

Gaps in Governmental Nutrition Support for the Malnourished Older Adult: A Case Study Using the Agent Based Approach (ABA)

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ABSTRACT: Malnutrition and poor dietary habits are a major concern for home-bound, socially isolated older adults. The Systems Thinking ABA approach was employed to examine the gaps within governmental nutrition assistance in the older adult aging-in-place community. Governmental nutrition assistance programs aim to reduce food insecurity in this population, but fail to address mental health's negative effects on dietary habits. Developing effective governmental and community programming surrounding dietary habits, social facilitation and social support can improve dietary habits and dietary intake in the older adult community.

Keywords: Elderly | Older Adults | Social Isolation | Social Support | Social Facilitation | Malnutrition | Dietary Quality | Dietary Habits | Aging in Place | Systems Thinking | ABA

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Introduction

MALNUTRITION is a major health complication in older adults, even though it is preventable. According to the Academy of Nutrition and Dietetics, malnutrition is a state of unbalanced nutrition - whether it be overnutrition or undernutrition¹. Overnutrition is best described as eating too many calories, but not consuming enough nutritious foods, leading to nutrient deficiencies and related disease. Overnutrition is heavily associated with food insecurity and poverty. Undernutrition is caused by under consuming total calories, protein or nutrients, and is associated with poverty, disease related complications (cachexia), eating disorders, cognitive diseases (such as Alzheimer's), and severely limited food access.

Malnutrition is a major health concern for the elderly population. In a study completed by Agarwal et al., 60% of the studied elderly patients were malnourished². Malnutrition in older adults is associated with frailty, loss of muscle mass and strength, reduced functional status and sarcopenia³. This creates the higher likelihood of falls, broken bones, diminished quality of life, and a shorter life expectancy.

Many factors can create malnutrition in older adults, such as lack of income, limited functional status, limited food access, and lack of social support. Literature has shown that social isolation is a major predictive factor of malnutrition and diet-related health complications⁴. Living and eating alone may lead someone to eat

¹ Esther Ellis, What is Malnutrition? Eat Right, *J Acad Nutr Diet*, 2021

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⁴ 4; and 5

less, skip meals, cook nutritionally inadequate meals, and overindulge in calorically dense but nutritionally poor foods for comfort.

Although governmental programs aim to reduce malnutrition in older adults through food pantries, meal delivery programs, transportation initiatives, and other assistance programs, malnutrition and poor diet quality still persists in our older adult population. Examining the gaps in our current assistance programs can identify and strengthen the weakest points in our system, and therefore provide for a healthier older adult population.

Methods

KNOWLEDGE CAN BE DESCRIBED as information combined with thinking, also known as actionable information⁵. This is information that is given meaning through thinking, and can be applied to complex problems in order to find a solution. Our world works in systems that are complex, unpredictable and non-linear in nature. Broadly, Systems Thinking attempts to realign how we think and process information with the real world that surrounds us⁶. Current thinking tends to be overly focused on parts rather than the whole, overly linear, biased on personal perspectives, bivalent, and hierarchical in nature. Eliminating these natural errors in current thinking allows us to isolate a system that is free of bias and represents the reality of the real world.

There are two major methods in Systems Thinking; Agent Based Modeling (ABM) and Agent Based Approach (ABA). Although they are similar in title, they are not similar in practice and in outcome. ABM is a method used to analyze a Complex Adaptive System (CAS), and the goal of an ABM model is to provide rationality for the collective behaviors of agents that are following simple rules.⁸ ABM provides a methodology for creating a “run-time” example of a system. In ABM, the agents, simple interaction rules and environment are identified, followed by an examination of how it will play out over time. ABM can be a very powerful tool in terms of Systems Thinking, but there are major limitations to this method. ABM models are only as effective as the specificity of the assumptions that are coded into them⁷. ABM is challenging to use when there is a lack of data, vague variables, lack of conceptual coding competency (of the individual) and shoehorning complexity⁸. This implies that one must know the intimate and specific details of a system to successfully employ the ABM method. For the topic of gaps in governmental nutrition support for the malnourished older adult, ABM is simply not feasible.

Why an Agent Based Approach (ABA)?

ABA IS A PROBLEM SOLVING METHOD used to examine CAS, with a final goal of creating recommendations and recommendation principles to advance the system to a more desirable state⁹. ABA is often used when ABM cannot be applied. Although both adapted from the theoretical insights of CAS, ABA is more applicable on a broader scale; ABA can be applied when there are limitations to ABM. ABA is a three-step method to better understand a current system, with the final product of recommendations that adapt the system from its current state to a more favorable state¹⁰.

Steps to an Agent Based Approach (ABA)

Step 1: DSRP Analysis of the System

DSRP IS THE ROOT theoretical construct of Systems Thinking, and provides the basic skills required for understanding and cognitively mapping complex systems¹¹. DSRP is considered the 'four simple systems thinking skills' and stands for Distinctions, Systems, Relationships, and Perspectives¹². Table 1 highlights the DSRP patterns and the elements within each pattern¹³.

Patterns	Elements
Distinctions (<i>D</i>)	identity (<i>i</i>) ↔ other (<i>o</i>)
Systems (<i>S</i>)	part (<i>p</i>) ↔ whole (<i>w</i>)
Relationships (<i>R</i>)	action (<i>a</i>) ↔ reaction (<i>r</i>)
Perspectives (<i>P</i>)	point (<i>ρ</i>) ↔ view (<i>v</i>)

Table 1: DSRP Summary

To properly understand the DSRP system, one must understand the elements within each pattern and the relationships formed within all elements. Cabrera et. al describes the interrelation of these four elements: "Distinctions can be made between and among things and ideas; things and ideas can be organized into systems, in which both the parts and the wholes can be identified; relationships can be made between and among things and ideas; and lastly, things and ideas can be viewed from the perspectives of other people, things, and ideas¹⁴."

