The COVID-19 Pandemic Impact on Access to Culturally Sensitive Food in Seattle

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Abstract

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Disruption of the COVID-19 pandemic created a relatively sudden and compressed onset of economic downturn, high unemployment rates, stay-at-home orders, closure/limited hours for food retail, with a substantial impact on food insecurity. While researchers have explored food access during the COVID-19 pandemic, assessing culturally sensitive food options was often not considered in their studies. This research aims to focus on this aspect using Seattle as a case study while considering food business operation status (closed or open). The study examines culturally sensitive food access changes with food business operation status (closed or open) and business ethnic associations. Building on research conducted from the beginning of pandemic lockdown in Seattle (Proksch et al. 2021) on business operational status, access is analyzed through three sets of binomial regression models representing three periods (early beginning, business reopening, and post restrictions) in the COVID-19 pandemic (May/ June of 2020, November/ December of 2020, and June/ July of 2022 respectively). The results suggested that during the COVID-19 pandemic, culturally sensitive food access was less likely to reduce compared to mainstream food access.

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1. Introduction

The COVID-19 pandemic has disrupted the economy and exacerbated vulnerabilities in the food system. In response to the COVID-19 pandemic, many US states and local governments started to impose physical distancing and later lockdown mandates after the declaration of a national health emergency on Mach 13, 2020 (Executive Office of the President 2020). These measures forced businesses in many states to close (Schumaker 2020). Fairlie (2020) points out that the number of active business owners in the US dropped by 3.3 million from February to April, an estimated 22% decline. California alone lost 17% of its business sales during the second quarter of 2020 compared with the prior year (Fairlie and Fossen 2021). These economic disruptions forced many workforces to be laid off, creating an unemployment rate of 7.9% in September 2020, a rate not seen since the great depression (Center on Budget and Policy Priorities, 2020).

Unlike other crises, the COVID-19 pandemic disruption created a relatively sudden and compressed onset of economic downturn, high unemployment rates, stay-at-home orders, closure/limited hours for food retail, school closures (and consequently the reduced offering of school nutrition programs), with substantial impact on food insecurity (Janda et al., 2021). Studies have shown that household food insecurity in the US increased from 11% in 2018 to 38% in March 2020 and more than 30% of households with children under 18 were food insecure as early as April of 2020 (Fitzpatrick, 2020; Bauer, 2020). The increase in food insecurity and reduction in food access were also observed in many parts of the nation, on both regional and local scales (Kar et al., 2021; Niles et al., 2020). Although

under this global pandemic crisis, everyone is more or less affected by this food access disruption, US communities of color, particularly non-Hispanic Black and Hispanic Americans, and communities with lower income levels had a higher likelihood of being food insecure or experiencing reduced access to food (Clay and Rogus 2021). Furthermore, while many studies explore the disruption of the COVID-19 pandemic on food access in the US, it has been challenging to find research exploring the disruptions to culturally sensitive food access during the COVID-19 pandemic.

The goal of this thesis is to explore culturally sensitive food access in Seattle during the COVID-19 pandemic. While researchers point out that the COVID-19 pandemic has impacted general food access, the impact on access to culturally sensitive food has not been mentioned in most research. Only a handful of research explored and included culturally sensitive food (Muhammad, 2021). In many studies, discussions of food access in ethnic minority neighborhoods were often associated with a higher concentration of fast food, liquor stores, and convenience stores rather than fresh produce and healthy food options. Yet, oftentimes culturally sensitive foods provided by local ethnic food businesses, not considered by most food access studies, are sufficient for the neighborhood where these businesses were located (Joassart-Marcelli, Rossiter, and Bosco, 2017). There are also cases where replacing local ethnic food businesses with mainstream grocery supermarkets have resulted in reducing food access for residents, especially those at lower income levels (Anguelovski 2015).

Furthermore, with reduced foot traffic due to work-from-home practices implemented by many workplaces and other public safety measures enforced by the government, the capacities of business operation were reduced, as well as consumers' mobility to visit and ability to purchase. This consequently reduced the number of visitors to food businesses. Research has shown all types of food retailers experienced a decline in the number of visitors in the early period of the COVID-19 pandemic (Kar et al. 2021). The customer base of food businesses also shifted to residents in their surrounding neighborhoods during the COVID-19 pandemic as foot traffic in large multipurpose center retail cores decreased and foot traffic in small local convenience centers increased (Ballantyne et al., 2022). Existing research exploring the COVID-19 disruption on food access generally used individual survey data (Clay and Rogus 2021; Niles et al. 2020; Janda et al. 2021) or individual travel data (Kar et al. 2021), both of which assessed food access disruption during the COVID -19 pandemic from the demand side perspective. From a supply-side perspective, this paper explores using food retail business operation status (closed or open) as a proxy to evaluate food access changes during the COVID-19 pandemic.

This paper assesses culturally sensitive food access changes during the COVID-19 pandemic by using food retail operation status. The study uses binomial regression models to estimate culturally sensitive food access changes based on food business operation status and ethnic association[1], which indicates whether a business provides culturally sensitive food. The research utilizes data collected from the University of Washington

[1] The ethnic association of business is determined by a method developed by this thesis. The detailed determination process is documented in the Data Collection section and Appendix.1.

COVID-19 Rapid Response Research[2] field survey data on food business closure during the COVID-19 pandemic in Seattle and other open data sources such as Google Knowledge Panel (Proksch et al. 2021). That research project analyzed 941 individual food businesses across 44 census block groups in Seattle, accounting for 17% of all food businesses in the City. In addition to ethnic association, this thesis also utilized other business characteristics and neighborhood characteristics in the models.

The remaining structure of this thesis is divided into the following chapters: literature Review, data and methodology, results, discussion, and conclusion. The literature review includes the definition of topics such as food access and culturally sensitive food, as well as existing literature studying food access during the COVID-19 pandemic. Next, the data and methodology explain the research goal, hypothesis, data collection, data description, and methods of this research. Then, the results present the findings of the analysis. Following that is the discussion, which reiterates the hypothesis and interprets the results, along with the findings of the results when compared to existing literature. The last chapter is the conclusion section of the paper, which wraps up the findings and addresses implications for future research.

