Measuring the accessibility of the home-delivered food program

by

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Being able to live independently and maintain a healthy nutritional lifestyle as an older adult is challenging in the United States (US). Prior studies have found that mental health, especially cognitive status, is associated with nutritional status in older adults.

The daily recommendation for older adults in the US includes at least five servings of fruit and vegetable consumption per day. In 2018, the USDA reports in the Dietary Guidelines for Americans that 90% of the population in the US does not meet their daily dietary recommendation. Many community organizations have launched home-delivered meal programs to supply additional food to support older adults to live healthier and independently. However, community organizations lack an instrument that can be utilized by field researchers and community organizations to evaluate how well they are serving their clients in the home-delivered meal program.

This study has two objectives. The first objective is to design a survey that can help community organizations quickly explore how clients in the program handle and use the food. The survey will examine the accessibility of a home-food delivered program offered by Fishes and Loaves Cooperative Ministries at Hazelwood, PA. Accessibility is defined as a) receiving food that can satisfy the nutritional needs of older adults who are enrolled in the program, and b) older adults in the program being able to handle and use safely the food they receive. The second objective of the study is to explore how cognitive factors are associated with older adults' food handling and food intake process. The results of the study showed that better memory performance

was related to greater fruit and vegetable consumption. But further study is needed to determine causality between cognitive and fruit and vegetable consumption. More efforts should also be focused on modifying the survey to not only make the survey easier to understand by the older adults but also explore whether additional behavior and cognitive factors also influence one's dietary intake.

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Preface

This project is supported by Fishes and Loaves Cooperative Ministries located in the Hazelwood, Pittsburgh. The data collected by this project will later be used by the Fishes and Loaves Cooperative Ministries to improve their home-delivered meal services.

I would like to thank my research team, Dylan Knapp-Scott, Dr. Albert, Professor Judith Dodd, and Dr. Deborah Hutcheson for their knowledge and dedication to make this project success. I would also like to thank Dr. Martha Ann Terry for not only providing detailed comments on the thesis, but also her wonderful introduction to community health course in the summer edge program. It was that course which inspired me to adventure further as a public health student. I would also like to thank Dr. Thistle I Elias for introducing me on the program evaluation certificate. I would never be able to make this far without everyone's support.

Last but not least, I would like to take the time to thank my family, friends and Kiko, who have been kindly support me through my toughest time. Thank you for your kindness and thoughtfulness that carried me to the success.

1.0 Introduction

Fishes and Loaves Cooperative Ministries (FLCM) is a nonprofit organization located in the Hazelwood community of Pittsburgh, Pennsylvania, that has been working closely with St. Stephen Catholic Church to provide necessary pantry delivery, congregate meals, emergency food, and food purchase services to help residents in the Hazelwood community obtain necessities for their daily living.

The goal of FLCM is to support older adults and residents in Hazelwood to live independently with a healthy lifestyle. The FLCM approach is based on the philosophy that older adults should be able to live independently while having dignity. The name of the organization was drawn from John 6:1-14 in *The Bible*, and the organization provides food to people in need. Since 2010, more than 30% of the population in Hazelwood is aged 65 or older. As Gehlich et al. (2018) have pointed out that mental health and cognitive function are two key factors in older adults' health maintenance. Studies have identified the potential of fruit and vegetable intake in combating stress and cognitive function decline (Payne et al., 2012). Fruits and vegetables contain a great variety of vitamins, fibers, minerals, and other micronutrients (Mottaghi, et al., 2017; Wallace et al., 2018). Having at least five servings of fruit and vegetable a day has shown promising results in reducing cognitive decline and stress levels (Nooyens et al., 2010). With the current Covid-19 hindering older adults in the Hazelwood community to purchase freshly produced food from Dylamato's Market, their access to fruit and vegetables relies more on the nutrition services programs (email communication, April 2022).

This master's thesis has two aims: A) to work with the FLCM on designing an instrument to better understand how the older adults in the FLCM home-delivered program handle the food.

Handling the food is defined as taking the food inside the house, reheating the food, consuming the food, and storing the food; and B) to conduct an exploratory study on the association between vegetable and fruit intake and cognitive functions among older adults in the home-delivered meal program setting. The background section provides an overview of the community partner of the Meals on Wheels program (MoW), the history and demographic information of the Hazelwood community, and the literature reviews on the relationship between older adults' dietary intake and cognitive function. The methods and results sections describe the screening criteria, data collection method, and crosstab results between nutrition score and memory score. The thesis finishes with a discussion on the potential opportunities to revise the survey for older adults to understand with fewer difficulties. In addition, the thesis also calls for future studies to explore the other factors that could influence older adults' dietary intake.

2.0 Background

In 2019, according to the United States (US) Department of Health and Human Services, the older adult population (age 65 or older) increased by 35% in 2018 compared to 2008 (profile of older Americans - ACL administration for …, 2019). In 2020, older adults in the United States made up 16% of the total population (Fact sheet: Aging in the United States, 2019). One out of four older adults in America lives alone, and adequate nutrition intake has become a significant problem due to the disability and isolation of this population (Thomas et al., 2015). Efforts have been made to address this issue.

