HEALTH BEHAVIOR CHANGE IN RURAL POPULATIONS: INSIGHTS TO INFORM NUTRITION AND PHYSICAL ACTIVITY PROGRAMMING

by

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ABSTRACT

Rural communities across the United States face unique barriers to maintaining healthy behaviors, including limited access to nutritious foods, exercise opportunities, and supportive health programs. These challenges contribute to higher rates of chronic illness and lower overall quality of life compared to urban populations. Despite growing interest in public health strategies that promote nutrition and physical activity, there remains a critical need to understand how to design and implement effective, sustainable interventions that reflect the specific needs of rural residents. This dissertation examines the problem of how to support health behavior change in rural communities, using the Social Ecological Model (SEM) to explore the multiple levels of influence that shape individual health choices. Three studies were conducted in rural Montana to investigate different aspects of nutrition and exercise behavior. The first study evaluated the reach, implementation, and sustainability of community-based produce prescription programs that provide free or discounted fruits and vegetables to individuals experiencing food insecurity. The second study explored the life experiences, environmental factors, and supports that encourage long-term physical activity among older adults. The third study examined how different types of support influence older adults' confidence in their ability to engage in and maintain regular exercise. Findings from the first study showed that produce prescription programs are more successful when they involve strong community partnerships, flexible distribution methods, and tailored educational components. The second study found that factors such as early-life activity habits, personal motivation, and social support were key to ongoing participation in exercise. The third study identified that facilitators like enjoyment, community encouragement, and accessible programming were linked to higher levels of exercise confidence among older adults. These findings suggest that promoting healthy behavior in rural communities requires attention to individual preferences as well as social and structural conditions. By applying the SEM framework, this research highlights the importance of addressing multiple levels of influence such as individual beliefs, social networks, community infrastructure, and health policies. Together, these studies offer practical guidance for developing locally relevant, sustainable health programs that improve nutrition and physical activity, ultimately supporting better health outcomes in underserved rural populations.

CHAPTER ONE

INTRODUCTION

Health behavior change is a central focus in public health due to its significant role in preventing and managing chronic disease, improving quality of life, and reducing healthcare costs at both the individual and population levels (Snowsill, et al., 2022). Despite its importance, achieving and sustaining meaningful behavior change remains a complex challenge. This difficulty arises from the interplay of social, emotional, and cognitive factors that influence individual decision making (Schwarzer, 2008). Elements such as motivation, self-efficacy, environmental barriers, and access to supportive resources all play a critical role in determining whether individuals adopt and maintain healthy behaviors (Kosteli, Williams, & Cumming, 2016). These challenges are often more pronounced in underserved populations, where structural inequities and limited resources can further hinder engagement in long-term health promoting behaviors (Jensen, Monnat, Green, Hunter, & Sliwinski, 2020). Understanding and supporting health behavior change is therefore essential for the development of effective, equitable interventions that promote lasting improvements in health outcomes. Over the years numerous models and theories have been developed to better understand behavior change and guide the design of interventions that help individuals achieve their health-related goals. This dissertation explores the complexities of behavior change in the context of nutrition and physical activity, with particular attention to program implementation strategies in rural communities such as those in Montana. Given some of the geographic and socioeconomic challenges faced by rural

populations, it is essential to explore best practices for effective intervention implementation (Weeks, et al., 2023).

The Social Ecological Model (SEM) serves as an appropriate and effective framework for understanding behavior change in this dissertation, as it provides a comprehensive lens through which to examine the multiple levels of influence that shape health-related behaviors. SEM emphasizes the dynamic interaction between individuals and their environments across five interconnected levels: intrapersonal, interpersonal, institutional, community, and public policy (McLeroy, Bibeau, & Glanz, 1988). This layered approach is particularly useful for investigating nutrition and physical activity behaviors, as it accounts for both individual-level determinants such as knowledge, motivation, and attitudes and broader contextual factors including social support networks, availability of resources, and policy-driven health initiatives (DeSalvo, Olson, & Casavale, 2016).

Importantly, SEM supports a nuanced understanding of behavior in rural populations by acknowledging the complex and often bidirectional influence that can either facilitate or hinder health behavior change. The model's flexibility allows for consideration of unique rural challenges, such as geographic isolation, limited access to healthcare and recreational infrastructure, and socio-economic disparities. (Haynes-Maslow, Osborne, & Jilcott Pitts, 2018). Furthermore, the inclusion of a temporal perspective, often referred to as the chronosystem, enhances the model's relevance by recognizing how life-course experiences and transitional periods shape current dietary and exercise habits. By employing SEM, this dissertation is grounded in a theoretical model that aligns with the real-world complexity of promoting health in

rural communities and supports the development of targeted, contextually appropriate interventions (Haynes-Maslow, Osborne, & Jilcott Pitts, 2018).

This dissertation explores the multi-level determinants of behavior change and identifies what we believe to be best practices for developing and implementing effective, community-driven interventions tailored to rural populations. The three studies presented collectively seek to understand and enhance health behavior change interventions, with a focus on understanding nutrition and exercise in rural communities. While extensive research has examined barriers to healthy behaviors, there remains a critical gap in understanding how to effectively implement facilitators of behavior change, particularly in rural settings (Haynes-Maslow, Osborne, & Jilcott Pitts, 2018) (Gilbert, Duncan, Beck, & Eyler, 2019). This research aims to address this gap by 1) exploring strategies to improve nutrition behaviors through produce prescription programs, 2) to enhance exercise participation and 3) to examine self-efficacy among older adults.

The first study examines the effectiveness of produce prescription programs in promoting nutrition behavior changes across three rural communities. Food security is a pressing issue in the United States, affecting approximately 11% of household (United States Department of Agriculture, 2025). Economic downturns, such as the 2007-2008 financial crisis and the Covid-19 pandemic, have exacerbated this problem, significantly increasing food insecurity rates (National Institute on Minority Helath and Health Disparities (NIMHD), 2024; United States Department of Agriculture, 2025).

Over the past half-century, efforts to combat hunger and food insecurity have primarily focused on ensuring sufficient food supply, often placing less emphasis on nutrient-dense foods,

like fruits and vegetables (Zenk, Tabak, & Perez-Stable, 2022). The USDA defines food security as consistent access to affordable, quality, and nutritious foods essential for health and disease management (United States Department of Agriculture, 2025). However, individuals experiencing food insecurity frequently rely on energy-dense foods, like processed foods high in salt or added sugar, which can lead to diet-related chronic conditions (Aiyer, et al., 2019). This behavior reflects intrapersonal and interpersonal influences, including food preferences, nutrition knowledge, and household-level financial constraints, while also being shaped by broader community and policy-level barriers to accessing nutritious foods.

Consistent with SEM food, access is influenced by an interrelated set of social, cultural, economic, and geographic factors. For example, at the community and public policy level zoning, transportation infrastructure, food pricing, agricultural subsidies can either facilitate or inhibit access to healthy food options (Little, et al., 2022). Structural disparities in food access disproportionately affect racial and ethnic minority groups and low-income populations, contributing to health inequities through increased rated of diet-related chronic illness (Amegbletor, Goldberg, Pope, & Heckman, 2023). These structural conditions often reinforce individual-level behaviors, illustrating the bi-directional nature of influence between environmental constraints and personal health choices.