[2] University of Washington COVID-19 Rapid Response Research is a collaboration among faculties from the Department of Urban Design and Planning, Department of Architecture, and Runstad Department of Real Estate at the University of Washington. The principal investigator of that research is Dr. Jan Whittington.

2. Literature Review

2.1. Food Access and Food Security

Before discussing food access, we should understand the definition of food security first as the concept of food access is one of the many elements addressed by food security. The definition of food security is an evolving concept. When it arose in the 1970s, the concept of food security initially referred mainly to food supply. However, the concept soon involved and included access to food as scholars at the time began to recognize that food availability was not sufficient for ensuring household access to food (Jones et al. 2013). Currently, according to the Food and Agriculture Organization, food security is defined as: *"When all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life."* (Food and Agriculture Organization of the United Nations 2005)

The current concept of food security could be broken into the following three dimensions: availability, access, and utilization (Jones et al. 2013; Leroy et al. 2015). Food availability, as mentioned above, refers to the food supply, which could be described as the physical availability of food in a nation or community. The dimension tackles food shortages and other food supply issues in the food system. As for food access, the dimension refers to individual access to the food source. This included physical (geographic) and economic access to food, access to food that is culturally acceptable, and safety of food consumption. Last but not least, food utilization refers to individual-level consumption and absorption. The dimension encompasses the allocation of food within

households, the nutritional quality of that food, and the bioavailability of nutrients in those foods. On top of these three dimensions, stability is also required to fulfill food security, which is when all three dimensions are present at all times.

Although food availability remains a fundamental component of our current understanding of food security, in food-rich developed nations (i.e. the US), instead of availability of food, lacking access to food contributes more to food insecurity (Barrett 2010). Food insecurity in this aspect does not occur alone. It is often associated with poverty or economic disadvantage. Research has shown that low-income households are more likely to be food insecure than people who live in higher-income households (Seligman and Schillinger 2010; Larson, Story, and Nelson 2009). In the US, in addition to income classes, race and ethnicity also create a disparity in this matter where people of color have a higher chance of being food insecure than people who are non-Hispanic white (Odoms-Young and Bruce 2018; Hernandez, Reesor, and Murillo 2017).

2.2. Culturally Sensitive Food

Cultural acceptability is one of the components addressed in the concept of food access as mentioned in the previous section. In addition to a nutrition function, food also shares a function that allows people to make social distinctions and establish social linkages (Rozin 2005). Cultural backgrounds such as ethnic groups and behaviors, as well as religious beliefs tend to affect our food preferences, which explains the ethnic and cultural food oasis we see in cultural minority communities. This includes the Taiwanese

community in Flushing, Queens, NY, the Middle Eastern community in Dearborn, MI, and the Cuban community in Little Havana, Miami, FL, to name but a few.

That being said, culturally sensitive food remains an understudied area in the field of food security and food access (Grigsby-Toussaint et al. 2010; Fleischhacker et al. 2011). The limited attention to culturally sensitive food received in the field has led to studies misinterpreting some communities' food security levels, especially those within an ethnically diverse population.

Joassart-Marcelli, Rossiter, and Bosco (2017) claim that ethnic markets or stores were often left out while determining whether an ethnically diverse neighborhood is considered a food desert. Their research investigated how ethnic markets contributed to food security in communities of low income and color in City Heights, San Diego, CA, which was deemed as a food desert according to the United States Department of Agriculture, by surveying every food store in the neighborhood and analyzing the community's food security through the lens of accessibility, affordability, and cultural acceptability. The study's results suggested that the community can access healthy and affordable food with the consideration of ethnic markets.

Culturally sensitive food may be difficult to define as culture is itself highly variable. Scholars may need to first understand food appropriateness based on cultural subgroups before defining culture. Furthermore, researchers would often time be misled by the

characteristics of ethnic markets, where most culturally sensitive foods are found, by failing to acknowledge their existence, or focusing on other characteristics such as the distinction between supermarkets, grocery stores, convenience stores, liquor stores, and so on (Moore and Diez Roux 2006; Cavanaugh et al. 2013). This critique is echoed by another study which mentioned that ethnic markets tend to be conflated with convenience, corner and liquor stores, with limited foods, sugar-sweetened beverages, alcohol, and little if any fresh fruits and vegetables since store type is used as an indicator of healthy food availability (with supermarkets presumably providing the best options) (Ortega et al. 2015).

With this in mind, acknowledging culturally sensitive food is curtail to truly understanding food access in a community. However, this doesn't disregard food access issues of ethnically diverse communities found in previous research. Instead, the acknowledgment of cultural factors or culturally sensitive food helps research in the field develop a more wholesome understanding of the food scene, and further provides adequate suggestions for policymakers.

2.3. Disruption of the COVID-19 Pandemic

2.3.1. Timeline and Public Safety Measure

The outbreak of SARS-CoV-2 started in Wuhan, China in the November of 2019 and became a global COVID-19 pandemic. The pandemic forced many worldwide governments to take action in order to reduce the infection rate. In the US, patient zero was first

identified in Seattle on January 21, 2020 (Singh 2020). By March 13, 2020, the US government declared a national emergency regarding the outbreak (Executive Office of the President 2020). Figure 1 illustrates the timeline of the COVID-19 pandemic (infection case number in both Seattle and King County) and public safety requirements issued in Seattle from 2020 to early 2021.

In Seattle, where patient zero was identified and where the study area of this paper is located, Washington State Governor Inslee declared a public health emergency for Washington State and King County on February 29, 2020 (Washington Governor's Office 2020a). Public safety measures, including social distancing and indoor space closures, commenced in King County on March 15, 2020, in an effort to decrease the virus spread.

The measure restricted all gatherings of 50 or persons to cease, particularly in the food retail industry where:

1) Restaurants, bars, dance halls, clubs, theaters, health and fitness clubs, and other similar indoor social or recreational venues must cease operations until March 31, 2020.
2) Restaurants and food service establishments may remain open only for drive-through, delivery, and pick-up only, until March 31, 2020. At this point, all other retailers such as groceries, pharmacies, banks, gas stations, hardware stores, shopping centers, etc. may remain (King County Executive 2020a).