Distinctions are comprised of an identity and an other, meaning that we define an idea or thing with a conscious reference to what it is not. Distinctions can be used to clarify the boundaries of what is inside and outside the scope¹⁵. Any-thing or idea can be distinguished from the other ideas or things it is with¹⁶.

Systems in and of themselves are constructed of parts and wholes, meaning that every whole can be broken into parts and every part can be found within a whole. This requires a micro-level and a macro-level analysis of the observed system to properly understand to the greatest degree of reality¹⁷.

17 12

Relationships must be classified between elements of the system, and identified relationships consist of actions and reactions. These relationships can be tangible (pipes connecting two faucets in a bathroom stall), conceptual (friendships formed between colleagues), or somewhere in the middle¹⁸.

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Perspectives are the lens we use to view our world, and the object and ideas found within said world¹⁹. Individuals, government agencies, political parties, businesses, and all identities alike have perspectives on all imaginable beings and beliefs within our world. Total awareness of perspectives allows us to step closer to a clear reality, as wicked problems are often caused by a disconnect between true reality and our biased perception of said reality.

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DSRP are the four core simple rules for systems thinking. These four simple rules can be combined and recombined in a myriad of ways to create a thorough understanding of larger systems, deepening in complexity with each review²⁰. While the relationships between the four core principles of Systems Thinking is important, it is critical that one's understanding is evolved through real world feedback²¹. To further one's understanding of their system comprised of these four elements, they must constantly and consistently present their mental models to the real world that surrounds them. In response, the real world provides actualized feedback on the theorized mental model. The current mental model is then adjusted and adapted based on the feedback, therefore pushing the model closer and closer to reality within each reality check. Figure 1 highlights the basis for Systems Thinking, DSRP loops and real world feedback on our current mental models²².

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DSRP is challenging to conceptualize without adequate visual explanation. Systems mapping is a method to visually display and organize one's mental model. Visual mapping is a powerful tool that is visual, kinesthetic, and object-oriented, allowing us to organize, contextualize, comprehend and communicate ideas and our current understanding of a specified system²³. Creating a map of a system allows us to observe the system as it currently exists, and evaluate said system for gaps in logistical disorganization. Mapping is used in all fields, such as physics, chemistry, politics, and all other imaginable disciplines²⁴.

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There are five major steps to Systems Mapping²⁵. First is to create a "Splat Map" of the system, meaning all relevant ideas are

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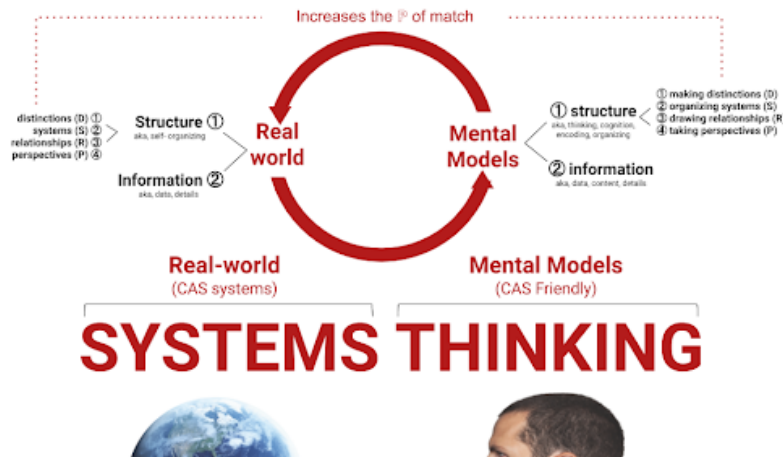


Figure 1: The ST-DSRP Loop and the Basis for Systems Thinking.

included and distinctions between items are being created. Next, create part-whole systems of the items that belong together, followed by identifying the key relationships. Then, take a deeper look into the part-whole systems, and define how those systems are interrelated. Lastly, identify important perspectives within the system. Once a system is mapped, one can recognize the underlying DSRP systems and utilize these tools to better understand a CAS.

Step 2: POSIWID and CAS Analysis

POSIWID STANDS FOR “the purpose of a system is what it does²⁶.” The intended mission or purpose of a system is often not what the system actually does. When assessing a system, it is critical to place focus on what the system actually does instead of its intended outcome. The POSIWID is the outcome of a system as it currently is, without any external impact²⁷. When completing a POSIWID analysis, analyze the outcomes of the system as by design – the system is ‘brilliantly designed’ at creating a ‘bad outcome²⁸.’

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²⁸ 7

Examining the POSIWID of a system allows for major systematic errors to be identified, and creates space for future recommendations and system improvement. Once the current POSIWID is defined, an ideal/desired future POSIWID is written and the root difference between the current and future POSIWIDs are identified. Examining the root differences identifies the errors within the system, allowing for informed recommendations and system improvement.

CAS are composed of autonomous agents following simple rules²⁹. CAS can be applied broadly to the world - any system imaginable can be defined as a CAS³⁰. The collective dynamics of the autonomous

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³⁰ 16; and 17

agents and the rules that they follow create complexity, adaptivity and robustness within a system. Individually, agents and simple rules do not create a system. When combined, agents following simple rules create self-organization, a collective dynamic, and complex emergent properties³¹. Identifying the agents within a system and the simple rules that they follow is the basis of understanding any existing system. The greatest impact one can have on the system is the agents and their simple rules – altering these factors will therefore adapt the collective dynamic and complex emergent properties³². Figure 2 illustrates the levels of CAS³³.