Beginning in 1954, a small group of Philadelphia citizens created the first home-delivered meal program in the United States. The program's goal was to provide support to help senior neighbors live independently and as healthily as possible. This goal was also adopted by MoW later. In 1965, the Older Americans Act (OAA) was established to address the lack of community resources (Older Americans Act, n.d.). Since then, many nutrition services programs have been funded through OAA, including MoW, a major home-delivered food program addressing older adults' nutritional needs. Thirty-nine percent of MoW's funding comes from the OAA Nutrition Program, while the rest comes from state/local sources, federal grants, and other donations (Facts & Resources, 2020).

Currently, MoW works closely with local community organizations to serve more than 19,000 zip codes with more than 3,900,000 clients annually across the United States. The MoW program provides crucial support in delivering healthcare and helping seniors live independently. More than two-thirds of program clients are at or below the poverty line, and 20% of local programs are the major or only meals provider in the rural communities. MoW offers support

mainly in four categories: Nutrition, In-home Safety, Socialization, and Community Connection (Thomas et al., 2015). Although MoW coverage varies depending on the resources that are available in the community, nearly all MoW programs offer direct nutrition services to seniors. Unlike other home-delivered meals programs, at least 40% of the MoW programs provide at least five minutes of client interaction during each delivery (Thomas et al., 2015). This social interaction offers a unique opportunity for the delivery driver and program manager to forge a close relationship with their clients. Clients in the MoW program speak positively about having their delivery driver check in on them every day since it makes them feel respected (The Allegheny County Department of Human Service, 2020). The program's older adults are connected to the outside world by their delivery drivers (History of Meals on Wheels, 2021). When the Covid-19 pandemic hit the United States, MoW grew 47% in 2020 compared to 2019 (Meals on Wheels America, 2021).

2.1 Community Partner: Fishes and Loaves Cooperative Ministry

FLCM was founded in 2011 in response to the lack of available food resources. FLCM was later developed into an independent 501(c)3 organization and has carried out the MoW program since 2015. The organization is currently located in St. Stephen Catholic Church Pastoral Center, which serves the dual purpose of hosting the Congregate Lunch program and administrative offices. The FLCM also uses the Spartan Community Center of Hazelwood and a commercial kitchen to cook and store their MoW food trays. The current Operations Manager of FLCM is DCN Tom Berna. The Board of Directors includes people from the Archdiocese of Pittsburgh, Hazelwood residents, and the owner of the only fruit and vegetable store in Hazelwood.

2.2 Hazelwood, Pittsburgh

The Hazelwood community is located along the north side of the Monongahela River in the city of Pittsburgh, PA as shown in figure 1. The neighborhood is bordered to the north by Oakland and east by Squirrel Hill. Hazelwood has a total area of approximately 1583 square miles.

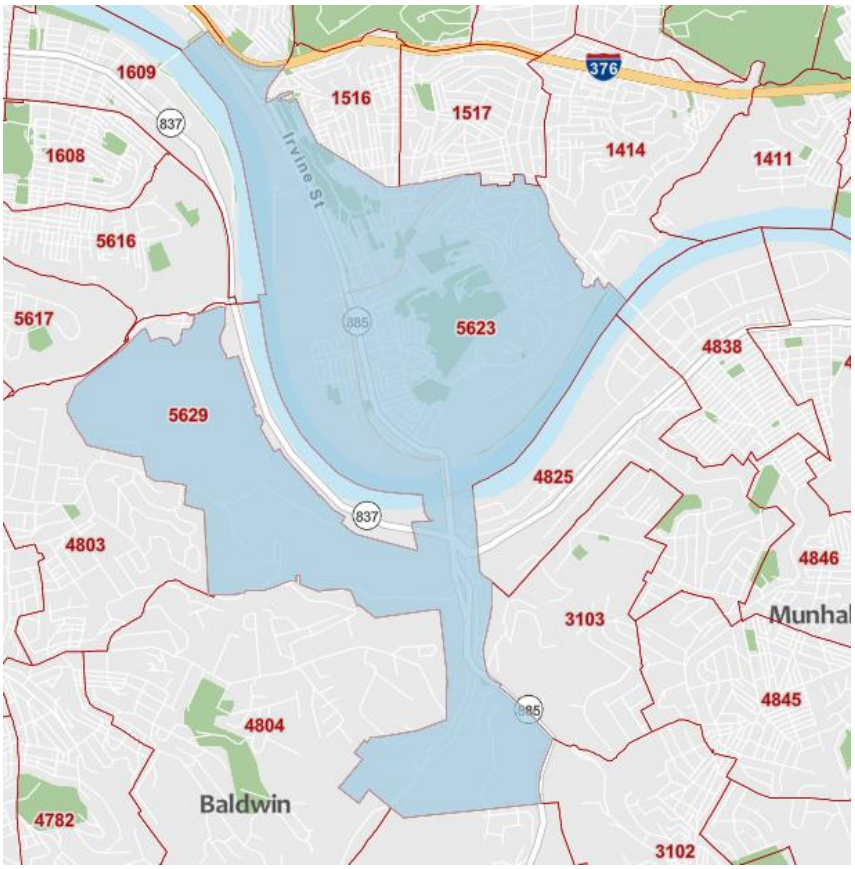

Figure 1 Census Tract 5629 and 5623

Second Avenue is the main street that connects the Hazelwood community with Oakland and other urban areas of the city of Pittsburgh. The Hazelwood community began its growth in 1883 when Jones and Laughlin Steel Company constructed an industrial plant in the area. The construction of the industrial plant soon initiated a surge in population and growth in the Hazelwood community. By 1960, the Hazelwood community had expanded into a large

community with approximately 13,000 residents and roughly 12,000 industrial workers in the industrial plants across the South Side and Hazelwood area (History, 2020). The number of residents in the Hazelwood community then faced a decrease very quickly in the 1980s due to the steel industry decline.