However, on March 23, 2020, the State issued a stay-at-home order with the exception of essential businesses and critical functions (Washington Governor's Office 2020b). The measure in Seattle was only loosened on June 19, 2020, under Governor Inslee's Safe Start program when the rate of infection gradually reduced. At this point, restaurants were allowed to resume operation to include in-person dining at 50% capacity (King County Executive 2020b). This measure was in place for a couple of months until November 16, 2020, when Governor Inslee once again ordered all restaurants to eliminate in-person dining, resorting to take-out and delivery services only, as the virus resurged (Washington Governor's Office 2020c).

After the holiday season and the peak of infection rate passed, the governor moved King County back into the 2nd reopening phase, allowing indoor dining at a 25 percent capacity on February 17, 2021. On June 30, 2021, Governor Inslee announced the reopening of all businesses at full capacity, marking the end of 15 months of strict public safety measures in Seattle (Washington Governor's Office 2021). While technically the COVID-19 pandemic was still an ongoing event, at that point, business activity resumed to pre-pandemic capacity. The only enforced public safety measure in place was the mask mandate in some indoor environments and transit facilities, which was lifted on April 18, 2022 (Savage and Murphy 2022). It is worth noting that since the COVID-19 pandemic is still an ongoing event, some businesses and entities may still enforce their own public safety measure. Individuals may also still practice public safety measures recommended by the Centers for Disease Control.

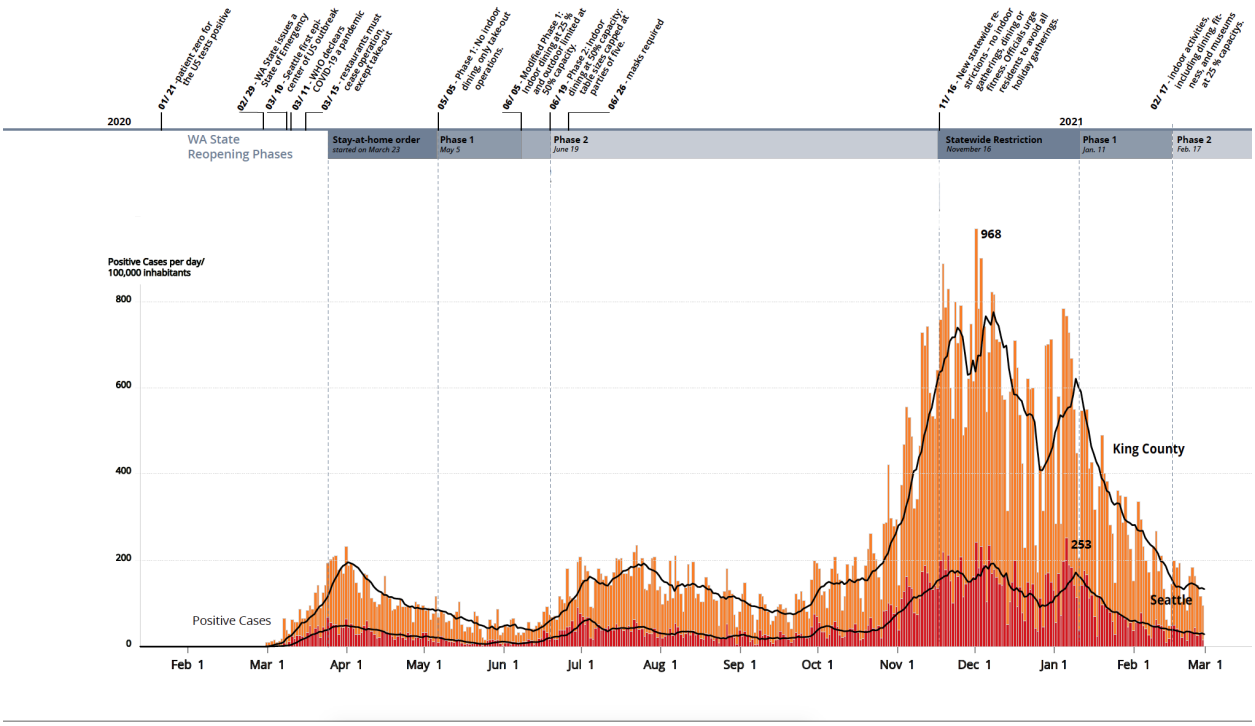

Figure 1 The COVID-19 Pandemic Timeline in Seattle 2020-2021
(Proksch et al. 2021)

2.3.2. Disruption to the Economy

The COVID-19 disruptions to the economy are evident from previous studies. In Fairlie's research (2020), the author indicated that social-distancing restrictions and health- and economic-driven demand shifts from COVID-19 shuttered many small businesses and entrepreneurial ventures, and provided an analysis of the impacts of the pandemic on the number of active small businesses in the US. The research discovered that the number of active business owners has dropped by 3.3 million (22%) from February to April of 2020 and a partial rebound from April to May and June, which is still down by 15% and 8 % respectively from February.

The economic losses in response to the COVID-19 pandemic were identified in Fairlie and Fossen's later study (2021). Evidence showed that sales losses were largest in businesses affected by mandatory lockdowns such as accommodations, drinking places, arts, entertainment, and recreation. Distinguishing between essential and nonessential businesses, which were subject to early lockdowns, and by the level of person-to-person contact, the authors indicated that local implementation and enforcement of lockdown restrictions for public health safety and voluntary responses to the perceived local COVID-19 spread both played a role. The economic disruptions also forced many workforces to be laid off, creating an unprecedented unemployment rate of 7.9% in September 2020 since the great depression (Center on Budget and Policy Priorities, 2020). O'Hara and Toussaint (2021) pointed out that due to the COVID-19 pandemic forced the closure of food businesses and hotels, millions of hospitality sector jobs have vanished, and food banks around the country are struggling to meet the demand of hungry Americans seeking help.

