with higher food insecurity. This study also acknowledges the cultural diversity, significant differences in culturally preferred foods among immigrants, and variability in affordability and accessibility to culturally preferred foods in Washington state. As a next step, it is important to identify the subgroups of immigrant populations who are underserved through WIC-authorized stores and prioritize the needs of high-risk immigrant populations.

## **Conclusion**

Census tracts with higher proportions of foreign-born individuals and WIC-eligible populations had the greatest accessibility to WIC-authorized ethnic stores, in terms of location and distance. However, WIC-authorized ethnic stores are rare in Washington state, present in only 2 percent of census tracts. To better serve the needs of immigrant WIC-eligible populations by providing access to culturally preferred fruits and vegetables through WIC-authorized ethnic stores, further participatory investigation on the barriers and facilitators for ethnic stores to become WIC-authorized would be needed.

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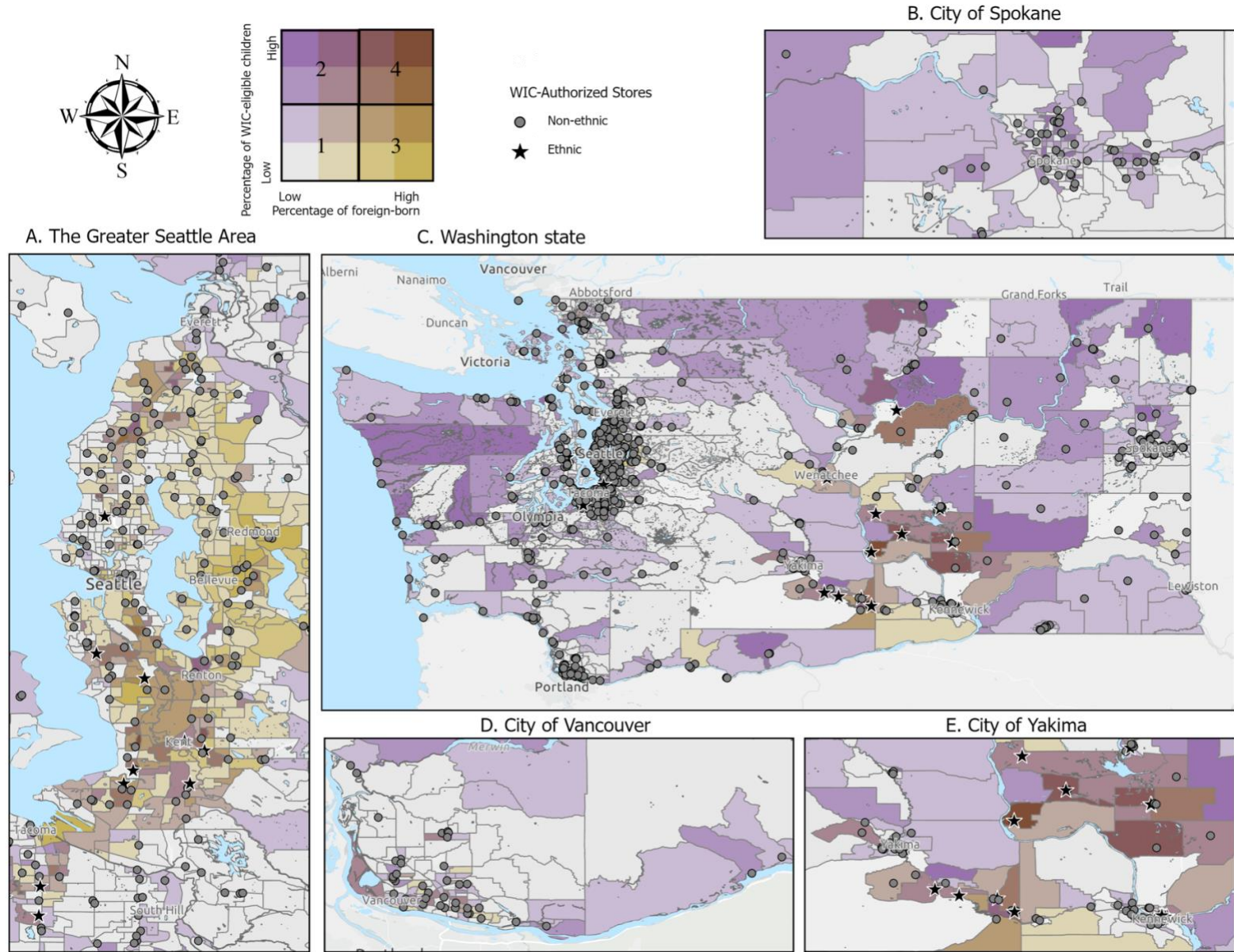
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**Figure 1:** Distribution of foreign-born individuals and WIC-eligible children and location of WIC-authorized stores in Washington state



**Table 1:** Characteristics of Washington state census tracts by proportion of foreign-born individuals and WIC-eligible children