Based on a report released by the University of Pittsburgh (University Center for Social and Urban Research [UCSUR], 2012), 30.4% of the people in Hazelwood are older than 55 while 16.8% of the population is older than 65. Fifteen-point one percent of the population is between ages 45 to age 54. In Hazelwood, 45% of Hazelwood's population was African American which is higher than 26% for Pittsburgh (UCSUR, 2012).

As shown in table one, Hazelwood is divided into two Geos in the US census tract system, 5629 and 5623. The four MoW delivery routes in Hazelwood follow these divisions. Delivery routes B and D are located mainly in census tract 5623, and delivery routes A and C are located mainly in census tract 5629. The two census tracts differ in poverty status. The nonpoverty percentage is 13.4% for 5629 compared to 40.9% for 5623. The nonpoverty percentage is calculated by dividing the number of people below 100 percent of the poverty level by the total number of people in the census tract.

Table 1 Population data for Census tract 5623 and 5629

	Census Tract 5623, Allegheny County, Pennsylvania		Census Tract 5629.01, Allegheny County, Pennsylvania		Sum
	Male	Female	Male	Female	
65 and 66 years	37	37	32	16	122
67 to 69 years	42	149	11	40	242
70 to 74 years	129	37	0	25	191
75 to 79 years	24	88	31	18	161
80 to 84 years	37	57	14	34	142
85 years and ove	29	145	3	15	192
Sum	298	513	91	148	1050

As Lisa Reihl, the Business Manager at the YMCA of Greater Pittsburgh, notes, the Hazelwood community faced a dramatic increase in the number of residents asking for food assistance after the 2008 financial crisis (personal communication, Jan. 10, 2022). As Ms. Reihl said, "Things were getting worse now with Covid-19." The research team also interviewed Dianne Shenk (email communication, April 15, 2022), the owner of Dylamato's Market in Hazelwood, and sought her input on the effects of Covid on food access in Hazelwood. Dylamato's Market is a 900 square feet grocery store located in Hazelwood since 2016. Despite being the only grocery store that sells fresh produce and deli food, the store supports the community's need for food. According to a feasibility study (email communication, April 2022), the population in Hazelwood was not large enough to support a big chain grocery store. In addition, other grocery stores such as Giant Eagle, Aldi, Walmart, and Costco are located in nearby neighborhoods. However, the lack of a grocery store in Hazelwood creates a barrier for those older adults without a reliable transportation method. Ms. Shenk mentioned that the Dylamato Market tried to provide food

delivery at the beginning of the pandemic to older adults who live in the high-rise apartment buildings. Yet the delivery service was quickly found to be unsustainable for Dylamato's.

2.3 Nutrition and Cognition in Old Age

Nutrition, cognitive status, and health are related to old age. Ninety percent of US older adults did meet their daily vegetable and fruit intake recommendations (DGAC 2015; USDA, 2018a). In their 2010 report, a public affairs firm found that the average US residents need to consume 76% more vegetables and 135% more fruits to meet the USDA recommendation level (Rosenfeld, 2022). The fruit and vegetable intake frequency is associated with improved cognitive health in older adults in developing countries (Gehlich et al., 2018). In a nationally representative sample of community-dwelling adults over age 65 in the US, older adults living alone without children and friends nearby had a consumption of vegetables and fruit that was 74% and 70% respectively of the intake of older adults who live with children and friends (Choi et al., 2020). This threatens older adults' health. Numerous studies have identified the benefit of daily consumption at least five fruits and vegetables portions for older adults on their mental and physical health (Wallace, 2020; Gehlich, 2018; USDA, 2020).

Without other supplements, a lack of fruit and vegetable intake will lead to vitamin C and other micronutrient deficiencies (Choi et al., 2020; Mottaghi, et al., 2017). Furthermore, vitamin C is closely related to vitality and stress levels (Fletcher et al., 2021). Declines in cognitive function may be associated with low intakes of multiple nutrients: vitamins B, D, and E; omega-3 fatty acids, zinc, and antioxidant phytonutrients such as carotenoids (Tucker, 2016). Also, studies have

found that the intake of antioxidants and phytonutrients can reduce oxidative stress and thus protect neuronal cells (Joseph et al., 2005; Vauzour, 2013).