On the other hand, under the COVID-19 pandemic, the working-from-home environment has become more widespread and accepted by many businesses. While small businesses obtain a relative growth advantage due to flexibility compared to large firms, they are typically more vulnerable under economic crises. Research has discovered that small businesses in states with higher working-from-home rates performed better with industry variations, controlling for local pandemic and socioeconomic factors; and working-from-home rates increased after stay-at-home orders were rescinded (Zhang et al.

2021). This presents another economic disruption of the COVID-19 pandemic. With the working-from-home rate increases, retail locations and services may shift to accommodate consumers' behavioral changes. Evidence showed in addition to sales dropping in all physical retail stores industries after the stay-at-home order, the share of large multipurpose center retail core decreased while the share of small local convenience centers increased (Ballantyne et al. 2022). These studies have shown a phenomenon of people concentrating their consumption in businesses nearby where they live and businesses increasing their dependence on customers who live close by.

2.3.3. Disruption to the Food Access

The COVID-19 pandemic created a relatively sudden and compressed onset of economic downturn, high unemployment rates, stay-at-home orders, closure/limited hours for food retail, school closures (and consequently the reduced offering of school nutrition programs), as well as other public safety measures have had a substantial impact on food insecurity (Janda et al., 2021). According to Feeding America's projection in the early COVID-19 pandemic, the organization projected up to an additional 17 million people could soon become food insecure (Feeding America 2020), adding to the nearly 13.7 million people that were already insecure in 2018, for a total of 23.5%. On the other hand, Northwestern University estimated that food insecurity prevalence would increase to 25.5% during the COVID-19 pandemic (Schanzenbach and Tomeh 2020). Studies have shown that household food insecurity in the US has increased from 11% in 2018 to 38% in March 2020 and more than 30% of households with children under 18 were food insecure

as of April 2020 (Fitzpatrick, 2020; Bauer, 2020). The increase in food insecurity and reduction in food access were also observed in many parts of the nation, on both regional and local scales. In Vermont, Niles et al. (2020) found food insecurity increased during the COVID-19 pandemic in their study. The research conducted a statewide population-level survey (N=3,219) and measured respondents' food insecurity before COVID-19 and during COVID-19. The results showed nearly one-third of respondents were food insecure, with 35% of food insecure respondents only becoming insecure since the COVID-19 pandemic. The research also that pointed out respondents experiencing job loss have significantly greater odds of experiencing household food insecurity since the COVID-19 pandemic.

In addition to the trend of an increasing number of people becoming food insecure during the COVID-19 pandemic, researchers also explore how the pandemic affected food insecurity and access to food for people of different socioeconomic conditions. On a national scale study, Wolfson and Leung (2020) assessed the early effects of the COVID-19 pandemic among low-income adults in the US. In their study, they found as of mid-March, 2020, 44% of adults with an income <250% of the federal poverty line were food insecure, and these individuals were more likely to be non-Hispanic Black or Hispanic. Evidence showed that in mid-March 2020, food insecure adults working essential jobs were at greater risk of losing their income or their jobs if they got sick from COVID-19. Within the low-income group, food insecure adults were more likely to be laid off compared to food secure adults. The study concluded that the short-term effects of the COVID-19 pandemic

amplified the existing disparities, which disproportionately affected low-income and food insecure households that were already struggling to meet basic needs.

Clay and Rogus (2021) also found a similar result. In their research, they examined issues with food access experienced by demographic characteristics, work disruptions, health impacts, and risk for contracting the virus among low-income and Black, Indigenous, and people of color (BIPOC) in New York State (excluding New York City). Their study concluded that Hispanic residents of New York State, which worked essential jobs, were more likely to experience issues with food access during COVID-19. On the other hand, (Janda et al. 2021) also got a similar result in their study. The team utilized data from 367 households in ethnically diverse low-income communities and measured respondents' food security before and since COVID-19 in Eastern Travis County, TX. Similar to studies mentioned earlier, the research results showed that respondents identifying as Latino and/or Black were additionally associated with being consistently food insecure before and during the COVID-19 pandemic.

Overall, essential workers have faced an increased risk of exposure to the virus and limited food access due to their work in low-wage, inflexible jobs that often do not offer paid sick leave. While there was no difference in the risk associated with food access prior to the pandemic, these individuals were likely in greater need of support during this time, particularly due to the increasing health risks they faced and the pandemic's economic disruption. Additionally, it is shown in research that communities of color, particularly

non-Hispanic Black and Hispanic Americans, and communities with lower income levels tend to have a higher chance of being food insecure or reduced access to food (Clay and Rogus 2021; Janda et al. 2021; Wolfson and Leung 2020). While many studies have explored the disruption of the COVID-19 pandemic on food access in the US, to the best knowledge of this paper, no existing research has explored the disruptions of culturally sensitive food access during the COVID-19 pandemic.

On top of the economic aspect of food access under the COVID-19 pandemic, research on physical access also portrayed similar disparities between different communities. Evidence has shown that grocery shopping trips in low-income areas experienced smaller changes even during the lockdown period. It is shown that a higher percentage of low-income customers was associated with lower store visits during the lockdown period. On the other hand, stores with a higher percentage of white customers declined the least and recovered faster during the reopening phase (Kar et al. 2021).

3. Data and Methodology

The goal of this research is to examine culturally sensitive food access in Seattle during the COVID-19 pandemic. The study uses food business operation status to indicate food access changes in the City of Seattle. The research evaluates whether ethnically associated food businesses that allow culturally sensitive food were being affected differently during the early stage of the COVID-19 pandemic in comparison with mainstream food businesses. The ethnic association of each food business is determined by information collected through the Google Knowledge Panel and additional information gathered from other internet sources. Classification is determined mainly through the following two sources, the name of the business and Google business classification.

The research question this study aims to answer is:
Whether culturally sensitive food businesses were being affected differently during the early stage of the COVID-19 pandemic in comparison with mainstream food businesses?