These challenges in food insecurity are particularly pronounced in communities with limited access such as rural communities where geographical isolation and lack of infrastructure limit food access (Dean & R, 2011). In Montana, for example, many residents must travel long distances to reach full-service grocery stores (Burrington, Hohensee, Tallman, & Gadomski,

2020).Nearly half of Montana's counties are classified as food deserts – defined as an area where more than 30% of residents live in poverty and are located at least ½ mile away from a supermarket, supercenter, or large grocery store – limiting individuals access to nutrient dense foods like fruits and vegetables (Montana Food Bank Network, 2025; DeWitt, et al., 2020; U.S. Department of Housing and Urban Development , 2025). These community-level conditions may not only restrict access to nutritious foods but also shape daily routines, social norms, and health-related behaviors across the population.

In response to these multi-level challenges, prescription (Food Rx) programs have emerged as a promising strategy to address food insecurity. These programs provide free or discounted produce to individuals including those with diet related chronic conditions. Produce prescription programs align with SEM by addressing multiple levels simultaneously: they reduce financial barriers at the individual level, offer social support through clinical and community-based networks, and contribute to policy-level solutions aimed at improving equitable food (Hager, et al., 2023). Moreover, they can influence future policy by demonstrating how community-driven models improve both health and economic outcomes.

While many existing programs have been studied in urban or clinical settings, less is known about how they function in rural contexts, where implementation must navigate unique structural, cultural, and logistical constraints. These settings provide an opportunity to examine how SEM's multiple levels interact in real-world, underserved environments. For example, ethe success of a Food Rx program in a rural area may depend not only on individual participation but also on the presence of local partnerships, community resource availability, and supportive

institutional practices. Likewise, participants improved dietary behaviors can reinforce community demand for healthy food access and increase support for program sustainability, demonstrating the model's bi-directional nature.

This study aims to address this gap by examining the reach, impact, and sustainability considerations of produce prescription programs in rural Montana. It explores how individual-level behaviors are shaped by social and structural conditions and how, in turn, successful community-based initiatives may influence broader systems. By grounding this research in the SEM, this work provided a holistic view of the factors that enable or hinder equitable food access and identifies pathways for developing and sustaining effective, community-driven interventions in rural settings (Owens, Cook, Reasoner, McLean, & Amy, 2024). These findings will inform future programs of potential methods for implementing a successful community-driven Food Rx program.

The second and third studies in this dissertation examine exercise behavior among older adults in rural Montana, with particular attention to how past experience (chronosystem) and various levels of influence within the SEM shape current engagement in physical activity. SEM provides a valuable framework for understanding the dynamic and reciprocal relationship between individual behaviors and broader social and structural contexts. These studies explore how facilitators at multiple levels including intrapersonal (e.g., motivation, self-efficacy), interpersonal (e.g., social support), institutional (e.g., availability of programs), community (e.g., local culture and infrastructure), and policy (e.g., public health funding) interact to influence long-term exercise habits among older rural adults.

By 2050, the population of adults aged 65 and older is projected to increase by 47%, rising from 58 million in 2022 to 82 million (Unites States Census Bureau, 2022). This demographic shift brings with it a range of age-related health challenges, including chronic diseases, mobility limitations, sensory decline, and cognitive impairments, all of which can increase the risk of disability, social isolation, and mortality sensory impairments, muscle weakness, chronic disease, and cognitive decline (Office of Disease Prevention and Health Promotion (OASH), 2024). Although regular physical exercise is a well-established, cost-effective strategy for maintaining health and quality of life, most older adults fail to meet the recommended 150 minutes of moderate exercise per week, with even lower participation rates in rural areas (Mehegan & Lampkin, 2023). This trend reflects not only individual-level challenges such as declining physical function or lack of motivation, but also community and policy-level barriers including limited infrastructure, lack of affordable programming, and minimal transportation options (Goins, Williams, Carter, Spencer, & Solovieva, 2005; Meredith, et al., 2023). These interrelated influences highlight the need to apply a multilevel perspective, as offered by SEM, to effectively support behavior change.

In Montana, where over 64.7% of the population resides in rural areas, and older adults are projected to outnumber younger populations by 2030 these issues are particularly relevant (Lo, et al., 2017). Although recreational activities are one strategy used to promote physical activity, many older adults cite environmental concerns such as poor lighting, uneven trails, and safety risks as deterrents (Montana State Parks, 2019). These concerns illustrate how environmental and policy-level conditions can negatively impact individual behavior and perceptions of self-efficacy. Previous research has predominately focused on barriers to exercise

(Bethancourt, Rosenberg, Beatty, & Arterburn, 2014). In contrast, this dissertation aims to shift the focus toward identifying and understanding facilitators of long-term engagement, while examining how those facilitators operate across SEM levels and interact with one another in behavior change

The second study investigates the facilitators that shape older adults' exercise experiences and contribute to continued participation in physical activity. Guided by SEM, this study examines facilitators across all levels from individual level factors such as personal motivation and perceived health benefits to interpersonal influences such as encouragement from family or friends, and institutional supports such as local Extension programming. By analyzing how these facilitators interact and reinforce one another, the study explores the bi-directional nature of influence. For example, how individual motivation may be strengthened by positive social reinforcement, or how improved infrastructure may increase confidence and participation. In doing so, the study provides valuable insight into how multi-level, contextually grounded strategies can be designed to meet the specific needs of rural older adults.

The third study builds on this foundation by exploring the relationship between exercise facilitators and exercise self-efficacy, which refers to an individual's belief in their ability to successfully engage in and maintain physical activity. While the literature research has traditionally emphasized barriers to exercise self-efficacy, there remains limited understanding of the positive influences that can enhance it (Bethancourt, Rosenberg, Beatty, & Arterburn, 2014; Patel, Sheth, & Jain, 2024). This study examines how facilitators at various SEM levels contribute to self-efficacy, such as how access to low-cost programs (policy), supportive peer

networks (interpersonal), and prior positive experience with exercise (chronosystem and intrapersonal) collectively impact an individual's confidence. This study also considers how increase self-efficacy may, in turn, influence perceptions of environmental and social support, demonstrating SEM's principles of reciprocal determinism. The findings aim to identify the most impactful facilitators and inform the development of interventions that build and sustain self-efficacy in rural settings, where traditional strategies may require adaptation.

Together, these studies contribute to a deep understanding of the layered and interacting factors that influence behavior among older adults in rural settings. By focusing on these multisystem influences, this research provides valuable insight into how interventions can be designed to overcome challenges unique to rural communities, ultimately informing best practices for improving health outcomes in rural communities.