Efforts to improve nutrition intake through home-delivered meals have demonstrated positive outcomes in the limited studies in this area. For instance, the home-delivered meal program by Older Americans Act has contributed to 37% to 50% of the participant's daily intake of the nutrients, which results in higher intakes of vitamins A, B6, D, and zinc compared to non-participants (Mabli et al., 2017). The European Society for Clinical Nutrition and Metabolism Society suggested in its guidelines that the use of Oral Nutrition Supplements (ONS) with close supervision in older adults will reduce cognitive decline (Volkert et al., 2015). The home-delivered meal program also improves diet quality and variety by supplying milk, fruits, and vegetables to participants (Frongillo & Wolfe, 2010). With the food supplement program, older adults could increase their nutrient intake and maintain excellent mental and physical health (Denissen et al., 2016; Zhu & An, 2014).

2.4 Need for Home Assessments of Nutrition

Currently, no nutritional assessment survey exists for community organizations to quickly assess the older adults they are serving. In 2015, researchers identified that suitable health assessment surveys are available for healthcare professionals to use in clinical settings (Moore, 2015). Yet it is also noted that there is a lack of nutrition assessments that can be used in non-clinical settings or by older adults themselves. Moore et al. (2015) mentioned two existing surveys for use in non-clinical settings: the Nutri-eSCREEN, which is developed from SCREEN II, and the Nutrition Screening Initiative DETERMINE Checklist (NSI).

The lack of surveys and research that have a good completion rate by older adults is also reflected by Pubmed keyword search. Under the search criteria “("self completed"[All Fields]) AND ("nutrition surveys"[MeSH Terms] OR ("nutrition"[All Fields] AND "surveys"[All Fields]) OR "nutrition surveys"[All Fields] OR ("nutrition"[All Fields] AND "survey"[All Fields]) OR "nutrition survey"[All Fields]) Sort by: Most Recent,” there were only 59 matched results. Huhmann et al. (2013) have demonstrated that the Mini Nutritional Assessment (Sf-MNA) has a high agreement with the Self-administered MNA (Self-MNA). The survey addresses health by adding "Have you been stressed or severely ill in the past three months?" and "Are you currently experiencing and/or prolonged severe sadness?" on the question list. Yet only 36.2% of the participants completed the question on their first attempt. Participants reported that font size and hard-to-understand terminology are the main issues interfering with completing the survey.

Since only a few nutrition assessments exist with questions that address food safety knowledge and participants' cognitive impairment, it is crucial to design a survey that field researchers and community organizations can use. The lack of a tool for a community organization to quickly assess its program accessibility for the older adults they are serving hinders the organization’s ability to deliver an effective program.

2.5 Research Question and Study Hypotheses

Given this lack of appropriate instruments for assessing nutritional needs in older people receiving home-delivered meals, this research developed a questionnaire that could be used by a community organization to explore how well its home-delivered meals program is serving clients.

We hypothesized that a group reporting poorer cognitive ability would have poorer access to delivered meals and poorer nutrition.

3.0 Methods

3.1 Recruitment

For recruitment, we obtained approval from FLCM to work with the participants in their MoW program in Hazelwood. Potential participants were approached through a short phone call by FLCM staff. This served as a recruitment step for this study and an opportunity for the FLCM to establish more contact with their participants. All participants in the MoW program were eligible for the study. Potential participants who were not able to or refused to give informed consent were excluded from the study. The study obtained exempt approval from the University of Pittsburgh IRB. The introductory script is shown in Appendix B.

The research team approached the community by contacting the AmeriCorps Vista worker at the Fish and Loaves, Dylan Knapp-Scott. Mr. Knapp-Scott was contacted by the author through a self-introduction email. Via email, we decided that the survey could provide new insight into program development. As mentioned earlier, the author also made contact with Hazelwood YMCA Business Manager, Lisa Reihl. during the monthly foodbank service. She briefly discussed the history of Hazelwood development and the existent program in the area.

3.2 Data Analysis

The research team first recorded respondents' answers to the demographic questions into the categories below:

-Age. 0: the participants who are below age 70; 1: the participants aged 71+

-Gender. 1: Female; 2: Male

-Education. 0: Earned a college degree or above; 1: Earned a high school diploma or below

-Memory. 0: the participant indicated fair or poor memory when compared with a person of their age; 1: the participant indicated good memory when compared with a person of their age.

After this recording, the research team cross-tabulated self-perceived memory by food access and nutritional indicators.

4.0 Results

The research assessed both the cognitive status and nutritional knowledge of participants. After the initial screening of nutrition status, the participants were asked if they would participate in a wellness survey. The survey was administered by research staff and the FLCM staff member visiting the participant's resident address. The survey consisted of two sections, nutrition status, and wellness, to examine not only self-perceived nutritional status but also safe food handling knowledge and change in the quality of life.

The first section of the survey includes questions to assess the nutritional status of older adults. This section contains three demographic questions, three questions on the participant's nutrition intake status, and five questions on the participants' experience with the program. Before the end of the first section, there are two questions designed to let participants provide their thoughts and reflections. The second section of the survey is composed of nine questions that assess participants' ability to independently complete daily activities. Questions and the survey logic are shown in Table 2 and Figure 3 respectively. The full survey items can be found at appendix A.