3.1. Hypothesis

This study hypothesized that under the disruption of the COVID-19 pandemic, Seattleites' main food source depended on food businesses located near where they lived. Food businesses' customer base shifted to surrounding residents when the COVID-19 pandemic began and public safety measures were implemented, which affected the businesses' operation capacity as well as consumers' mobility to visit and ability to purchase. With the neighborhood's main food source depending on nearby food businesses

and food business operations relying on the surrounding neighborhoods, food business operation status (closed or open) would be closely connected with food access changes. Therefore, operating status could serve as a proxy for food access changes.

3.2. Data Collection

The research intends to evaluate the culturally sensitive food access impacts through the closure of ethnic food businesses after the COVID-19 pandemic begins. The main dataset utilized in this study is the food business survey data collected by the University of Washington COVID-19 Rapid Response Research (COVID RR) Team which includes the food business operation status during the early period of the COVID-19 pandemic (Proksch et al. 2021; Sun et al. 2022). Inspired by the American Association of Geographers (AAG) presentation of the COVID RR Team (Proksch and Whittington 2022), research for this thesis included collecting additional business characteristics information associated with the COVID RR sampled food businesses. Business characteristics collected by this thesis include business ethnic associations, business current price range (as of 2022), and business current (June/July 2022) operation status (closed or open). The collected business ethnic associations are later used as the basis to determine whether a food business provides culturally sensitive food.

3.2.1. COVID RR Dataset

The COVID RR examined the impact of built environment and social demographic data on the operation status (closed and open) of the food business in the City of Seattle

during the height of the COVID-19 pandemic (Proksch et al. 2021; Sun et al. 2022). The COVID RR survey data was collected in two waves of field audit during the first two peaks of the COVID-19 pandemic, first during May and June and repeated in November and December of 2020. The COVID RR collected data from 941 individual businesses across 44 census block groups in Seattle, Washington. The sampling comprised the complete populations of customer-facing food businesses within each census block group, representing in part or whole the business districts within 16 of Seattle's neighborhoods, and 17% of all food businesses in the City of Seattle according to the 2018 Seattle food permit data (Sun, et al., 2022). The data collected by the COVID RR team is a representative sample of food businesses in Seattle (Proksch et al. 2021). The neighborhood study areas were geographically distributed throughout the city (Figure 1).

In addition to field survey data, COVID RR also joined the data with other publicly available datasets, including food businesses permit data, Google Knowledge Panel, zoning information, and census data. Census data obtained by COVID RR consist of racial composition and median household income in the study areas. The racial composition and median household income in the study areas were collected from the American Community Survey 2018 5-year data. The COVID RR measures the neighborhoods characteristics at a 400-meter buffer area of each food business, which is the walking distance preferred by most US research (a quarter mile). The sampled food businesses cover low-income, median-income, and high-income areas in the City.

The COVID RR datasets this thesis used are the business operation status during the first two peaks of the COVID-19 pandemic, the price range of the sampled businesses before the pandemic, and neighborhood characteristics which include median household income and the percentage of non-Asian people of color (NAPC).

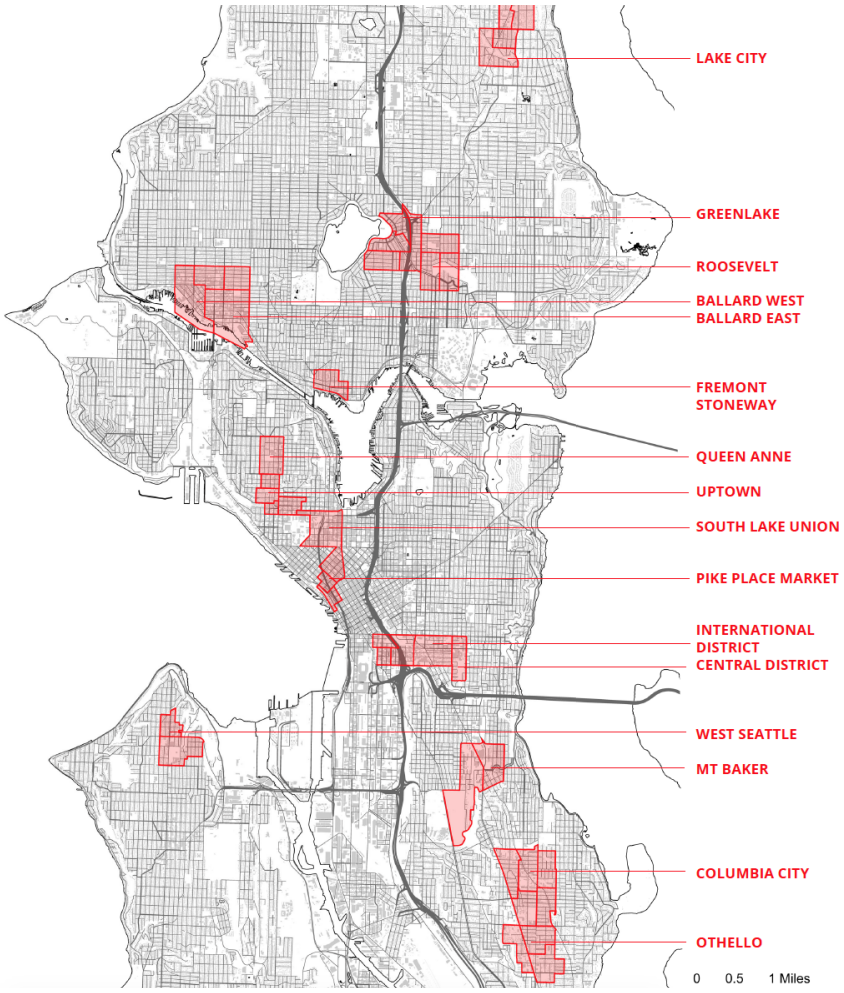

Figure 2 Study Areas of COVID RR and this research (Sun et al. 2022)

3.2.2. Google Knowledge Panel

In addition to data obtained from the study by Proksch et al. (2021), this thesis also gathered information on the ethnic association of individual food businesses, the current (the year 2022) price range of each business, and the current operations status of each business (permanently closed or still operating) from Google Knowledge Panel.