Research Aims, Objectives, and Questions

The overarching aim of this research is to explore strategies for effectively promoting behavior change in nutrition and exercise among rural populations. The specific objectives are:

1. To evaluate the implementation of a community-designed produce prescription program in three rural Montana communities.
2. To identify key facilitators that positively influence an individual's exercise behavior and experience, particularly among older adults
3. To assess how exercise self-efficacy is influenced by different facilitators and whether specific facilitators have a greater impact on individuals' confidence in maintaining an active lifestyle

Key research questions include:

1. How do rural produce prescription programs function outside of traditional research interventions, and what best practices can be identified
2. What life experiences and environmental factors most significantly shape individuals' long-term exercise habits
3. How do different facilitators influence exercise self-efficacy in older adults, and which are most impactful in fostering sustained engagement in physical activity

CHAPTER TWO

MITIGATING NUTRITION INSECURITY AMONG RURAL POPULATIONS: EVALUATION OF PRODUCE PRESCRIPTION PROGRAMS

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Introduction

For nearly half a century, efforts to address hunger and food insecurity have primarily focused on ensuring adequate food supply, often without explicit consideration of nutritional quality (Zenk, Tabak, & Perez-Stable, 2022). However, researchers are increasingly exploring the importance of nutrition in food security – defined by the USDA as consistent access to affordable, quality, nutritious foods necessary for maintaining health and managing disease. Individuals experiencing food insecurity often rely on energy-dense, processed foods high in calories, salt, or added sugar, as opposed to whole foods dense in diverse nutrients (Aiyer et al., 2019). Adequate access to nutritious foods is a key factor in preventing diet-related chronic conditions and fostering long-term health (cite). Various social, cultural, economic, and geographical factors influence an individual's ability to access and afford healthful nutrient dense foods (Little, et al., 2022). To develop effective, sustainable solutions to address food and nutrition insecurity for all, it is important to recognize the interconnected role of environmental and socioeconomic factors in shaping dietary habits.

In spite of numerous prevention and support efforts, access to food – and more critically, to nutritious food – remains a significant challenge across the United States. Household food insecurity, defined as the economic and social condition of limited or uncertain access to adequate food is a widespread issue affecting approximately 11% of U.S. households (United States Department of Agriculture , 2025). Periods of economic downturn tend to exacerbate food insecurity, as seen during the 2007-2008 financial crisis when food insecurity surged to 15% and

again during the COVID-19 pandemic when it increased to 13% (National Institute on Minority Health and Health Disparities (NIMHD), 2024; United States Department of Agriculture, 2025).

Widespread Impact of Food Security

Food and nutrition security affect all populations, though some groups experience disproportionately higher rates of nutrition-related chronic conditions and associated medical costs. Research has established a strong link between food insecurity and the development of diet-related chronic disease, particularly diabetes and cardiovascular disease (Amegbletor, Goldberg, Pope, & Heckman, 2023). Individuals managing diabetes while experiencing food insecurity often struggle to adhere to recommended dietary and medical management strategies due to financial constraints (Strings, Ranchod, & Laraia, 2016). Furthermore, individuals with chronic diet-related conditions, such as diabetes, incur medical costs estimated to be 2.3 times higher than those without the disease (Veldheer, et al., 2021).

In its most severe form, food insecurity can prevent individuals from meeting their basic caloric needs. In less extreme cases, individuals may need to shift their diets toward lower-cost, energy-dense foods, which can have long-term negative health effects (Seligman, Jacobs, Lopez, Tschann, & Fernandez, 2012). Research has also found that food insecurity disproportionately increases the risk of type 2 diabetes among certain populations, particularly Latinas and white men and women. African American men and women, as well as Latinos also faced increased risk of developing type 2 diabetes, though food insecurity alone was not as strong a predictor due to other contributing factors in these groups (Strings, Ranchod, & Laraia, 2016).

Disparities in Access to Nutritious Foods

Food and nutrition insecurity disproportionately affect racial and ethnic minorities, low-income populations, and individuals living in rural, remote, insular, and tribal communities (Seligman et al., 2023). Limited economic access to healthful foods compels individuals to adopt hunger-coping strategies, such as consuming foods that are culturally unfamiliar, misaligned with their preferences, or energy dense yet inexpensive, prioritizing immediate cost savings over long-term health outcomes (Calloway, Carpenter, Gargano, Sharp, & Yaroch, 2022). Individuals earning at or near minimum wage, facing underemployed, or those that are unemployment often struggle to afford basic living expenses, making it difficult to prioritize healthful eating (Byker Shanks, Calloway, Parks, & Yaroch, 2020). This challenge is particularly pronounced among low-income populations managing diabetes in rural states, where limited access to nutritious food options may further compromise their health and overall well-being.

This is particularly pronounced in rural states like Montana, where access to fresh, nutritious food is limited by geographic isolation, transportation barriers, and a scarcity of grocery stores (Dean & R, 2011). Barriers such as transportation impact individuals' ability to access the produce and impacts the quality of the produce they have. The shortened growing season in Montana means that fresh produce has to be transported from several states away potentially impacting the quality. Half of Montana's 56 counties are classified as food deserts where residents must travel more than 10 miles to reach their nearest grocery store (Montana Food Bank Network, 2025). Furthermore, 33% of Montana's population resides in rural or frontier areas, while the majority of the population is concentrated in just 10 of the state's 56 counties (U.S. Department of Health and Human Services, 2023). These disparities contribute to

higher rates of diet-related chronic disease among rural populations compared to their urban counterparts (DeWitt, et al., 2020) Due to some of the challenges faced by rural individuals, methods to address nutrition insecurity may require adaptive interventions (Stroud, Jacobs, Palakshappa, & Sastre, 2023).

Produce Prescriptions

One promising strategy to address food and nutritional insecurity is the implementation of produce prescription programs, which provide free or discounted produce to food insecure individuals with or at risk for diet-related chronic conditions. These programs aim to mitigate the financial burden of healthy eating and support improved dietary habits (Hager, et al., 2023).

Although various produce prescription program models exist, they differ in structure, implementation, and outcomes. Many of the programs share overarching goals to enhance affordability, improve nutritional literacy, and increase access to preventive healthcare while reducing reliance on costly medical services such as emergency room visits (Little, et al., 2022). Most provide vouchers of varying value, redeemable at participating grocery stores and farmers markets (Hager, et al., 2023). In addition to financial assistance, participants often receive nutrition education materials, though the delivery format and content of these resources vary.

Studies suggest that produce prescription programs have successfully met these goals. Research notes they led to measurable improvements in fruit and vegetable intake, reductions in household food insecurity, enhanced self-reported health status, and in some cases, improvements in certain biomarkers associated with diabetes, such as HbA1c (Hager, et al., 2023). However, there is little research understanding of the implementation outside of

structured, research-based interventions in urban settings. When community sites develop their own best practices to meet localized needs, it remains unclear how these programs function and how outcomes compare across different settings.

Implementation Considerations – Multilayer Approach

The successful implementation of produce prescription programs requires a comprehensive, multilayer approach; therefore, it is appropriate to use the social ecological model (SEM) to understand the impact of this work. (Slagel, et al., 2022). At the intrapersonal level, the SEM approach offered participants an opportunity to increase their nutritional knowledge and skills. This may have helped raise awareness of their dietary habits and supported more informed food choices. At the interpersonal level, the programs incorporate bi-directional opportunities for participants to interact with healthcare providers, program facilitators, educators, and family members. These interactions can help reinforce these behaviors, offering support and guidance throughout the intervention. The organizational level provided participants with access to healthcare services, the ability to redeem vouchers at designated food retailers, and potential connections with community organizations that could support nutritional needs. At the community level, there may have been improvements in food access within their local areas, possibility contributing to greater food security for participants as well as their fellow community members. Finally, at the societal level, the program may have contributed to a broader shift toward the normalization of utilizing such resources within healthcare and community settings.