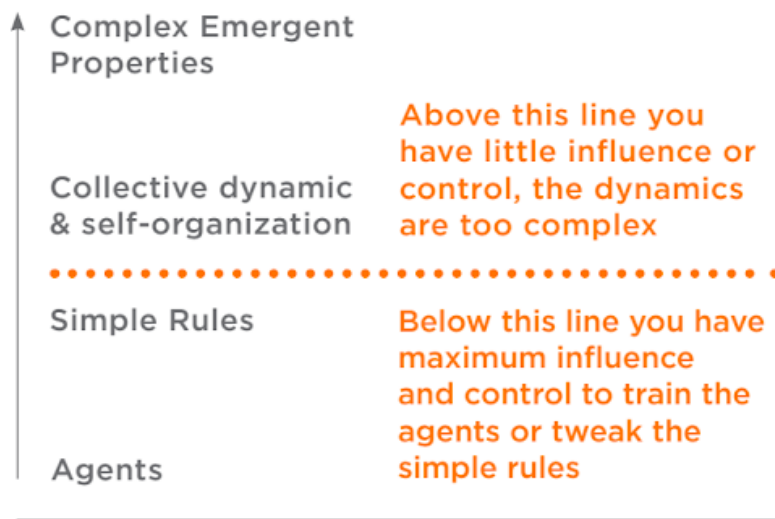


Figure 2: Levels of CAS

The purpose of a CAS analysis is to identify the elements that embody the system, and identify at which levels one can be most effective within their intervention and recommendations³⁴. To complete a CAS analysis, it is critical to first identify the agents within the system, each agent's perspectives, the simple rules the agents follow, the system-level behavior/emergent properties of the system, and how all of the items lead to a system-level behavior³⁵. Once these factors are identified, dive deeper into the listed agents of the system. Fill out a complete description of the agent, and clearly define their simple interaction rules. This step is critical, as this is the level that will be targeted within any recommendation or intervention.

Step 3: Rubric and Recommendations

RECOMMENDATION RUBRICS are used to create the “recommendation principles” that all future recommendations are required to meet³⁶. This rubric exists as recommendation design principles, and helps ensure that the recommendations posed will be effective and feasible within the current system. Creating the rubric forces the researcher to look beneath the specific recommendations to identify the patterns that connect all current and future recommendations, and is heavily based on the POSIWID Root Difference Analysis³⁷. If any recommendation made violates the principles established in the recommendation rubric, it should be rejected.

Recommendations following the rubric are more likely to be effective within the identified system. The goal of a recommendation is to change the identified system, moving towards the identified future/idealized POSIWID statement. The recommendations made can be innovative, creative and ‘out of the box,’ as long as they fall within the criteria of the recommendation rubric.

Results

DSRP Analysis of the System

TABLE 2 highlights the DSRP structures used in this map. The dropping rules used to define the parameters of this map are as follows: location (Tompkins County, New York), population (socially isolated, low income/ impoverished older adults (60+)), and focus (nutrition related factors). The perspectives in this map include; Older Adults, Governmental Nutrition Assistance Programs, and Family and Friends of the Older Adult. Approximately nine structural predictions were employed and the ST loop was navigated 26 times to approach the final iteration of this map. This map was checked through personal knowledge and working experience within this population, discussing factors and relationships with experts in the field, personal conversations with isolated older-adults from the target population, and a strenuous literature review highlighted throughout the DSRP analysis.

Dietary Intake

DIETARY INTAKE is the major outcome examined within this system. A well balanced diet of protein, carbohydrates and fat is crucial, as well as adequate intake of micronutrients, water and fiber, and a moderate to low alcohol intake. Figure 3 highlights the Dietary Intake SPW.

DSRP Structures	Number of Times Used
Identities (i)	63
Relationships (r)	18
Perspectives	3
Part-Whole Systems (SPW)	7
Actions (A)	16
Part Whole Systems on a Relationship (RDS)	3
Part Parties	2
Feedback Loops	2

Table 2: DSRP Structures Utilized in Map

Factors Worsening Diet Quality in Older Adults

THERE ARE TWO MAIN FACTORS that impact a low-income older adult's dietary intake. This includes access to safe and healthy foods, and poor mental health/mental status. Low access to safe and healthy foods can be described as food insecurity, and can be impacted by many external factors³⁸. Within the factor of access to safe and healthy foods, it is crucial to consider income, limited functional ability, and the need for a specialized diet. These three additional factors create a reversible feedback loop, as highlighted in Figure 4. Limited income reduces access to safe and healthy foods, as it makes the older adult unable to afford these food items³⁹. Specialized diets affects an older adult's access to safe and healthy foods, as it may create complex dietary restrictions that are challenging to maintain and follow, therefore making the older adult's food unsafe to consume⁴⁰. Limited functional ability reduces food access, as an older adult will be less able to grocery shop and adequately and safely prepare foods⁴¹. These three factors are interrelated. Limited income affects the older adult's ability to purchase potentially expensive foods that fit within their specialized diet. Limited/no income also means that the older adult is not working, which can worsen their functional limitation as they are not pushing themselves to continue moving. Specialized diets worsen limited income, as a higher percentage of the adult's monthly income is needed to be spent on food. Specialized diets affect functional ability; if an adult cannot follow their specialized diet, their functional ability will decrease (i.e. loss of toes/feet in a poorly managed type two diabetic)⁴². Functional limitations affect income, as the older adult will be unable to work if they are functionally limited. Functional limitations also may affect specialized diets because if the adult is functionally limited, they may not have the physical skills required to purchase and physically prepare foods needed for their specialized diet.