Ethnic association data this thesis used are built upon the ethnic restaurant data of Ballard, Colombia City, and Othello in Seattle collected by the COVID RR team (Proksch et al. 2022). Based on the dataset and similar data collection approach, this thesis collects ethnic association information of COVID-RR sampled food businesses in the remaining 12 neighborhood study areas.

The name of the business is the first step of screening as it shows what ethnic association the business owners identified their business with, if there was one. The study examines the business name through whether the business includes a specific socio-geographic term or a staple cuisine in its name, e.g. R&M Indian grocery or Wann Sushi (Appendix.1.). Next, the study looks into the business classification on the Google Knowledge panel and explores whether Google business classification indicates a business ethnic association, e.g. Thai Restaurant. If the previous two data sources couldn't provide sufficient information to determine the ethnic association of a business, the study would look into more descriptions from other internet sources (e.g. menu, internet review, yelp, etc.) to support the classification process.

As some of the initial classifications are too detailed or redundant for analysis, the study modifies categories based on their characteristics and the type of food served. Classifications that share similar characteristics or serve similar types of food are merged into a more general ethnic category (e.g. Turkish, Greek, Lebanon cuisine merge into the Mediterranean; brunch, burger, pizzeria be reclassified under the American) (Appendix.2.). In the meantime, notes are taken for food businesses that serve more than one category of ethnic association. However, a primary ethnic association is still selected and used for analysis in this research. The study identifies mainstream food as businesses under the American category or without specific ethnic association and culturally sensitive food as businesses under the category of other ethnicities.

Similar to the food business ethnic association, the current price range and the current food businesses' operation status are also collected from the Google Knowledge Panel supported by information from other internet sources. Both datasets are loosely based on the Google Knowledge panel designation with additional information from the internet such as the business's website and the business's Yelp page.

3.3. Data Description

The dataset used in this thesis, building on COVID RR dataset (Proksch et al. 2021; Sun et al. 2022), includes 941 individual businesses across 44 census block groups in Seattle, Washington. The sampling comprises the complete populations of customer-facing

food businesses within each census block group, representing in part or all the business districts within 16 of Seattle's neighborhoods, and 17% of all food businesses in the City of Seattle according to the 2018 Seattle food permit data. The dependent variable is the food business operation status in three periods of time during the COVID-19 pandemic. Two in 2020, obtained from the COVID RR field survey in May/June and November/December respectively, and the other in June/July 2022, which was collected by this thesis research through Google Knowledge Panel and other internet sources.

Independent variables can be categorized into business characteristics and neighborhood characteristics. Business characteristics include the pre-pandemic price range and 2022 price range as well as businesses' ethnic association. Neighborhood characteristics include median household income and non-Asian people of color (NAPC) percentage. Table 1 summarized the group of variables collected through COVID RR, Google Knowledge Panel, and other open data sources.

Table 1 Data distribution

Variables	Descriptions
Dependent Variables	
Operation status	Dichotomous variables (open/ closed). Status of May/Jun and Nov/Dec of 2020 source: COVID RR dataset; Status of Jun/Jul of 2022 source: This thesis, obtained from Google Knowledge Panel
Independent Variables	
Ethnic Association	Dichotomous variables (Ethnic/ Mainstream). Source: This thesis, obtained from Google Knowledge Panel and other internet sources
Price Range	Categorical variable. Pre-pandemic price range source: COVID RR dataset; Current price range source: This thesis, obtained from Google Knowledge Panel and other internet sources
Median Household Income	Continuous variables. Source: Based on COVID RR dataset. Data gathered from American Community Survey 2018
NAPC percentage	Continuous variables. Source: Based on COVID RR dataset. Data gathered from American Community Survey 2018

Table 2 provides a summary statistic for businesses. According to the COVID RR field survey in May and June 2020, around 25% of the sampled businesses were closed. By November and December of 2020, business closures had reduced, with the closure rate recovering to around 14%. The reassess of sampled businesses conducted by this thesis in June and July 2022 through internet sources found among all sampled businesses in 2020,

around 12% of businesses are closed. Businesses with ethnic associations account for almost half of the samples, with 43% of the samples having one or more ethnic associations. The majority of businesses within a two-dollar sign price range both before the COVID-19 pandemic and in 2022.

The neighborhood characteristics are measured within a 400-meter radius of each food business. Under this measurement, the mean aggregated median household income sampled was 83,710 dollars. The study also accounts for racial composition in the area by measuring the NAPC percentage. The mean NAPC percentage is 17%.

Table 2 Descriptive statistics of variables

		Overall	(N=941)
Closed in May/June 2020		(Count)	
	FALSE	703	74.71%
	TRUE	238	25.29%
Closed in November/December 2020		(Count)	
	FALSE	809	85.97%
	TRUE	132	14.03%
Closed in June/July 2022		(Count)	
	FALSE	825	87.67%
	TRUE	116	12.33%
Ethnic Association		(Count)	
	FALSE	540	57.39%
	TRUE	401	42.61%
Price Range pre-Pandemic		(Count)	
	$	334	35.49%
	$$	549	58.34%
	$$$	5	0.53%
	Not Available	53	5.63%

		Overall		(N=941)
Price Range in 2022		(Count)		
	$	352		37.41%
	$$	558		59.30%
	$$$	31		3.29%
Median Household Income		(USD)		
	Mean	83,710	Min.	33,119
	SD	24,174	Median	82,539
			Max.	147,762
NAPC percentage		(%)		
	Mean	17.16%	Min.	3.16%
	SD	8.86%	Median	17.01%
			Max.	48.55%

3.4. Methods

The study conducts the analysis with three sets of binomial regression models representing three times periods of the pandemic. The three time periods are early beginning (when the virus outbreak first started and stay-at-home orders were in place), business reopening (when businesses were allowed to operate their indoor space with limited capacity), and post restrictions (when most restrictions were lifted). The dependent variable of each model is the business operation status (open/closed) of May/June of 2020 (Period 1), November/December of 2020 (Period 2), and June/July of 2022 (Period 3) respectively. As for independent variables, all models include business ethnic associations, neighborhood median household incomes, and the NAPC percentage of the neighborhood. Since the dataset of independent variables would remain the same in three models, business operation status collected in different periods is expected to reflect food access changes in different periods of the COVID-19 pandemic. Period 1 and Period 2 models

reflect the immediate food access changes in the early beginning of the COVID-19 pandemic and the reopening period of the pandemic respectively. Model of Period 3 reflects the food access changes in the long term after most public health safety measures are lifted.