By integrating these layers of support, prescription programs can potentially promote long-term behavior change, improve food accessibility, and reduce chronic disease risks (Slagel, et al., 2022). Additionally, these programs provide valuable data for policymakers, helping refine and expand national and state-level funding initiatives (Stroud, Jacobs, Palakshappa, & Sastre, 2023).

Research Purpose and Objectives

Nutrition insecurity remains a pressing public health issue, with profound implications for chronic disease prevalence, healthcare costs, and overall well-being. While produce prescriptions programs offer a promising solution, further research is needed to optimize their implementation in communities across the country, especially rural communities. Our study seeks to explore the effectiveness of three rural Montana produce prescription programs, examining their reach, impact, and sustainability. By evaluating how these programs function outside of a fully scripted intervention, we aim to explore best practices for implementing successful, community-driven initiatives. Specifically, we aim to understand if these practices can promote nutritious dietary behavior change and improve food security.

Methods

Study Design

This study employed a case series approach across multiple sites with data collection from participants at each location. Data was collected using a quantitative tool with a minimal number of short answer open-ended questions. Quantitative information from these surveys was qualitatively analyzed, making project analysis mixed methods. Recruitment for the study began

between late 2022 and early 2023 after being granted internal approval of secondary data sharing was granted by the Montana State University Institutional Review Board (IRB) in March of 2023. Data sharing officially commenced in June 2023, with initial surveys collected from all three sites.

Study Sites and Participants

The study included 107 participants across three sites in Montana, primarily in the western region: Land to Hand (Flathead County), Providence (Missoula County), and St. Peters (Lewis and Clark County). Each site agreed to participate in a three-year data collection period. Eligible participants were individuals diagnosed with diet-related health conditions (with specific focus on recruiting individuals with diabetes and prediabetes) and identified as food insecure by a referring healthcare provider.

The Produce Prescription Program (PPRx) was administered by Farm Connect Montana, an organization dedicated to equitable food access through initiatives that support local farmers' markets, fresh food affordability, and nutrition education (Farm Connect Montana , 2025). All PPRx operated by Farm Connect Montana were included in the study's first year. These programs were developed in collaboration with local healthcare facilities and food suppliers to enhance fruit and vegetable intake, food security, and community well-being. Data collection at each site was securely transmitted to the evaluation team for analysis.

Montana Produce Prescriptions Program Implementation

Participants referred by health care providers were enrolled in a participating site, where they received financial incentives in various forms, as detailed in Table 1. Voucher values varied

by site, with distribution occurring weekly or monthly, depending on program structure. Regardless of distribution method, the primary goal was to increase fruit and vegetable consumption.

Throughout the program participants worked closely with healthcare providers and received nutrition education in various formats, such as one-on-one counseling with a registered dietitian, weekly recipes and food storage tips. The delivery method for nutrition education varied across sites as shown in Table 1; however, all participants had access to nutritional education. Program durations ranged from 6 months to indefinite, depending on site capacity.

Table 1: Individual Program Descriptions

Site Name:	Site 1	Site 2	Site 3
Location	Flathead and Lake County	Missoula and Lake County	Lewis and Clark County
Eligibility	Food insecure participants diagnosed with diet related health conditions	Food insecure participants diagnosed with diet related health conditions	Food insecure, at risk or diagnosed with diet-related health condition

Table 1: Individual Program Descriptions Continued

Site Name:	Site 1	Site 2	Site 3
Prescription Value	Produce share (Seasonal Option: Weekly stipend)	$20 grocery store voucher	$15 monthly grocery store gift card
Prescription Distribution	Bi-weekly Delivery/Pick Up	Weekly Voucher	Monthly gift card value increased

	(Seasonal Option: weekly)		based on family size
Prescription Redemption Location	(Seasonal Option: Farmers Market)	Local Food Retailer (Missoula), Chain Food Retailer (Lake), Farmers Market and Winter Market	Chain Food Retailer
Nutrition Education	Weekly recipes, cooking and storage tips	1:1 Nutrition education diabetes educator and program coordinator, nutrition and recipe handouts	1:1 counseling with dietitians, nutrition and recipe handouts mailed monthly

Data Collection

Participant data was collected in person at each site by the program coordinator or staff. Each site was provided with the final survey template and could either print the surveys independently or request copies from the evaluation team, which also provided return postage where necessary. Surveys completed on-site were securely emailed to the evaluation team for data entry. To maintain participant confidentiality, all data were de-identified, and each participant was assigned an anonymous code. Data were entered into Qualtrics, with physical copies stored in a secure, two-lock filing system. The types of questions that were asked included (all various measures) for this analysis we used the following

Phenomena of Interest

Program Outcome Variable

Fruit and vegetable consumption: This domain captures the individual's food frequency scores which were initially represented in numerical scores calculated using participant responses to the modified food frequency questionnaire. This measure included ten different food categories 4 whole food categories (e.g. leafy salad) and 6 mixed food categories (e.g. pizza) each asking participants to refer to a month time frame, providing consistent frequency considerations, and providing similar levels of details for respondents. (During the past month, how often did you eat other vegetables that were not deep-fried? These are vegetables like carrots, broccoli, collards, green beans, corn or other vegetables that are not deep fried. Include canned, frozen, or fresh vegetables. Also include vegetables that are raw, boiled, broiled, baked, grilled, stir-fried, or microwaved. Responses ranges included never, 1-time last month, 2-3 times last month, 1 time per week, 2 times per week, 3-4 times per week, 5-6 times per week, 1 time per day, 2+ times per day (GUSNIP NTAE CENTER, 2025). Responses were then transformed to qualitative categories by calculating the initial change scores for food frequency. To ensure consistency across food frequency questions, select variables – fruit, salad, beans, and vegetable – were reverse coded to align with coded values. Next, food frequency outcomes were categorized using an objective Likert scale ranging from “very desirable” to “less desirable” change. Each variable was assigned a corresponding category, allowing for structured comparison and further analysis.

Household food security: This domain captures the individual’s household food security score which were initially represented in numerical scores using the Six-Item Short Form of USDA Food Security Survey Module. This measure included six questions with responses evaluated against standardized USDA food security criteria (United States Department of Agriculture , 2025). Change scores were calculated for household food security and then household food

security outcomes were categorized using an objective Likert scale ranging from “very desirable” to “less desirable” change. Each variable was assigned a corresponding category, allowing for structured comparison and further analysis.

Program Activities Variables

Program engagement measures: To understand program engagement participants reported frequency of voucher usage with response options including never, 1-2 times, 3-10 times, more than 10 times, prefer not to answer. They also self-identified how much nutrition education they engaged in with response options ranging from none, one activity, 2-4 activities, 5+ activities, prefer not to answer. The averages were then compared to predefined measurement scales: “never used” to “10+ uses” for voucher redemption and “none” to “5+ activities” for nutrition education participation.