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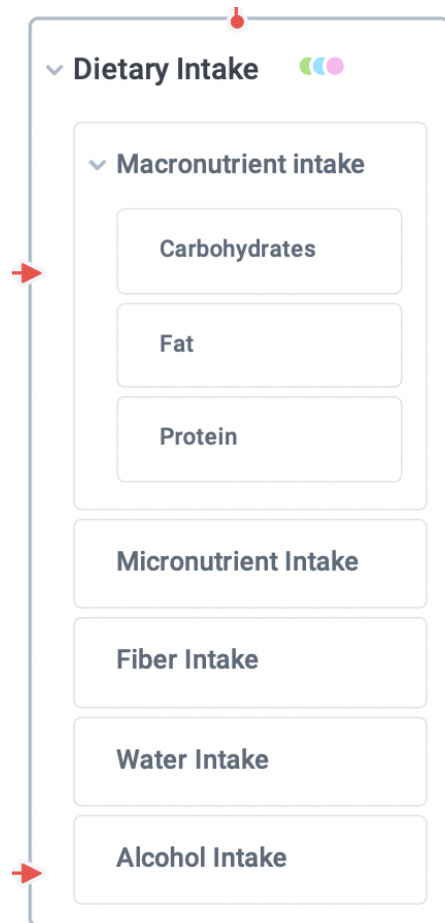


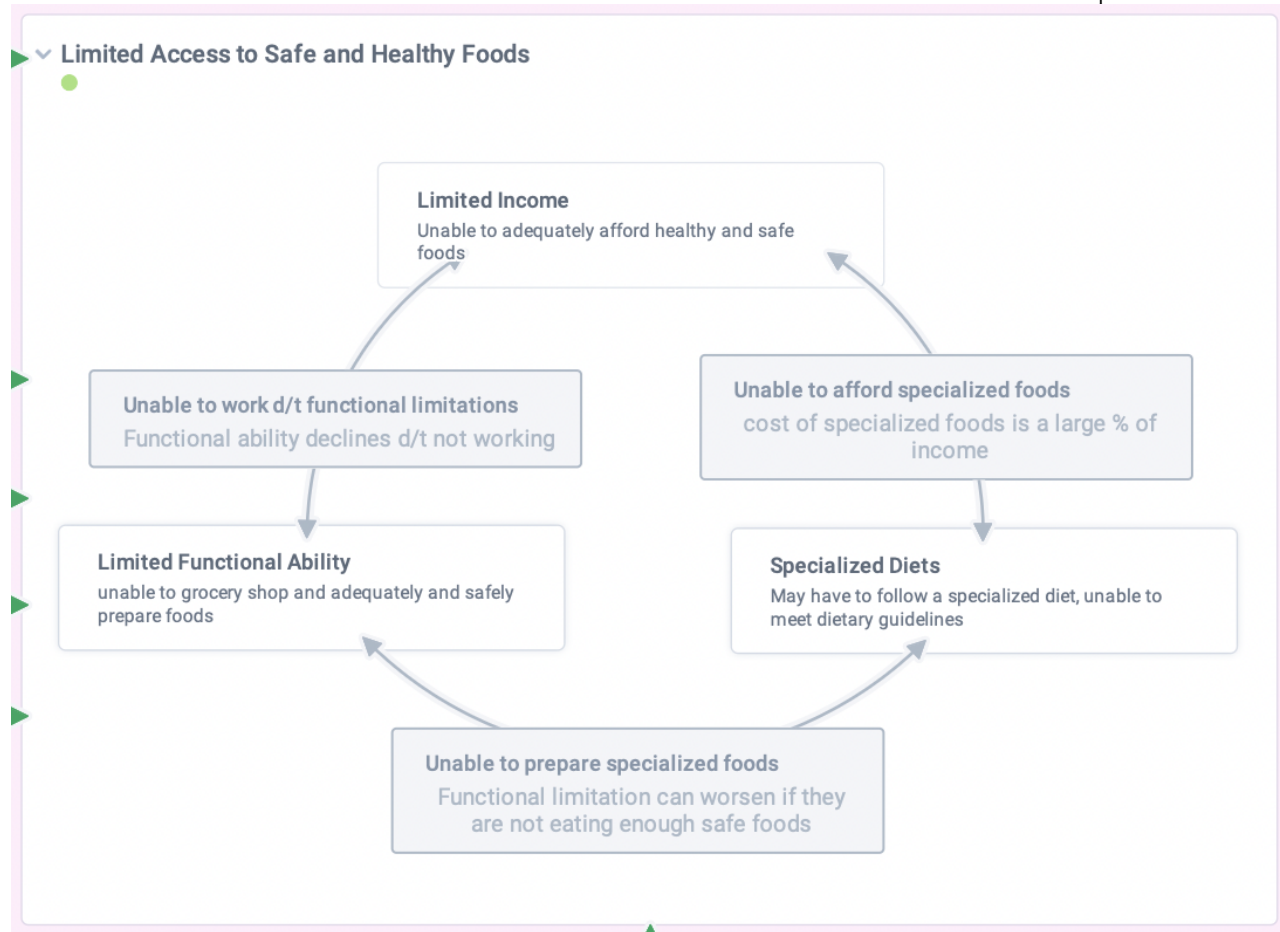
Figure 3: Dietary Intake SPW

Mental health and mental status is a major determinant of diet quality. Within the whole of Mental Health/Health Status there is a part-party describing the different elements of poor mental health that older adults often face. This part-party is depicted in Figure 5. These factors are social isolation/loneliness, cognitive disease (Alzheimer's, dementia, etc.), depression, anxiety and stress. Depression, anxiety and stress are all worsened by social isolation and loneliness.

In general, both of these wholes (Access to Safe and Healthy Foods and Mental Health/Mental Status) and the parts within them negatively affect diet quality in older adults. Figure 6 depicts the RDS between the two identified wholes and diet quality. The parts within this relationship whole are a high consumption of processed and ready-prepared foods, inadequate protein intake, excessive carbohydrate intake, and an inadequate caloric intake.