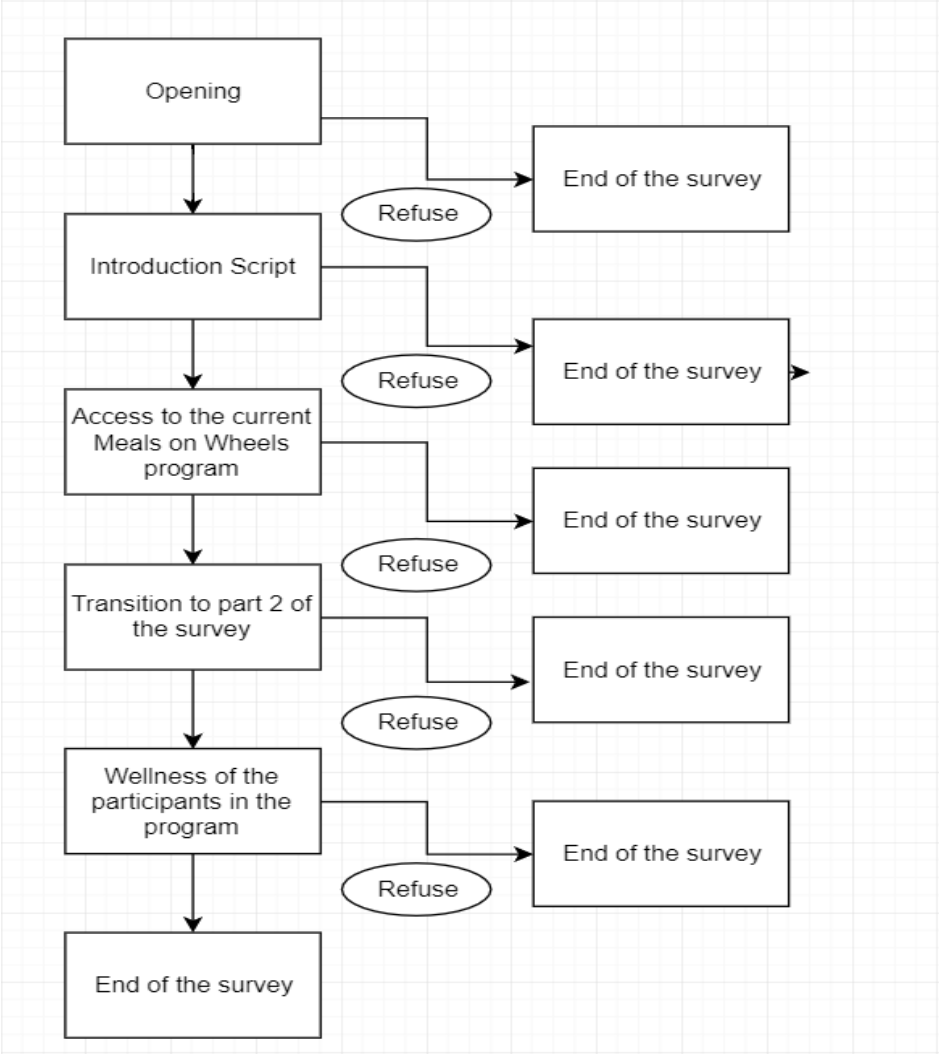

Figure 2 Survey logic flow chart

Table 2 Survey questions and coded value

Item Number	Question	Response options	Code Value
Q6	How often do you have to skip meals due to not having enough food?	Never or Rarely 1-2 times per week 3-5 times per week More than 5 times a week I don't know	5 4 3 2 1

Q7	How often do you eat vegetables on a regular day?	Never or Rarely 1-2 times per week 3-5 times per week More than 5 times a week I don't know	2 3 4 5 1
Q8	How often do you eat fruits or juices on a regular day?	Never or Rarely 1-2 times per week 3-5 times per week More than 5 times a week I don't know	2 3 4 5 1
Q10	How often is the tray meal cold when you bring it inside?	Never or Rarely 1-2 times per week 3-5 times per week More than 5 times a week I don't know	2 3 4 5 1
Q11	How often do you feel it is difficult for you to lift your tray meal to bring it inside?	Never or Rarely 1-2 times per week 3-5 times per week More than 5 times a week I don't know	5 4 3 2 1
Q12	How often do you still feel hungry on a day you receive and eat a MOW?	Never or Rarely 1-2 times per week 3-5 times per week More than 5 times a week I don't know	5 4 3 2 1
Q17	In general, how is your memory compared to a person of your age?	Good Fair Poor	3 2 1
Q18	Are you able to heat water and turn off the stove?	No problem Sometimes not Often not	3 2 1
Q19	Do you feel you have problems expressing yourself when speaking (e.g., coming up with the right word)?	No problem Sometimes not Often not	3 2 1

Q20	Do you feel you have problems organizing your daily activities?	No problem Sometimes not Often not	3 2 1
Q21	Do you feel you have problems finding your way around familiar places?	No problem Sometimes not Often not	3 2 1
Q22	Do you feel have problems concentrating (e.g., while watching T.V., reading, or doing work)?	No problem Sometimes not Often not	3 2 1
Q23	Do you feel you have problems solving everyday math problems (e.t., calculating change or amount to tip)?	No problem Sometimes not Often not	3 2 1
Q24	Do you feel you have problems thinking clearly?	No problem Sometimes not Often not	3 2 1
Q25	Do you feel you have a problem thinking quickly?	No problem Sometimes not Often not	3 2 1

The research team coded and analyzed responses from 22 people out of 47 total people in the MoW program served by FLCM. The response rate of the study is 46.8%. This is higher compared to FLCM's previous satisfactory survey response rate which was 20%. Failing to respond was mainly due to the participants not responding to the initial greeting upon first contact. The data were collected from the participants through the program’s in-home visit accompanied by FLCM staff members. The participation rate of the study varied based on the delivery routes. Routes B and D in the higher poverty census tract had a response rate below 50%, as shown in Table 3.