All of the models are checked for multicollinearity and variables with high correlation with others are excluded from the models, namely pre-pandemic business price ranges and price range in 2022. Compare to other variables, the categorical nature of both price range variables provides less information. These variables are also the only variables with missing values (shown in Table 2, "Not Available"), which led to the decision of excluding the variables.

3.5. Limitations

The data used in this thesis has a few limitations that are worth mentioning. Business ethnic association data are collected in June of 2022, which is not able to reflect the ethnic association condition of sampled businesses in the first two periods of the COVID-19 pandemic. Furthermore, neighborhood characteristics are based on the American Community Survey 5-year estimates in 2018, which may not fully account for the socioeconomic condition of 2020 and 2022, especially under the disruption of the COVID-19 pandemic.

4. Results

The results of each model are presented in Table 3. Coefficients were converted to odds ratios for better interpretation and comparison. If an odds ratio is less than one, it means there is a lower odds of association between the exposure and outcome. This indicates that the correspondent variable reduces the odds of business closure, which decreases food access changes. An odds ratio greater than one means there is a greater odds of association with the exposure and outcome. This indicates that the correspondent variable increases the likelihood of business closure, which amplifies access changes. The further an odds ratio is away from one, the stronger the association between the independent variable (exposure) and the dependent variable (outcome).

Table 3 Factors affecting food access changes

Factors	Closed in May/ Jun 2020 (Period 1)		Closed in Nov/ Dec 2020 (Period 2)		Closed in Jun/ Jul 2022 (Period 3)	
	aOR	SE	aOR	SE	aOR	SE
Ethnic Association	0.56***	0.17	0.67*	0.22	0.72	0.22
Median Household Income (Thousand Dollars)	0.98***	0.00	0.98***	0.01	0.99	0.01
NAPC Percentage (Percentage)	0.98	0.01	0.97	0.01	0.98	1.44

*Level of Significance: p-value < 0.01: '***', p-value < 0.05: '**', p-value < 0.1: '*'*
aOR: Adjusted Odds Ratio
SE: Standard Error

In the Period 1 model, the results suggest the odds of food business closing were 44% less in businesses with ethnic association compared to those without ethnic association. As for neighborhood household income, each one thousand dollars increase in the average neighborhood median household income of a food business 400m radius was associated with a 2% decrease in the odds of the business closing. In terms of non-Asian people of color (NAPC) percentage, every one percent increase in the average neighborhood NAPC percentage of a food business 400 m radius was associated with a 2% decrease in the odds of the business closing. However, the result for the NAPC percentage did not reach statistical significance in this model. This means that the observation of NAPC percentage in the Period 1 model could happen by chance.

In the Period 2 model, the results indicate food businesses with ethnic associations had 33% smaller odds of the business closing compared to those without one. Every one thousand dollars increase in the average neighborhood median household income of a food business 400 m radius was associated with a 2% decrease in the odds of the business closing. Each percent increase in average neighborhood non-Asian people of color portion of a food business 400m radius was associated with a 3% decrease in the odds of the business closing. Yet, the model suggests that the result for the NAPC percentage did not reach statistical significance. This means that the observation of NAPC percentage in the Period 2 model could happen by chance.

As for the Period 3 model, the results show food businesses with ethnic associations were associated with a 28% decrease in the odds of closing compared with businesses without associations. Every one thousand dollars increase in the average neighborhood median household income of a food business 400m radius was associated with a 1% decrease in the odds of the business closing. Each percentage increase in the average neighborhood non-Asian people of color percentage of a food business 400 m radius was associated with a 2% decrease in the odds of the business closing. That being said, the model suggests that the results for all variables in this model did not reach statistical significance. This implies that the observation of this model could happen by chance.

5. Discussion

This research aims to assess culturally sensitive food access changes during the COVID-19 pandemic by using food business operation status. The study estimates food business closure in three different periods of the COVID-19 pandemic, in association with business ethnic association, as well as income level and racial composition in neighborhoods surrounding a business.

5.1. Findings

The findings of the thesis show that in all three periods of the COVID-19 pandemic, food businesses with ethnic associations were less likely to close down compared to those with no ethnic association, which suggests culturally sensitive food access had a smaller likelihood of changing compared to mainstream food. The results show a pattern that food businesses with ethnic associations were less likely to close down compared to their counterpart that serves mainstream food in Period 1 and Period 2, and the odds ratio of the latter period is smaller than the earlier period.

As for neighborhood characteristics, the findings in Period 1 and Period 2 imply that for median household income, every increase in these variables was associated with the decrease in odds of food business closure. In other words, in neighborhoods where food businesses were sampled, food businesses located in an area with higher income levels had a smaller likelihood of closing in the early pandemic and reopening period, indicating smaller chances of food access changes during those periods. The indication of food access

was less likely to change in neighborhoods with higher income during the pandemic found in this research aligned with previous food access and the COVID-19 pandemic research where lower-income communities and individuals had a higher chance of experiencing reduced food access or food insecurity during the COVID-19 pandemic (Clay and Rogus 2021; Janda et al. 2021; Wolfson and Leung 2020).

Overall, the findings suggest that culturally sensitive food access was less likely to change. The findings also indicate that food access was less likely to change in neighborhoods of higher income levels during the early beginning of the COVID-19 pandemic. The same correlation applied during the reopening period of the pandemic, with the likelihood of culturally sensitive food access changes greater than in the previous period.