The factors shown above are the overall outcome of the two wholes (Access to Safe and Healthy Foods and Mental Health/Mental

Figure 4: Access to Safe and Healthy Foods Feedback Loop



Status) combined impact on dietary intake in older adults. However, Social Isolation/Loneliness has its own direct impact on dietary intake, which is depicted in Figure 7. Major parts of this relationship whole are diminished appetite, lack of motivation to eat and prepare full meals, lack of social modeling to eat a full meal, a worsened relationship with food, and a reduced desire to eat⁴³.

A feedback loop exists between Social Isolation/Loneliness and Dietary intake, and is depicted in Figure 8. As previously explained, social isolation worsens dietary intake. As it seems, poor dietary intake can worsen social isolation and loneliness. This is through the development of malnutrition and its serious comorbidities. When an older adult becomes malnourished, their immune system is weakened⁴⁴. They also experience higher levels of frailty (sarcopenia), making them at higher risk for falls and bone fractures⁴⁵. In addition to being at higher risk for acute illness and injury, poor diet is a major comorbidity for chronic disease⁴⁶. All of these factors combined

⁴³ 25; 26; and 27

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⁴⁵ 29; and 30

⁴⁶ 31; and 32

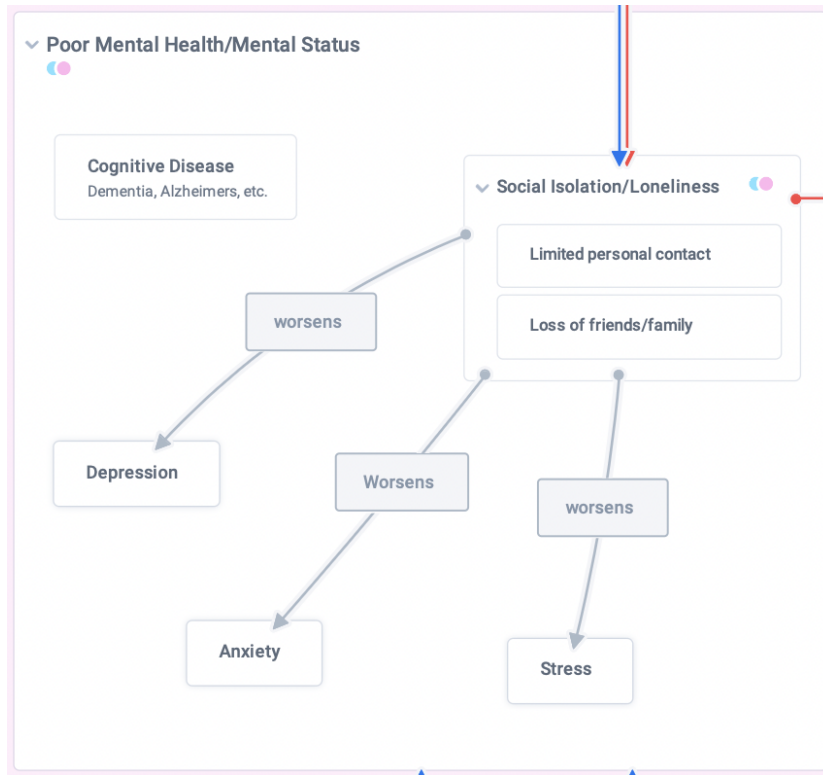


Figure 5: Mental Health/Mental Status
Part Party

make an older adult less likely to leave the safety of their own home, as they are more afraid of developing an illness or experiencing an injury. These factors worsen social isolation and loneliness. This worsening social isolation and loneliness further worsens dietary behaviors, creating an even worsened dietary intake.

Nutrition Support Services

THERE ARE GOVERNMENTAL and non-governmental nutrition assistance programs aiming to improve diet quality in older adults. The goal of the Office for the Aging is to “develop and make the most efficient use of supportive services and nutrition services in meeting the needs of older individuals⁴⁷.” Governmental nutrition assistance programs perceive limited access to safe and healthy foods as of critical importance. These governmental assistance programs aim to improve food security for the older adult. The governmental food-assistance programs are depicted in Figure 9. Funding for the governmental food-assistance programs are defined by Title III of the Office of the Aging, and include monetary support for: congregate meal services, Meals on Wheels, Farmers Market Coupons, SNAP benefits, and food pantries⁴⁸. These programs aim to increase food

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⁴⁸ 33; and 34

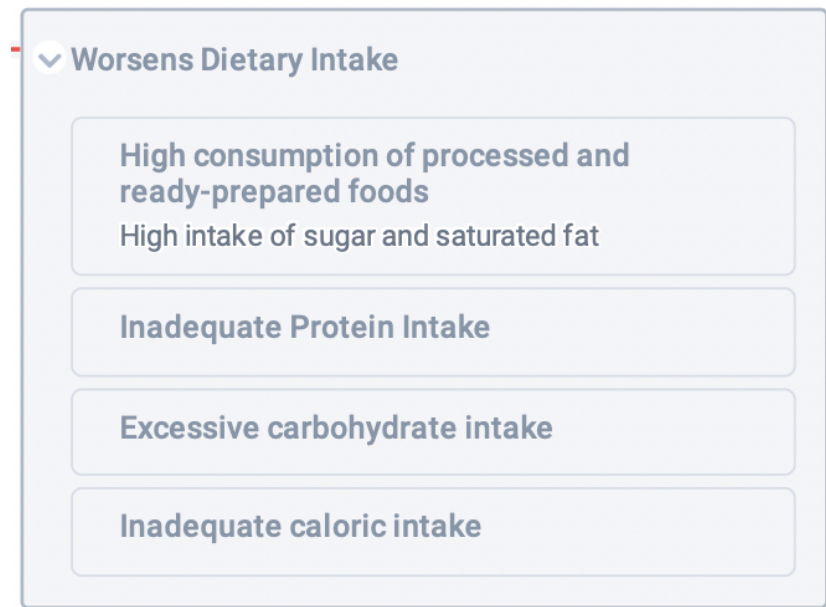


Figure 6: RDS between Factors Worsening Diet Quality in Older Adults and Diet Quality

security in older adults, by providing food and resources to purchase food⁴⁹.