Contextual Variables

Demographics: To contextualize the scope of this study, researchers collected self-reported demographic information from participants. Age was collected as a self-report continuous variable and averaged across the site. Gender and race were collected as single select categories and calculated as percentages within each site. Household size was also self-report including self as a continuous variable and was averaged for analysis comparison. These data were used to assess the reach of each of the produce prescription programs. All data collection procedures adhered to ethical guidelines established by the Montana State University Institutional Review

Board (IRB). Informed consent was obtained from all participants, and data security protocols were implemented to maintain confidentiality throughout the evaluation.

Data Analysis

A qualitative case series approach was applied to analyze the data (CITE). Site level outcomes were organized into domains to guide the analytical process. Using an abductive approach, two researchers collaboratively developed coding categories to capture patterns in site-level change scores. These codes and associated data were entered into an Excel matrix. Subsequently, the researchers independently analyzed the domains and coding patterns, identifying emergent themes, areas of convergence, and points of contrast. Findings were then discussed collaboratively to achieve consensus.

As distinct and well-defined themes emerged, trends were explored within each domain, such as amount change in fruit and vegetable consumption or changes in household food security measures. Throughout the process, themes were continuously refined for clarity and merged where necessary.

Findings

All sites structured their delivery models different; however, they maintain regular professional contact through a regularly scheduled meeting, consistent evaluation procedures, and agreed upon key components including a produce prescription provision, regular meetings with their healthcare provider, and regular nutrition education opportunities. Profiles for each site are described in Table 1, and the cross-site thematic outcomes are explored in Table 3. The

profiles provide a description of key patterns in delivery models. The cross-site themes explore patterns in food consumption, food security, and participation.

Site 1 – Hand to Hand

Nineteen participants completed pre and 6-month post surveys at Site 1. Demographically, the majority of participants were female, with an average age of 40 and majority predominantly white racial background. The average household size of 3.5 individuals.

Participants at site 1 demonstrated modest improvements in their food frequency scores, reporting increased consumption of whole fruit, vegetables, and beans. There was also a notable increase in calorie dense foods, the intake of fruit juice, fried potatoes, and pizza over the course of the intervention. Despite the mixed dietary changes, participants at this site showed a trend toward improved food security. Specifically, participants indicated fewer days without sufficient food, a reduction in skipped meals, and fewer instances of portion restrictions due to food scarcity. Self-reported health scores also showed a modest shift toward fair health.

Voucher redemptions rates varied, with most participants using their vouchers one to two times, while a smaller subset reported redeeming them 10 or more times. Notably, participants at this site did not engage in any formal nutrition education activities. Nevertheless, overall program satisfaction was high, with several participants expressing very positive perceptions of their experience.

Regarding food assistance program utilization, most participants at site 1 had been using SNAP benefits for less than a year, though participants later reported in the post survey that they had not used SNAP benefits. However, 100% of participants reported utilizing the local food

bank and a smaller proportion also accessed WIC benefits. Healthcare utilization trends at this site differed from other programs in the following ways: participants reported fewer visits to primary care providers and specialists but an increase in emergency room visits.

Site 2 – Providence

Thirteen participants completed pre and 6-month post surveys at Site 2. Demographically, the majority of participants were female, with an average age of 64 and majority predominantly white racial background. The average household size of 3.5 individuals.

Participants at site 2 showed improvements in their dietary habits, as indicated in enhanced food frequency scores. They reported increased consumption of fruits, salad, and vegetables, while reducing their intake of fried potatoes and pizza. Food security also improved, with fewer days of insufficient food and a decline in meal skipping. Additionally, self-reported health status shifted from an average rating of poor at baseline to good following the produce prescription interventions at the six-month post survey.

Participation in program activities at site 2 was relatively high. Voucher redemption rates varied, with most participants redeeming between three and ten vouchers throughout their involvement in the program. Engagement in nutrition education was also strong, with many participants attending at least one session, while some reported attending five or more sessions. Overall, program reception was overwhelmingly positive, with several participants expressing a very favorable experience.

Most participants reported having started using SNAP benefits at the six months follow up, and 71% of participants reported ongoing SNAP usage. Additionally, 71% accessed local

food banks, while some utilized Food Distribution Program on Indian Reservations, community meals, and non-food support programs. Healthcare utilization patterns indicated that participants maintained their use of both primary care and specialist services throughout the program. There was also an increase in emergency room visits and inpatient hospitalizations.

Site 3 – St. Peter's Health

Thirty-one participants completed pre and 6-month post surveys at Site 3. Demographically, there was an even split between the genders, with an average age of 54 and majority predominantly white racial background. The average household size was 2.6 individuals.

Participants at site 3 exhibited modest improvements in dietary behaviors, as reflected in their food frequency scores. There was a reported increase in fruit and bean consumption, no significant change in pizza consumption and slight reductions in fruit juice and fried potato intake. St. Peter's program showed the largest positive change in household food security with a trend toward fewer days skipping meals and reduced instances of hunger due to food scarcity. Additionally, self-reported health status showed a slight improvement, with participants moving toward an average of fair health.

Voucher redemption rates at site 3 were like those at site 1, with most participants redeeming vouchers one to two times, while some reported using them ten or more times. Engagement in nutrition education was comparable to site 2, with participants attending an average of one session, while some attended five or more sessions. Overall, program reception was positive, with several participants expressing a very favorable experience.

Participants at site 3 reported using SNAP benefits for less than a year at the time of the post survey. Additionally, 56% of participants accessed food banks, while others utilized SNAP, FDPIR, and free and reduced-price school lunch programs. Healthcare utilization trends at this site were distinct compared to site 1 and site 2: participants reported a large increase in primary care and specialist visits, alongside a decrease in emergency room visits.

Thematic Comparison Across Sites

Increase whole food consumption

Across all three sites, participants demonstrated improvements in whole food consumption patterns, with a consistent increase in fruit intake. Additionally, all three sites reported increased non-deep-fried vegetable, leafy salad, and cooked bean consumption. However, changes in consumption of mixed-category foods varied by site. At Land to Hand there was less of a decrease in energy dense foods including increased consumption of fruit juice, fried potato, salsa, pizza, and tomato sauce. In contrast, Providence exhibited a similar increase in fruit juice consumption but showed improvements in fried potato, salsa, pizza, and tomato sauce intake. Site 3 participants reported a greater decrease in energy dense foods such as fruit juice, fried potato, and tomato sauce consumption, while salsa and pizza consumption remained relatively unchanged.

Increase household food security

In terms of household food security, all three sites showed a positive change toward improved household food security. Though sites were trending toward improvement it is worth noting that all three sites stayed within the low food security category as determined by the

measure scoring (Rabbitt, Hales, & Reed-Jones, 2025). Notably, all sites reported a reduction in the number of days participants skipped meals. Additional improvements varied by site: Land to Hand and Providence participants reported fewer days with insufficient food in the household, while participants at St. Peter's Health reported fewer instances of experiencing hunger.

Consistent program utilization

Self-reported program utilization varied across sites. Individuals at site 1 and 2 reported less than those at site 3. Engagement with nutrition education was generally low across all three sites. Most participants at Providence and St. Peter's Health reported engaging in only one nutrition education session, though some reported participating in five or more experiences. In contrast, participants at Land to Hand indicated they did not engage with any nutrition education throughout the intervention period. Interestingly, reports from site providers indicated that participants were receiving more nutrition education than they reported.