5.2. Constraints

One constraint of this paper is this analysis only examined food access changes during the COVID-19 pandemic. More research is needed to evaluate whether people in Seattle had sufficient access to culturally sensitive food prior to or post-pandemic. Moreover, the research design and data used in the model were only able to examine the "reduction" in food access changes. Although it was more likely for a business to cease operation during the COVID-19 pandemic, the research did not account for an increase in food access (newly established business) since operation status in Period 2 and Period 3

only reassessed the operation status of businesses sampled in the initial Period 1 field survey.

Furthermore, while accounting for cultural factors, the data collection methods this paper implemented were only able to account for immigrant ethnic groups. Ethnic associations of many other minority groups, such as African Americans and Native Americans, were not accounted for by the paper. This is due to the information was not available to the paper at the time of data collection and the paper was not able to be identified these ethnic groups without a deeper understanding of their culture. Future studies on culturally sensitive food could tackle the issue by developing a deeper understanding of the communities in the study area.

This research also noticed there were several factors regarding food business operation status that were not included in this paper while part of the original dataset collected by the COVID-19 Rapid Response Research team did which future study could provide a deeper understanding of the topic. One of them was the physical settings of food businesses. This included whether the business was located in walkable storefronts, food courts, strip malls, or stand-alone buildings, to name but a few. These characteristics presented a different level of an obstacle for businesses to stay in operation while preventing the transmission of the virus, which affected the likelihood of business operation status (Sun et al. 2022). Additionally, this thesis didn't account for the rise of the digital food retail sector during the pandemic. The application of food and grocery delivery

service could help individuals maintain their food access under public health restrictions and expand food businesses' limited service areas during the pandemic. While the application of food and grocery delivery services may have benefited individuals' access to food and improved food availability to them, the service may not be accessible to everyone. This may be due to additional costs from the service, which could create a burden on individuals of low-income groups. The service fee these services impose on food businesses could also exclude small food businesses with little resource to spare or leverage to negotiate, especially minority-owned ethnic food businesses providing culturally sensitive food. Furthermore, the delivery service area may not be able to serve individuals who were already experiencing food access issues before the pandemic due to their isolation from food businesses or other food sources.

6. Conclusion

Disruption of the COVID-19 pandemic has created a relatively sudden and compressed onset of economic downturn, high unemployment rates, closure/limited hours for food retail, as well as other public safety measures, which have had a substantial impact on the food system. While many researchers have explored food access during the pandemic, the element of culturally sensitive food was often not considered in these studies. This study is set forth to examine culturally sensitive food access changes compare with mainstream food access during the COVID pandemic.

The paper evaluates culturally sensitive food access changes during the COVID-19 pandemic by using food retail operation status. The study uses binomial regression models to estimate culturally sensitive food access changes based on food business operation status and business ethnic association. The results suggest that culturally sensitive food access was less likely to change compared to mainstream food access during the early beginning and reopening periods of the COVID-19 pandemic.

This research introduces cultural factors to the field of food access studies during the COVID-19 pandemic and provides empirical evidence suggesting there is an impact of cultural factors on food access. In addition, the research also provided suggestions for future studies to consider when applying culturally sensitive food factors and food business operation status in research.

Appendices

Appendix.1. Ethnic Association Classification Protocol

Preliminary business ethnic classification:

1. Examines the **business name**:

   Whether the business includes a specific socio-geographic term or a staple cuisine in its name.

   e.g. R&M Indian grocery or Wann Sushi.

2. Looks into the **business classification** on the **Google Knowledge panel**.

   Whether Google business classification indicates a business ethnic association.

   e.g. Thai Restaurant, Japanese Restaurant

3. If the **business name** and **business classification from the Google Knowledge panel** couldn't provide sufficient information to determine the ethnic association of a business, look into **more descriptions from other internet sources** to support the classification process.

   This includes but is not limited to *menu, internet reviews,* and *yelp.*

4. Business with **no specific ethnic association** would be place under the ethnic group of "American "

   e.g. Coffee shop

5. Notes are taken for food businesses that serve more than one category of ethnic association. However, a primary ethnic association is still selected and be used for analysis in this research.

   e.g. Vientiane Grocery, classified as a *Laotian business*, also provides food products for multiple *East/ Southeast Asian ethnic groups*. Thus, a second ethnic association would be noted ("*Asian*" in this case), and the business would still be considered *Laotian* when undergoing further grouping.

6. Businesses with **no specific ethnic association** would be placed under the ethnic group of "American "

   e.g. Coffee shop

Ethnic food groups integration:

7. Classifications that share similar characteristics or serve similar types of food are integrated into a more general ethnic category.

   e.g.

   Based on ethnic characteristics: *Turkish, Greek, and Lebanon cuisine merge into the Mediterranean*

   Based on types of food: *brunch, burger, and pizzeria be reclassified under the American*

8. Mainstream food definition: *Businesses under the American category*

Appendix.2. Ethnic Association Summary

Overall, this thesis identifies 46 ethnic classifications in the preliminary classification process and integrates these classifications into 10 categories. The summary of the classifications is in Table 4.

Table 4 Business Ethnic Categories Summary Table

Category	Food Business Count
African	**22**
African	3
East African	1
Eritrean	2
Ethiopian	13
Somali	1
West African	2
East Asian	**100**
Asian	1
Cantonese	19
Chinese	54
East Asian	6
Korean	12
Taiwanese	8
European	**47**
European	1
French	8
German	1
Irish	1
Italian	28
Nordic	1
Portuguese	1
Russian	1
Scottish	1
Spanish	4
Indian	**7**
Indian	7
Japanese	**58**
Hawaiian	9
Japanese	49
Latin American	**42**
Argentinian	1
Bolivian	1
Caribbean	1
Latin American	1
Mexican	38
Mainstream	**540**
American	539
Cajun	1
Mediterranean	**31**
Greek	4
Halal	6
Mediterranean	13
Middle Eastern	3
Persian	2
Turkish	3
Multi-Ethnic	**3**
Multi-Ethnic	3
Southeast Asian	**91**
Cambodian	1
Filipino	2
Laotian	2
Southeast Asian	2
Thai	23
Vietnamese	61
Grand Total	**941**

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