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Congregate meal services also aim to improve social isolation/loneliness in older adults, but this program is not feasible for the immobile adult, or one who cannot afford transportation.

Non-governmental nutrition assistance programs are depicted in Figure 10. The parts within this whole are nursing homes and eldercare facilities, familial support, and faith based organizations such as churches. Nursing homes and eldercare facilities provide specialized diet-specific foods to older adults. Family and friends of the older adult view Mental Health/Health Status and Social Isolation/Loneliness as critically important for the older adult, and aim to lessen negative impacts of these parts, as well as provide food. Churches and faith based organizations provide food, social facilitation and a sense of community for older adults⁵⁰.

⁵⁰ 36; 37; and 38

POSIWID Analysis

THE MAIN GOAL of governmental nutrition assistance programs is to decrease food insecurity and improve dietary habits in older adults, and is highlighted in the POSIWID table below. The current POSIWID explains how the system is currently functioning, whereas the future POSIWID is the idealized statement that identifies the most favorable outcome of the system. The root differences between



Figure 7: RDS between Social Isolation/Loneliness and Diet Quality in Older Adults

the two statements are described, and errors in the system leading to the current POSIWID are identified.

Current POSIWID	Future POSIWID	Root Difference
The social support system for older adults is exceptionally well designed and good at its purpose of increasing rates of chronic disease and malnutrition.	The social support for older adults system is exceptionally well designed and good at its purpose of decreasing rates of chronic disease and improving diet adequacy of Older Adults.	At its core, POSIWID difference is 1. Lack of appropriate outreach (not serving the appropriate population adequately) vs. appropriate outreach to serve all eligible individuals. 2. Lack of support for mental health, loneliness and social isolation vs. adequate support. 3. Lack of support for programs that serve older adults - limited funding, understaffed, programs are ineffective vs. adequate administrative and monetary support.

Table 3: POSIWID Analysis

CAS Analysis

AS SEEN IN THE TABLE BELOW, the three major agents within this system are older adults in the United States, Governmental Support Programs for the Older Adult, and Non-Governmental Support for Older Adults. Older adults currently follow these simple rules;



Figure 8: Feedback Loop between Social Isolation and Dietary Intake

accept help from family and support organizations, try to continue life as normal while facing functional limitations, and stay home to avoid illness and injury. Older adults' system level behavior is to accept help when offered, experience social isolation, depression, stress and anxiety, and to accept socialization when it is safe and feasible.

The current simple rules for governmental support programs for older adults are as follows; provide food and resources to older adults, reduce food insecurity in older adults, and react to political changes/adapt programs to reflect current political demands. At its system level behavior, governmental support programs use funding to provide food-related services, and respond to changes in politics when adjusting programs (not the social needs of the individual).

Non-governmental support for older adults (family, friends, faith based organizations) provide food and resources to the older adult, as well as social, emotional and mental health support. Non-governmental support for Older Adults feel responsible for the health and well-being of the older adult. At the system level, the behavior of the non-governmental support is to respond to the needs of the older adult, and to feel overwhelmed by the social needs of the older adult. Since this agent is the only system providing emotional support, they may be unable to fully support the socialization needs of the older adult population.

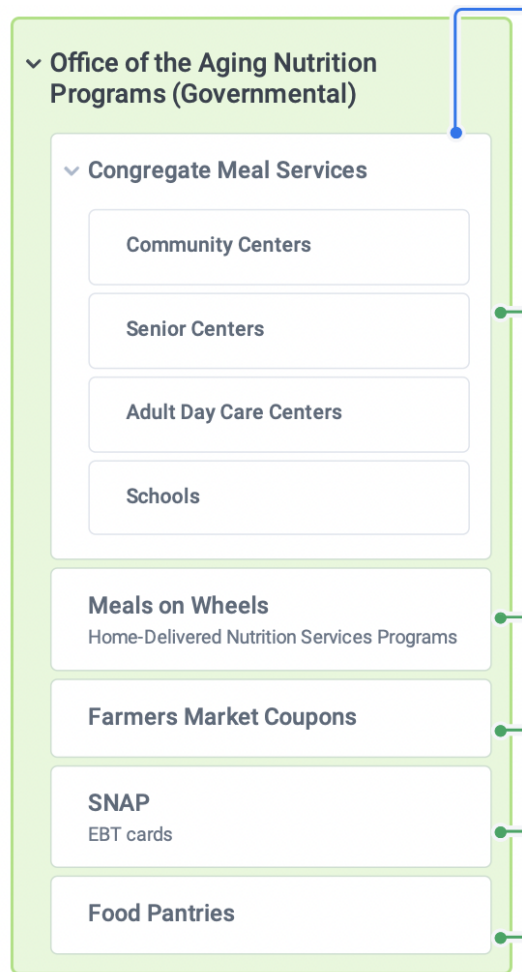


Figure 9: Office of the Aging Nutrition Programs SPW

Rubric and Recommendations

ANY RECOMMENDATIONS made should not violate the rules described in the recommendations rubric below. There are three major recommendations for this system, and they all incorporate social support systems and mental health services into the governmental nutrition assistance programs.