Table 2: Individual Site Demographics

Site Location (n)	Gender (n) %			Age	Household Size	Race/Ethnicity
	Male	Female	Non-Binary	M	M	(n)%
Site 1 (19)	26 (18)	68 (18)	0	40	3.51	94 White (18)
Site 2	20	70	10	64	3.5	90 White

(13)	(10)	(10)	(10)			(10)
Site 3 (31)	48	52	0	54	2.65	94 White

Note. Gender identity and race/ethnicity are representative of participants that responded to the question, not all participants.

Table 3: *Thematic Findings*

Theme	Examples
Increase whole food consumption	- Sitewide positive change in fruit - Sitewide positive change in vegetables - Sitewide positive change in salad consumption - Sitewide positive change in bean consumption - Varied consumption changes in mixed foods
Increase household food security	- Improved change score for household food security - Fewer days skipping meals - Mixed "other" household food security changes
Consistent program utilization	- Average number of voucher redemptions - Participant reported average number of nutrition activities

Note: Thematic findings were represented by the given codes. Refer to the data analysis for understanding of code development.

DISCUSSION

This study provided valuable insights into the impact of produce prescription programs on food consumption behaviors in three rural Montana communities. The findings highlight variability in program utilization and its potential influence on dietary habits. Overall, these findings support the past research (Hager, et al., 2023) and suggest an increase in whole food

consumption, an increase in household food security, and a relatively consistent engagement with the produce prescription programs.

Food Frequency Changes

The consistent increase in whole produce consumption across all sites aligns with overarching goals of their respective produce prescription programs. If this is the goal of a produce prescription program, these findings suggest that multiple program models can effectively support increased produce intake. This aligns with previous research linking produce prescription programs to an average increase of 0.85 cups of fruit and vegetable consumption (Hager, et al., 2023). While the study does not quantify the precise amount of fruit and vegetable intake, future analysis should explore these dietary changes in terms of cups consumed to provide a more objective measure to confirm this theme. Additionally, most studies broadly categorize fruit and vegetable intake using food frequency questionnaires, rather than examining specific food variations within these groups. The findings from this study indicate potential variation within these broad categories, warranting further exploration.

Notably, this study observed an increase in leafy salad and bean consumption – two dietary components that have not been widely examined as independent components in prior research (Hager, et al., 2023). Most existing studies use the 10-item food frequency questionnaire and broadly categorize whole fruit (including fruit juice) and vegetables (including leafy greens and non-fried vegetables) (NTAE, 2023). The observed changes in leafy salad and bean consumption suggests that produce prescription programs may influence specific dietary behaviors differently. This highlights an important avenue for future research, particularly in

understanding how programs categorize their findings and how that may contribute to reported dietary changes.

This study identified mixed results regarding changes in the intake of more processed or multi-ingredient foods, such as fruit juice, fried potatoes, pizza, and tomato sauce. Many of these foods would not have been included in the fresh produce voucher or redemption options for participants at any site. Prior research has largely focused on whole food consumption and has not extensively examined how produce prescription programs influence mixed food intake (Little, et al., 2022). While some studies have explored how produce prescription programs influence fiber intake and fast-food consumption, little is known about their effects on the consumption of processed or multi-ingredient foods that contain fruit or vegetable (Trapl, et al., 2018; Mozaffarian, Appel, & Van Horn, 2011).

Further research is needed to understand the long-term impact of produce prescription programs in relation to their sustainability and capacity to promote lasting behavior change. While this study captures promising short-term outcomes, such as improvements in dietary habits, it remains unclear whether these changes are maintained over time. Longitudinal studies could help understand whether the benefits observed persist beyond the duration of the intervention and offer insight into the factors that support continued behavior change.

Increased Household Food Security

Beyond dietary shifts, this study identified trends toward improved household food security across all three sites. Consistent with prior meta-analysis which have found that up to one-third of produce prescription participants experience improvements in food security (Hager,

et al., 2023), our findings suggest a similar trend. While the degree of change varied, all programs showed movement toward greater food security on average.

The variation observed in household food security before and after program implementation was likely influenced by the demographic differences across the three study sites. For instance, the lower baseline food security reported at site 1 may be related the higher portions of older adults and female participants. Prior research suggests that individuals aged 65 and older are less likely to experience food insecurity potentially due to their increased likelihood of utilizing available services. Additionally, males have been shown to report lower rates of food insecurity compared to females (Walker, et al., 2021). Future research should further investigate whether baseline food security levels, particularly in rural populations, influence program outcomes.

The variation in household food security change scores may be related to program utilization. Sites with greater change also had higher levels of service utilization. This is in line with previous literature which has found that if produce prescription programs incorporate direct clinical nutrition education individuals report improvements in their household food security outcomes. (Slagel, et al., 2022). The difference in engagement and program structures across the three sites suggest varying levels of effectiveness, warranting further examination of nutrition education delivery. Specifically, exploring the content covered, presentation of the material, or number of interactions might impact participants' beliefs and attitudes about the self-reported number of nutrition education experiences.

Consistent Program Utilization

Flexibility in program design such as varying number and value of vouchers, redemption locations, and models for nutrition education can be noted as strengths across sites. The consistent engagement reported throughout the intervention aligns with each site's goals, suggesting that adaptability in program structure can effectively support participant involvement. These findings align with prior research suggesting that flexible produce prescription models are better equipped to address the unique needs of rural communities (Lyonnais, Kaur, Rafferty, Johnson, & Jilcott Pitts, 2022) .

In addition to steady voucher redemption, participants reported some level of engagement with nutrition education over the course of the program. However, a key consideration was a mismatch between what program sites considered nutrition education and what participants recognized as such. For example, program elements like food storage and usage tips may not have been perceived as education by participants unless explicitly framed that way. Future iterations of nutrition education may benefit from clearly communicating these components as intentional learning opportunities. This clarity could help increase participant awareness and perceived value of educational offerings.

Notably, nutrition education participation appeared higher at hospital-based sites, likely due to the structured nature of one-on-one counseling, an approach participants may more readily identify as formal education (Slagel, et al., 2022). One site, however, lacked the staffing capacity to offer such individualized services highlighting a common challenge in rural healthcare settings (Stroud, Jacobs, Palakshappa, & Sastre, 2023). To address this gap, online platforms may offer a feasible and effective alternative, especially in communities with limited personnel resources.

Prior research supports the use of virtual education in rural produce prescription programs finding this modality to be both practical and engaging (Burrington, Hohensee, Tallman, & Gadomski, 2020). Future research should explore alternative delivery methods including digital tools, group-based learning, and recipe or cooking demonstrations as potential strategies to improve access to nutrition education in rural areas (Bhat, et al., 2021).

Limitations and Future Directions

This study is not without limitations. To enhance the trustworthiness of these findings, results will be shared with participating sites for member checking, allowing stakeholders to review and reflect on the identified themes in relation to their experience. While the transferability of this study may be limited, incorporating data from all three years in future analysis will provide a more comprehensive assessment of outcomes. Convenience sampling was the most practical approach for evaluating real-world program implementation. However, it may not ensure broad or representative all potential participation in these communities, making these findings more specific to who individual who were recruited and agreed to participate in these programs and site contexts. As this study relied on site-based data collection, resulting in inconsistencies where not all participants were followed at both pre- and post-time points. Addressing these gaps will help refine produce prescriptions programs, ensuring they are responsive to the unique needs of diverse rural populations.