		<b>Low/Low<sup>1</sup></b> (n=1279)	<b>Low/High<sup>2</sup></b> (n=295)	<b>High/Low<sup>3</sup></b> (n=155)	<b>High/High<sup>4</sup></b> (n=55)	<b>Total Washington state</b> (N=1784)
<b>Age (years)</b>	Median	39.80	36.70	36.40	32.10	38.80
	(IQR)	(35.30-44.60)	(31.65-43.20)	(33.75-38.90)	(26.80-35.25)	(34.60-43.70)
	Missing*	14	0	0	0	14
<b>Household income (\$)⁵</b>	Median	87859	56421	104800	53865	80658
	(IQR)	(68736-110600)	(45426-68195)	(72158-140600)	(47456-65891)	(61596-106800)
	Missing*	23	1	1	0	25
<b>Percent of 25 years+ with Bachelor's degree or higher (%)</b>	Mean	38.19	23.28	50.55	20.68	36.25
	(SD)	18.71	13.22	24.34	16.46	19.88
	Missing*	14	0	0	0	14
<b>Population Density (person/square miles)</b>	Median	2506	2751	2596	1348	2524
	(IQR)	(487.3-5348.0)	(760.9-5455.0)	(287.5-5734.0)	(267.3-3441.0)	(499.2-5346.0)
	Missing*	25	1	0	0	26
<b>Percent of foreign-born (%)</b>	Mean	10.72	11.06	37.77	37.32	13.95
	(SD)	7.29	7.83	6.77	6.07	11.33
	Missing*	0	0	0	0	0
<b>Percent of WIC-eligible children (%)</b>	Mean	17.83	68.77	17.75	71.45	27.90
	(SD)	15.45	14.10	17.22	13.67	25.53
	Missing*	0	0	0	0	0
<b>Distance between census tracts' centroids and the nearest WIC- authorized ethnic store (km)</b>	Median	20.27	43.17	10.80	3.04	18.76
	(IQR)	(7.96-60.38)	(9.39-125.10)	(5.27-17.23)	(1.56-10.16)	(7.46-59.28)
	Missing*	5	0	0	0	5

<sup>1</sup> Census tracts that have a low proportion of foreign-born individuals ( $\leq 29.8\%$ ) and a low proportion of WIC-eligible children ( $\leq 50\%$ )

<sup>2</sup> Census tracts that have a low proportion of foreign-born individuals ( $\leq 29.8\%$ ) and a high proportion of WIC-eligible children ( $> 50\%$ )

<sup>3</sup> Census tracts that have a high proportion of foreign-born individuals ( $> 29.8\%$ ) and a low proportion of WIC-eligible children ( $\leq 50\%$ )

<sup>4</sup> Census tracts that have a high proportion of foreign-born individuals ( $> 29.8\%$ ) and a high proportion of WIC-eligible children ( $> 50\%$ )

<sup>5</sup> The average household income greater than \$250,000 was reported as \$250,000+ in the original census data. Since the actual average household income is unknown, the calculation was made assuming the average household income is \$250,000 when it is reported as \$250,000+.

\*Not available due to ACS data suppression.

WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

**Table 2:** Distribution of WIC-authorized stores (any, ethnic, non-ethnic) by census tract category based on the proportion of foreign-born individuals and WIC-eligible children

	<b>Low/Low<sup>1</sup></b> (n=1279)	<b>Low/High<sup>2</sup></b> (n=295)	<b>High/Low<sup>3</sup></b> (n=155)	<b>High/High<sup>4</sup></b> (n=55)	<b>Total Washington state</b> (N=1784)	<b>p-value</b>
<b>Any WIC-authorized Store</b> n (%)	348 (27.2%)	107 (36.3%)	44 (28.4%)	21 (38.2%)	520 (29.1%)	p=0.008 <sup>†</sup>
<b>Any * WIC-authorized ethnic store</b> n (%)	6 (0.5%)	12 (4.1%)	5 (3.2%)	8 (14.5%)	31(1.7%)	p<0.001 <sup>‡</sup>
<b>Any WIC-authorized non-ethnic store</b> n (%)	345 (27.0%)	97 (32.9%)	42 (27.1%)	19 (34.5%)	503 (28.2%)	p=0.15 <sup>†</sup>

\*Categorization of ethnic stores was completed by meeting one or more of the following criteria. 1. (Self-Identification) Stores identify themselves as international, or as serving a specific ethnicity or race in their name. Examples include those containing the words “Mexican” or “Asian” in their names. OR 2. (Language) Language of signages in the stores, and/or language used to advertise online, and/or language in the store name is a language other than English. AND 3. (Product Assortment) Any type of non-chain grocery store that sells a substantial amount of food items that are distinctly cultural for one or more ethnicities. The stores typically specialize in catering to specific ethnic cuisines and may have a wide range of culturally specific ingredients, spices, and traditional foods. The stores may also carry products and brands that cater to the preferences and dietary needs of those ethnicities.

<sup>†</sup> Chi-square test

<sup>‡</sup> Fisher’s exact test

<sup>1</sup> Census tracts that have a low proportion of foreign-born individuals ( $\leq 29.8\%$ ) and a low proportion of WIC-eligible children ( $\leq 50\%$ )

<sup>2</sup> Census tracts that have a low proportion of foreign-born individuals ( $\leq 29.8\%$ ) and a high proportion of WIC-eligible children ( $>50\%$ )

<sup>3</sup> Census tracts that have a high proportion of foreign-born individuals ( $>29.8\%$ ) and a low proportion of WIC-eligible children ( $\leq 50\%$ )

<sup>4</sup> Census tracts that have a high proportion of foreign-born individuals ( $>29.8\%$ ) and a high proportion of WIC-eligible children ( $>50\%$ )

WIC = Special Supplemental Nutrition Program for Women, Infants, and Children