Recommendation Rubric

No specific recommendation should violate these rules:

1. The recommendations must not force the Older Adult to leave their home if it is unsafe or not feasible.
2. The recommendations must be proactive and seek to prevent loneliness and social isolation in Older Adults.



Figure 10: Non-Governmental Nutrition Assistance SPW

3. The recommendations must lead to coordinated response and interventions rather than merely a collection of responses and interventions.
4. The recommendation must increase evidence-based public communication and awareness.
5. The recommendations must be Older Adult centered and not centered by political affiliation.

Specific Recommendations

1. **Intervention/Recommendation 1:** The Office of the Aging administration should redesign their nutrition support programs to prioritize mental health and relationships with food in the populations that they serve.
2. **Intervention/Recommendation 2:** The Office of the Aging should develop support groups led by dietitians and mental health professionals for socially isolated Older Adults who are following specialized diets, cooking for one/eating alone or are experiencing functional limitations. These support groups should be led weekly over video chat to provide support, socialization, and creative problem solving for isolated adults aging in place facing difficulties during meal periods.
3. **Intervention/Recommendation 3:** The Office of the Aging should establish dining programs over video chat for isolated Older Adults to provide social modeling and social connection during meal periods.

List of Salient Agents	Current Simple Rules	Current System Level Behavior
Older Adults in the United States	1. Accept help from family and support organizations 2. Try to continue life as normal with functional limitations 3. Stay home to avoid illness and injury	1. Accept help when offered 2. Experience social isolation, depression, stress and anxiety 3. Accept socialization when safe and feasible
Governmental Support Programs for Older Adults	1. Provide food and resources to Older Adults 2. Reduce Food Insecurity in Older Adults 3. React to political changes/adapt programs to reflect current political demands	1. Use funding to provide food-related services 2. Respond to changes in politics, not the social needs of the individual
Non-Governmental Support for Older Adults	1. Provide Food and Resources to Older Adults 2. Provide socialization and emotional and mental health support for Older Adults 3. Feel responsible for the health and wellbeing of the Older Adult	1. Respond to the needs of the Older Adult 2. Feel overwhelmed by the social needs of the adult, unable to sufficiently and fully support the Older Adult's socialization needs

Table 4: CAS Analysis

Discussion

DSRP Analysis of the System

THE MOST CRITICAL ASPECT of the results presented using the ABA process is that the only nutrition related service that provides social facilitation is congregate meal services, which are not possible to attend for the immobile older adult. The only social support provided for older adults is from families and faith based organizations. The lack of social support creates major disruptions in adequate dietary patterns, which was noted in Figure 7. When an older adult is socially isolated, they are incredibly less likely to eat full and balanced meals. This lack of desire to eat can create a downward spiral, as individuals are more likely to experience worsening acute and chronic disease if they are malnourished. When someone faces worsening disease, they are more likely to be socially isolated due to frailty and illness - therefore worsening social isolation. This feedback loop is a major downward spiral in diet quality and mental health for the older adult, and must be addressed within our governmental nutrition assistance programs.

POSIWID Analysis

THE ROOT DIFFERENCES between current and future POSIWID are as follows; governmental nutrition assistance programs are not serving the entirety of its eligible population, mental health and social isolation in older adults is not being addressed, and there is a lack of funding in governmental nutrition assistance programs, leading these programs to be ineffective as a whole. Addressing these root differences will allow for the system to move towards the idealized POSIWID: “The social support for older adults system is exceptionally well designed and good at its purpose of decreasing rates of chronic disease and improving diet adequacy of older adults.”

Many of the root differences can be improved through adequate funding. Monetary support is the bloodline at the basis of every government initiative, and without it programs will flat-line. One major way to improve the outreach and effectiveness of any government assistance program is to increase monetary support, and government nutrition assistance programs do not differ in this value.

To reach the entirety of its eligible population, governmental nutrition assistance programs must have better outreach into the community, and eligible individuals must be interested in participating within the programming. This can be done in several ways. If funding is improved, the quality of the programs will improve, therefore inevitably encouraging more individuals to be interested in participating. Education and information about the existing programs should be broadly advertised. If more people know about the services and what they provide, more eligible participants are likely to enroll.

Addressing mental health and social isolation is a major challenge for older adults aging in place. However, as previously discussed, it is critical to improving the dietary habits and therefore the health and wellbeing of this population. Mental health and socialization is not currently being addressed adequately within governmental nutrition assistance programs. In an idealized POSIWID, these factors would be addressed.

CAS Analysis

THE MAIN TAKEAWAYS from the CAS analysis show that older adults are socially isolated due to fear of illness and injury, and are struggling with the effects of aging alone. Older adults in the United States will accept help when it is offered, but the only social support being offered for home-bound older adults is non-governmental.

These non-governmental support systems include families and faith based organizations, and aim to provide food, resources, and social and emotional support to the older adult. Faith based organizations create a wonderful sense of community for the older adult, but require the older adult to leave their home to attend events. This may not be possible for immobile adults with functional limitations, or for adults that refuse to leave their homes due to fear of illness or injury. This leaves the majority of social and emotional support coming from family. Since family is the only emotional and social support for the home-bound older adult in the current system, this can be a rather challenging and overwhelming task. This can place enormous amounts of pressure on the older adult's direct family, as their family may be limited in the time and support that they can provide. Many individuals face obligations such as work and their own family, making it challenging to devote their time to emotionally supporting another human being.

Governmental support programs for older adults provide food and resources to the older adult, with the main goal of reducing food insecurity within this population. While food insecurity is a major concern that should be addressed, it does not paint the full picture of dietary habits and behaviors. Older adults are accepting of the foods provided, but if the adult is not motivated to eat, they will not benefit from the provided food. Addressing the social isolation experienced by the aging in place community has major potential to improve dietary behaviors and therefore dietary intake.