In conclusion, these findings contribute to a deeper understanding of how produce prescription programs can be effectively administered through flexible community-driven initiatives. Overall, the programs demonstrated progress toward site-specific goals of increasing

access to and consumption of fruits and vegetables. Notably, flexibility in voucher distribution and nutrition education delivery emerged as key strengths, particularly in rural settings where program structure may vary. These insights highlight the importance of adaptable, locally tailored approaches in supporting dietary change for these food and nutrition insecure populations in a rural state. As policymakers and public health leaders consider expanding produce prescription efforts, ongoing evaluation will be essential to optimizing their effectiveness and fostering sustainable improvements in food security and overall health.

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CHAPTER THREE

A QUALITATIVE STUDY: THE LIVED EXPERIENCES OF PAST AND CURRENT EXERCISE BEHAVIOURS IN RURAL OLDER ADULTS

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Abstract

Objective: Given that nearly 65% of Montana's population resides in rural areas, older adults in these regions demonstrate lower levels of physical activity compared to their urban counterparts. With that said, less is known about the specific factors that influence exercise behaviours in rural communities. The purpose of this study aimed to understand how past exercise experiences influence current exercise participation among rural, older adults.

Setting: A survey was administered to adults aged 55 and older residing in Montana.

Participants: A sample of 42 participants were included in this study. Participants primarily identified as white (92%), mostly retired (55%) and exercised an average of 30-59 minutes per day (48%) for 4-5 days per week (50%).

Design: The Social Ecological Model served as the theoretical framework, and van Manen's hermeneutical approach was used for the study design and data analysis. Participants were asked to discuss an experience that was instrumental in establishing their current exercise habits through a survey.

Results: Five themes emerged from the data including health and wellness, accessible instruction/resources, friends and family, community programming and youth activity. The themes were identified and agreed upon by the research team and validated through a triangulation process.

Conclusion: These findings highlight intrinsic motivations as the primary driver of exercise participation among older adults in rural Montana. Support from Extension agents and companionship from family dogs played meaningful roles in encouraging physical activity. Further qualitative research, including interviews within rural communities, is recommended to validate and deepen the understanding of these influences.

KEY WORDS: Rural Communities, Physical activity, Seniors, Previous Exercise Engagement, Exploratory Research

What is already known on this subject?

- Numerous studies have explored barriers older adults face in relation to physical activity. Research reported that there was a lack of infrastructure, transportation issues, financial burdens, pain management, lack of support, fear of falling and aging stereotypes that limited their physical activity.
- Those involved in rural health care education, planning, and/or development need more knowledge of their rural communities and how to keep older adults physically active.

What does this study add?

- Instead of focusing on barriers related to inactivity, this research provides an alternative approach to discover how the aging rural population are successful in their current exercise.
- Older adults engaged in exercise due to health and wellness benefits, accessibility to resources/instructors, and received support from family or friends.
- Additionally, we learned that extension or free community interventions keep older adults motivated to exercise extensively. Involvement in sports in youth was also mentioned to support current exercise habits.

Introduction

It is projected that by 2050 there will be a 47% increase (from 58 million in 2022 to 82 million by 2050) of adults aged 65 and older.[1] Sensory changes (hearing, visual, vestibular function), muscle weakness, living with multiple chronic diseases, increased risk of obesity, and cognitive decline are a few health implications related to aging.[2-3] These changes can have significant long-term consequences, often leading to risk of disability, loneliness, reduced quality of life, and even mortality due to functional declines and effects of chronic diseases.[4] Moreover, economic and healthcare barriers can magnify the negative health effects for older adults.[5-6] We hope this research speaks to the urgency to initiate more effective ways to address these complications with the aging population.

Exercise is a preventive tool that can reduce the risk of negative health implications, address social loneliness[6-7] and is a cost-effective method to increase independence and lower healthcare costs.[8] Many older adults understand the benefits of exercise, yet few achieve the recommended threshold of 150 minutes of moderate aerobic exercise per week or 75 minutes of vigorous-intensity aerobic activity.[4,9] Most research on this topic aims to understand the barriers older adults face in order to address the limitations and promote physical activity.[10-11] Despite the efforts, this age group continues to be least physically active.[4]

The Health Resources and Service Administration (HRSA) defines rurality as a non-metropolitan county, with a population of no more than 50,000.[12] In rural areas there is a significantly lower percentage of older adults exercising compared to urban areas.[13] These behaviours were attributed to a lack of infrastructure, transportation issues,[14,15] financial

burdens,[14] pain management, schedule conflicts, lack of support,[16] fear of falling, aging stereotypes [2,11] and/or were influenced by perceptions of their community.[17] While these are commonly reported limitations, each rural setting can be quite different from the other.[18] Montana is described as one of the most rural states in the US, as over half the population (64.7%) are living in rural areas.[11] By 2030, Montana is also projected to be among the ten states in the nation to have more people over the age of 65 than under the age of 18.[19] Recreational activities are frequently used as a method to be physically engaged, but a survey in 2019 suggested that safety concerns limited older adults' further involvement.[20] Research on older adults and physical activity in Montana is restricted with a majority using the same data from a Diabetes Prevention Program in Montana.[11,21] To address older adults' inactivity, the primary focus continues to explore barriers. This research provides an alternative approach to discover how the aging population are successful in their exercise behaviours.

Theoretical Framework

The Social Ecological Model (SEM) has been used in previous research to understand numerous factors influencing health behaviours. The SEM highlights human-environmental interactions on five levels: intrapersonal, interpersonal, institutional, community, and public policy to identify the various levels impacting an individual's behaviours across one's lifespan.[22] Intrapersonal factors are related to individual knowledge, attitudes, and access to health information that may influence one's physical behaviours. Interpersonal (immediate support encouraging physical activity, gym buddies), institutional (access to fitness facilities, work wellness programs), community (availability of parks, walking trails, recreational facilities, community based exercise programs), and policy (government regulations related to physical

activity, funding for community health initiatives) are other factors that may influence an individuals' physical activity behaviours.[22] Another component of this model includes the chronosystem which considers changes from each human-environmental level across one's lifespan. These would include past experiences, life transitions, and societal changes that influence current exercise behaviours. The current study used SEM to recognise the multifaceted components associated with behaviours as participants reflected on past experiences that inspired their exercise habits.

The current study aimed to understand how past experiences with exercise influenced current exercise participation among rural, older adults. Previous studies asked older adults to reflect on habits related to their inactivity. This research seeks to provide insight into habits that were instrumental to their physical activity. Thus, the questions guiding this research included: Are current exercise practises impacted by past participation in exercise? Do older adults report exercise experiences unique to rural communities?