Table 3 Survey Participation by MoW Route

Route Number	Responded	Refused	Didn't respond	Total	Response Rate
A	7	0	3	10	0.7
B	3	0	7	10	0.3
C	5	0	5	10	0.5
D	7	0	10	17	0.4
Total	22	0	25	47	0.47

The survey was conducted in the participant's home in the Hazelwood community, Allegheny County, Pennsylvania. The in-home visit was conducted by the study researcher and a staff member from the FLCM. During the first round of phone calls and discussions, the research team and the staff members from the FLCM determined that having a member from the FLCM can reduce the stress of the participants and increase their response rate. The potential participants were more likely to answer the knock and initial greeting once they saw the staff member from FLCM. The demographics of participants are shown in Table 4.

Table 4 Demography of participants

	Age	
	Frequencies	Percent
below 70 years old	14	63.6
above 71 years old	8	36.4
	Gender	
	Frequencies	Percent
Male	14	63.6

Female	7	31.8
Missing	1	4.5
	SchoolLevel	
	Frequencies	Percent
College or above	10	45.5
High school or below	12	54.5

The study team found that 14 out of 22 respondents (63.6%) self-identified as female, seven out of 22 respondents (31.8%) self-identified as male, and one had missing data due to an invalid answer; 14 out of 22 respondents (63.6%) of the respondents were below age 70, and eight out of 22 respondents (36.4%) were age 70 or greater; 14 out of 22 respondents (63.6%) earned some level of a college degree or above, and eight out of 22 respondents (36.4%) of the respondents had a high school degree as their highest educational credential. The cross-tabulation of memory and nutrition access indicators is shown in Table 5.

Table 5 Self-Reported Memory and Accessibility of Meals on Wheels Delivered Food- Good performance

Self-Reported Memory Complaint	How often do you eat vegetables on a regular week? (More than 5 times per week)	How often do you eat fruits or juices on a regular week? (More than 5 times per week)	How often do you feel it is difficult for you to lift your tray meal? (Never or Rarely)	How often is the tray meal cold when you bring it inside? (More than 5 times per week)	How often do you still feel hungry on a day you receive and eat MoW? (Never or Rarely)	Skip meals due to not having enough food? (Never or Rarely)
People without problem (0), Good memory N=15	0.533	0.4	0.8	0.733	0.667	0.8
People with problem (1), Fair-poor memory N=7	0.429	0.143	0.857	0.571	0.571	0.429

Table Five shows the low percentage of respondents who report their memory to be fair or poor compared to a person of their age and people who report their memory to be good compared to a person of their age. Fifteen people reported that they do not think they have memory problems; seven people reported that their memory was fair or poor compared to their peers.

For the respondents who answered that their memory is good when compared to a person of their age, eight out of 15 respondents (53.3%) ate vegetables more than five times a week. Six out of 15 respondents (40%) with good perceived memory consume more than five times fruit or juice per week. Twelve out of 15 respondents (80%) with good perceived memory report they

never or rarely found difficulty lifting their meals and bringing them inside their houses or apartments. Eleven out of 15 respondents (73.3%) report they found their meals are always cold by the time they find them. Ten out of 15 respondents (66.7%) report they are never or rarely hungry after finishing their MoW delivery. Twelve out of 15 respondents (80%) report they never or rarely have to skip meals due to not having enough food.

For the respondents who reported fair or poor self-perceived memory when compared to a person of their age, three out of seven (42.9%) respondents reported they eat vegetables more than five times a week. One out of seven (14.3%) respondents reported they consumed more than five times fruit or juices on a regular week. Six out of seven (85.7%) respondents reported they never or rarely felt it difficult to lift their meal and bring it inside their houses or apartments. Four out of seven (57.1%) respondents reported they always found their meal to be cold. Four out of seven (57.1%) respondents reported they never or rarely felt hungry on a day they receive and eat MoW delivery. Three out of seven respondents (42.9%) report they never or rarely have to skip meals due to not having enough food.

Overall, participants reporting better memory were associated with a greater consumption of the fruits and vegetables in the delivered foods while reporting poor memory were associated a lower consumption of fruits and vegetables. These participants may derive greater health benefits from the program due to the improved nutritional intake. The result is consistent with the existing literatures where studies have identified correlation between greater fruit and vegetable consumptions with lower psychological stress and mental health (Saghafian, et al, 2018; Gehlich et al., 2018).

5.0 Discussion

This study aimed to explore how participants in the MoW program consume the vegetables and fruits as well as the effect of self-perceived cognitive status. The primary goal was to review the way program delivered the food and how the participants consume the food they received to gauge the potential nutritional benefits of the program. The study represents a strong collaboration. In the Allegheny County Home-Delivered Meal Satisfaction survey, 58 out of 595 people (9.7%) participated, a much lower response compared to the participate rate of this study. (*The Allegheny County Department of Human Service*). After the research team compared the answers of fruits and vegetables intakes to the question asking the respondents who indicate that their memory is fair or poor, it was found that participants who think that their memory is better than their age peers performed better on the following three questions:

a). "How often do you eat fruit?"

b). "How often is the tray meal cold when you bring it inside?"

c). "How often do you have to skip meals due to not having enough food?"