Rubric and Recommendations

THIS RUBRIC PROVIDES a valuable tool to creating effective recommendations and interventions, and can be used for future programming. As long as the recommendations do not violate any of the rules highlighted in the rubric, they are more likely to be systematically effective. The first rule is that the recommendations posed must not force the older adult to leave their home if it is unsafe or not feasible. This rule is critical. Older adults afraid to leave their homes due to fear of illness or injury will not participate in programs that require travel, therefore rendering the programs useless. Any program to improve social isolation in these adults must be able to take place within the older adult's place of residence.

Programs that prevent the problem are more effective than programs who attempt to reverse the damage from the problem. Recommendations made must be proactive and seek to prevent loneliness and social isolation in older adults. This means that programs and interventions

placed must reach the adult before they are completely socially isolated, in order to prevent the feedback loop between social isolation and dietary intake highlighted in Figure 8.

Interventions must be interconnected and coordinated between community organizations and government entities. This is the basis of the third recommendation; the recommendations must lead to coordinated response and interventions rather than merely a collection of responses and interventions. This means that the community is involved in the interventions and programs implemented through the government organization. Community organizations can aid through outreach, education and recruitment for these socialization programs, to help target the most vulnerable older adults. Creating a unified front between community organizations and government entities will also provide for stronger, more effective programs rather than small programs separately run by different organizations.

All programs and interventions must be founded in scientific evidence. Programs and interventions should be pilot tested in a small scale, low-risk setting to ensure that they are safe and feasible for the population they serve. Managing mental health services is incredibly challenging, and may pose ethical and health concerns for the older adults involved. It is critical to ensure that the programs will be effective before they are implemented on a larger scale. This will save governmental and community time, effort, and monetary resources for only the programs that are most likely to succeed.

The last recommendation rubric rule is that the recommendations must be older-adult centered, not centered within political affiliation. This means that the social facilitation programs are only founded in benefits for the population they serve, and are not aimed to benefit either political party. While the implementation of these programs may inevitably benefit one political party over another, the sole aim of these interventions must be to benefit the older adult aging in place.

All three recommendations posed are agent-based, meaning that they focus on the three agents identified within the CAS analysis (older adults, governmental nutrition assistance programs, and non-governmental support for older adults). The first recommendation focuses within governmental nutrition assistance programs, and is as follows; "The Office of the Aging administration should redesign their nutrition support programs to prioritize mental health and relationships with food in the populations that they serve." This recommendation means that it is critical for mental health to be addressed and seen as a major concern within the older adult community, as it is a main predictor of dietary habits and dietary intake. Future

nutrition programming run through government entities must prioritize mental health, and focus on mending the older adult's relationship with food, one meal at a time.

The second recommendation focuses specifically on the older adult and specific support systems that would prioritize their mental health. The second recommendation is as follows: "The Office of the Aging should develop support groups led by dietitians and mental health professionals for socially isolated older adults who are following specialized diets, cooking for one/eating alone or are experiencing functional limitations. These support groups should be led weekly over video chat to provide support, socialization, and creative problem solving for isolated adults aging in place facing difficulties during meal periods." This recommendation provides an outline to specific socialization events that are safe for the older adult, promote socialization within the older adult community, and mend the older adult's relationship to food. Providing virtual support groups (through Zoom or similar technology) that cover food and health related information will allow the older adults to socialize with their peers, discuss challenges they are facing, as well as develop creative solutions to resolve some of their issues. Having weekly check-ins with this program will allow older adults to voice their concerns to their peers, and develop relevant and timely solutions to the issues that they are facing.

The third recommendation is to establish dining programs over video chat for isolated older adults to provide social connection during meal periods. This recommendation is founded in the belief of social modeling. Literature has demonstrated that social modeling can have a major positive impact on dietary behaviors of an individual⁵¹.⁵¹ 39; 40; and 41 If older adults know that they are expected to eat a meal with another person, they are more likely to prepare a full, well balanced meal. Having a scheduled time to eat a meal with a peer will also encourage the older adult to actually eat a meal, even if they do not have a large appetite, instead of skipping the meal period completely.

These recommendations are expected to change the behavior of the system. The implementation of social programs through governmental nutrition assistance will extend the reach that governmental nutrition assistance programs have within the older adult community. This will improve socialization, dietary behaviors and dietary intake.

Implementing government social support programs will also lighten the burden placed on community, family and faith based organizations. Currently, these are the only institutions providing social support to the isolated older adult. Once nutrition based social programs are implemented, the weight of providing social facilitation will be spread through the community, allowing for improved

social networks. These programs will connect older adults with peers facing similar challenges, allowing for more personal support than other organizations may be able to provide. This increase in socialization will also lessen the impact that loneliness has on stress, anxiety and depression faced by older adults, as highlighted in Figure 5.

With the implementation of said improved social support programs, the degree of social isolation that older adults face will lessen. Improving social isolation and loneliness will therefore improve the dietary behaviors related to loneliness - interrupting the feedback loop between social isolation and dietary intake highlighted in Figure 8. This interruption in the feedback loop will improve social facilitation, dietary behaviors, dietary intake, and overall health and nutrition status for the older adult aging in place.

Opportunities for Future Research

Future research should be conducted to examine effective community and governmental programming to improve social facilitation in the aging in place population. To maintain socialization in home-bound adults, technology will have to be implemented. The use of new technology is often challenging in this population, so rigorous pilot testing of new technology should be employed before a program is implemented on a large scale. Once appropriate technology is identified, different forms of food-related social and emotional support programs should be examined for effectiveness and feasibility.

Once the recommendations are in place, a follow-up ABA analysis will be conducted. This will examine the newly adjusted system, and identify the effectiveness of the enacted programs on social isolation, loneliness and therefore dietary intake in older adults.

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