From this study, 40% of the study participants with good perceived memory reported consuming more than five times fruit or juice per week compared to 14.3% of the study participants with poor or fair memory respectively. The study results are congruent and develop from the previous studies and meta-analysis. Saghafian, et al. (2018) observed that the odds of depression and psychological distress were decreased with a greater intake of fruits and vegetables in a 3362 cross-sectional study in Iran. In a meta-analysis of 539 articles, Mottaghi, et al. (2018) suggest a healthy diet pattern- a diet that is rich in vegetable, fruits, nuts, olive oil, and legumes- is associated with better verbal and memory outcome. In a cohort study in the Netherlands with 2613 participants, higher

fruit and vegetable intakes were observed with smaller cognitive decline (Nooyens et al., 2010). As mentioned in the Dietary Guidelines for American (DGA), 2020-2025, older adults faced a greater risk of cardiovascular disease, chronic disease, and health conditions related to bones and muscles (DGAC; USDA 2020a). Because of the challenges mentioned, older adults' needs to be more careful about their daily nutrient intake. An individual with a change in metabolism needs a lower-calorie diet. Additional evidence suggested that a higher intake of fruits and leafy vegetables can promote higher levels of optimism and self-efficacy, and reduce the psychological stress level (Glabska et al., 2020; Choi et al., 2020). Thus, providing consistent nutritious meals with adequate fruit and vegetables can potentially help older adults maintain good mental health and cognitive ability.

5.1 Future Research

Given that the study collected only 22 surveys, a more in-depth and detailed study is needed in order to gain a fuller perspective of the participants in the MoW program in the Hazelwood community. During the tour around each route, the research team noticed that house conditions varied a lot based on where they were located. Furthermore, the research team noticed that a number of people did not pick up their food until the research team visited them between 10 am and 11 am. The food was able to stay cold since the study took place in early spring, and the temperature was about 40 Fahrenheit. However, things will change when the weather gets hot. While the home-delivered meal program by FLCM is accessible to its participants, more effort should be made to improve access and food quality, and food quantity. People reporting fair or poor memory are at greater risk of nutritional insufficiency and may need additional support. We

suggest further study to explore more the impact of environment and food choices on the clients' experience with the home-delivered program. Additionally, the study did not address the location and transportation factor of the participants. Those could become a confounding factor since the older adults with more access to the nearby markets are likely to have more access to the fresh fruits and vegetables compare to those who did not have transportation method.

6.0 Conclusion

Numerous studies globally suggest that adequate nutrition (macronutrients, micronutrients and phytonutrients) is crucial for maintaining vitality, lowering oxidative stress levels and improving cognitive function. (Fletcher et al., 2021; Joseph, 2005; Wallace et al., 2020). With the MoW and the local community organizations' efforts, participants are able to receive food supplements and social interaction, which are beneficial to their mental and physical health (Gehlich et al., 2018; Thomas et al., 2015). It is also noted the lack of a nutrition survey weakened the community organization's ability to understand how the clients in the program are using the food they received. Despite the current nutrition assessment providing good instruction and high validity (Moore et al., 2015), a standard nutrition tool such as the Self-MNA requires healthcare professionals to assist in order to complete the full assessment. Conducting an in-person interview also provides a chance for the community organization to build a closer relationship with the people that they are serving. Through collaborating with FLCM, the research team was able to develop a survey to fulfill the organization's needs- collecting the demographic information of the participants in the program and understanding how the participants make use of the food they received.

The results suggest that older adults who had lower perceived memory ability tend to consume fewer vegetables and fruits. However, it is important for future studies to explore in depth the causal relationship between memory ability and fruit or vegetable consumption. Throughout the in-home visit, despite the participant's attitude about the program, they were satisfied as they felt their voice is being heard, which led to a feeling of being respected.

The results also showed that differences in vegetable and fruit consumption, the time that the respondents took to pick up their food, and how often people skip meals due to not having enough food are potentially due to respondents' self-appraisal of cognitive function. However, the study did not yield statistically significant differences due to its small sample size.

It was also noticed during the survey process that two questions were hard for the respondents to understand. The first question that caused confusion asked the respondent, "How often do you feel it is difficult for you to lift your tray meal to bring it inside?" It often required the staff member from FLCM to explain the question further so the respondents could understand what the researcher was asking. The second question that required further explanation under most scenarios was, "Are you enrolled in other food programs than Meals on Wheels?" Most often, the respondents were not able to recall all of the food programs in which they were currently participating. When probing with examples like "what about the SNAP program?", the respondents immediately recalled other food programs they were currently receiving.

The research team did not address caregiver factors. Some older adults performed better in terms of being able to pick up food and eat on time due to a reminder from their family caregivers. Further study should consider questions that can address this factor.

In addition, the response rate of the study was 46.8%. The research team was unable to reach the remainder. This was more common in the high poverty census tract. The inability to reach some of the clients in the MoW may cause a bias where the population that responds differs significantly in terms of their characteristics from the unable-to-reach population (Cheung et al., 2017). The geographic region of census tract 5629 also covers part of the residents who live on the south side of the Monongahela River. The FLCM covered only the area on the north side of the

Monongahela River. Yet, the study team was not able to separate the residents who live on the north and south side of the Monongahela River due to a lack of detailed data.

While the home-delivered meal program is able to provide food to those in need and makes positive impacts on its clients' lives, this is only the beginning. While remaining an affordable option to its clients, the home-delivered meal program should strive to address its clients' needs and provide diverse meal options. Many clients that the research team visited indicated the need for soft food since they were having a hard time chewing. Bringing the food to the doorstep is only a beginning. What is more important is what the clients do with their food afterward. No one wants to see food being wasted or dumped when small adjustments might help the older adults such as additional food, cooking help, and more food variety. FLCM cannot be expected to make all the required changes on its own. Other organizations need to design a plan collaboratively with professional guidance to address these issues. Only in this way will we be one step closer to building an aging-friendly community in Hazelwood.

Appendix A Survey Questions

Demographic Survey:
What gender do you identify with?
What is your age?
What is the highest grade in the school you have completed?

Nutrition Assessment Section:
How often do you have to skip meals due to not having enough food?

- 1-2 times per week (5)
- 3-5 times per week (4)
- More than 5 times per week (3)
- Prefer not to answer (2)
- I don't know (1)

How often do you eat vegetables on a regular week?

- 1-2 times per week (5)
- 3-5 times per week (4)
- More than 5 times per week (3)
- Prefer not to answer (2)
- I don't know (1)

How often do you eat fruits on a regular week?

- 1-2 times per week (5)
- 3-5 times per week (4)
- More than 5 times per week (3)
- Prefer not to answer (2)
- I don't know (1)

How often is the tray meal cold when you bring it inside?

- 1-2 times per week (3)
- 3-5 times per week (4)
- More than 5 times per week (5)
- Prefer not to answer (2)
- I don't know (1)

How often do you feel it is difficult for you to lift your tray meal to bring it inside?

- 1-2 times per week (5)
- 3-5 times per week (4)
- More than 5 times per week (3)
- Prefer not to answer (2)
- I don't know (1)

How often do you still feel hungry on a day you receive and eat a MOW?

- 1-2 times per week (5)
- 3-5 times per week (4)
- More than 5 times per week (3)
- Prefer not to answer (2)
- I don’t know (1)

Wellness Section:
In general, how is your memory compared to a person of your age?

- Good (0)
- Fair (1)
- Poor (2)
- I don’t know (9)

Are you able to heat water and turn off the stove?

- No problems (0)
- Sometimes not (1)
- Often not (2)
- I don’t know (9)

Do you feel you have problems expressing yourself when speaking (e.g., coming up with the right word)?

- No problems (0)
- Some problems (1)
- Major problems (2)
- I don’t know (9)

Do you feel you have problems organizing your daily activities?

- No problems (0)
- Some problems (1)
- Major problems (2)
- I don’t know (9)

Do you feel you have problems finding your way around familiar places?

- No problems (0)
- Some problems (1)
- Major problems (2)
- I don’t know (9)

Do you feel have problems concentrating (e.g., while watching T.V., reading, or doing work)?

- No problems (0)
- Some problems (1)
- Major problems (2)
- I don’t know (9)

Do you feel you have problems solving everyday math problems (e.t., calculating change or amount to tip)?

- No problems (0)
- Some problems (1)
- Major problems (2)
- I don’t know (9)

Do you feel you have problems thinking clearly?

- No problems (0)
- Some problems (1)
- Major problems (2)
- I don’t know (9)

Do you feel you have a problem thinking quickly?

- No problems (0)
- Some problems (1)
- Major problems (2)
- I don’t know (9)

Appendix B Introductory Script

I am Zizhou Su. You can also call me Joe. And I am one of the students from the University of Pittsburgh GSPH. We really appreciate your interest in this research and now I am going to read you the purpose of this study. As XXX has mentioned before, this survey is about health survey. Please feel free to interpret me at any time if you have questions or clarification you would like. The purpose of this research is to determine how wellness is related to the accessibility to the home-delivered meal program. Participants of this study will include the participants in the XXXXXX. This is a survey that will be read to you by the study researcher. It will take approximately maximum of 5-10 minutes to complete. The survey includes 2 sections, which include 9 questions asking about your access to the current Meals on Wheels program and 9 questions asking about your wellness. The potential risks include questions that may cause emotional distress or stress. You will not be receiving payment for participation. All participants will be deidentified by random ID numbers. Your information will be safely stored in a password-protected file on my laptop. Your participation is entirely voluntary, and you may withdraw from the study at any time. Your current access to the food program will not be affected by any of your decision. Should you choose to withdraw, the data collected up until the point of withdrawal will be used. Risks are rare but may include potential violation of confidentiality and/or sensitivity to questions regarding mental health. This study is being conducted by me, Zizhou Su (Joe). If you have any questions regarding the study, please call us at xxx-xxx-xxxx. Would you like to participate in our survey? Do you have any questions?

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