Materials & Methods

Participants and Recruitment

Approval of the project by the Institutional Review Board was given in May and recruitment continued through August of 2024. This study relied on cross-sectional convenience sampling in communities with local Extension agents. Extension agents provide education for state residents via a variety of modalities on various topics and are known for their connection to community members. In addition to local Extensions, participants were recruited through professional contacts within the healthcare field, media (newspaper, social media, email list

serves), and word of mouth. Inclusion criteria for participation included being a current Montana resident and ≥ 55 years old.[23] All eligible individuals were asked to self-report anonymously, either through a secure online link, QR code, or via a paper copy. Participants were asked to complete the surveys independently without assistance; no specific screenings for cognitive impairments were conducted. This study explored the responses from a subset (N=42) of the total participants (N=101). Thus, participants that completed the qualitative components of the survey self-selected into the study.

Study Design

This research utilised van Manen's hermeneutical phenomenology approach, which seeks to interpret and convey the meaning of lived experiences shared by individuals encountering a common phenomenon.[24] Guided by this framework, the research emphasized both the participants' rich, descriptive accounts and the researchers reflective engagement, acknowledging that interpretation is influenced by the researchers' prior knowledge and experience.[24-25] The process involved identifying a relevant lived experience, collecting data, and interpreting emerging themes through a combination of participant narratives and researcher reflection.[26]

Measures

The framework of this survey was designed to capture the relevant experiences of older adults in Montana to better understand if they are like those of previous research. As a part of a large-scale survey, participants were asked to report on their demographics, educational background, physical activity level and type, exercise self-efficacy, and perceived facilitators and

barriers to exercise. The present project specifically focused on the qualitative components of the dataset. Participants were asked to discuss an experience that was instrumental in establishing their current exercise habits. Participants were given the option to respond to open-ended questions by choosing either the yes or no option. If they selected the yes option, participants described their response in the text box provided. Those that did not respond to the question were not included in the qualitative analysis. This project focused specifically on a question regarding instrumental influences in current exercise engagement, and asking participants to describe a person, situation, or event that was instrumental in their current exercise habits. As with other qualitative research, the questions were developed to further understand this experience and reviewed by experts.[7]

Data Analysis

Phenomenological research methods were used to investigate the complexity and multidimensional aspects in relation to the exercise experiences of older adults.[27] The research team consisted of three researchers (1 male, 2 female); a professor and two doctoral candidates. All the researchers had prior experience in qualitative research methods and completed human subject training. Researchers conducted manual content review of the data prior to analysis to familiarize themselves with the responses and gain a comprehensive understanding of the data. Researchers then independently developed categories based on participant responses which were discussed in depth amongst the group. Together the team made the case for each category before collapsing the lesser categories into larger encompassing themes. Researchers independently reviewed the data again and coded the text to the appropriate theme indicator. Researchers reconvened to cross-check coding and to reach consensus for each theme before sending it for

review by an independent researcher unfamiliar with the data for triangulation of the identified themes. to ensure trustworthiness and accuracy. Participants' results were analysed using van Manen's[24] hermeneutical approach and theme development relied on an inductive approach, drawing themes directly from the participant responses.

Results

This sample represents 11 different counties in Montana, with most responses concentrated in the western half of the state. Of the 11 counties identified, 4 were considered metropolitan/micropolitan with the remaining counties being classified as rural. It is worth noting that of the 42 participant locations collected 29 (69%) were from rural communities, further emphasizing the role of rurality. The responses of those participants were then used for the previously mentioned analysis. There were no significant differences in the participant demographics beyond self-selecting to complete the questions.

Most participants were between the age range of 65-74, female (73%), and white (92%). Additionally, they were highly educated (71%) completing a higher education degree (or graduate/professional degree) and mostly retired (55%). Participants were also more likely to engage in aerobic exercise (movements that increase the heart rate and breathing frequency like dancing, walking, hiking, biking, swimming, running, etc.) for an average range of 30-59 minutes (48%) and 4-5 days a week (50%). The following five themes were identified to support current engagement in exercise amongst rural older adults in Montana: health and wellness (18), accessible instruction/resources (17), friends and family (13), community programming (10), and youth activity (4). See figure 1 for more details.

Theme	Quote	Meaning
Health and wellness	Two knee replacements 8 years ago provided an incentive to continue to work my knees and strengthen my legs. I condition for winter skiing, patterned horse racing, hiking and living a healthy life (Male, 65-74) I firmly believe in the old saying, "Use it or lose it" and really want to be able to be physically able to take care of my home and myself as long as I live which means I need to maintain or improve muscle mass and strength, mobility, balance, and flexibility and exercise classes addressing those goals are the best way to remain independent (Female, 75-85)	Having participated previously in a recovery/prevention process and/or mitigating the risk of losing functional ability through current exercise practises
Accessible instruction/resources	Years of great yoga teachers (prefer not to say, 85+) ...local hospital health services... provided a lot of diet and exercise information and encouragement (Male, 65-74)	Having access and support from facilities and professional individuals that are knowledgeable and set up to service older adults
Friends fand family	I find if I leave exercise to myself, it often goes by the wayside, but if I have a class to attend, I am much more likely to participate. Having a set program and being with others is a big motivator for me. These classes have been a real blessing (Female, 75-85).	Social support and connection that encourages continued engagement in exercise

Theme	Quote	Meaning
Community Programming	Recently the classes offered in our community by the extension office and health department have been so helpful. We are allowed to participate at our own rate and level of comfort. These classes have been a real blessing (Female, 75-85)	Low cost, flexible and ease of access to programs- particularly the importance of extension programming
Youth Activity	My dad liked to walk and took me along on his walks around the neighborhood when I was a little girl (Female, 75-85) I was involved in activities as a high school student and as a family we skied and camped (Female, 65-74)	Having exposure to exercise in early life through adolescence

Figure 1: Brief Descriptions from Thematic Analysis

Health and Wellness – Intrapersonal

Participants specified personal health and wellness as major motivators for continued engagement with exercise throughout their lifetime. Individuals frequently mentioned the need to participate in exercise to maintain their wellbeing. This was particularly emphasised in one participant's response "[I have] always realized the importance of exercise and have always enjoyed and participated in many exercise classes through the years from aerobics to step classes and walking programs" (Female, 75-85). Another participant mentioned "[I] need to maintain or improve muscle mass and strength, mobility, balance... flexibility, and [attend] exercise classes

[to] address those goals [and] to remain independent" (Female, 75-85). These words further emphasised the need to participate in regular exercise in order to maintain independence. Another participant mentioned the importance of exercise to "ease any depression, anxiety, etc." (Male, 65-74) bringing attention to the role exercise plays in maintaining mental health along with physical. Finally, several participants described the role exercise played in prevention of injury or treatment: "I'd rather do prevention than have an intervention" (Female, 65-74).

Accessible Instruction/resources – Institutional

Additionally, participants noted the importance of having accessible instruction/resources as another motivator in the continued engagement with exercise. Participants responses mentioned the role of their physician in encouraging their exercise habits. In addition to the support of health care providers, several participants mentioned access to quality fitness instructors. Statements like "[I've had] years of great yoga teachers" (Prefer not to say, 86+) or "[a] young mentor showed me how to use weights at the gym" (Female, 55-64) emphasised the role fitness professionals had in their exercise behaviours. In addition to the positive motivation several participants expressed the importance of having relatively easy access and the low costs associated with the facilities. The availability of these resources and support were beneficial to participant's current exercise.

Friends and Family – Interpersonal

Support of friends and family surfaced as a major motivator for participating in exercise throughout individuals' lifetime. Several participants mentioned the specific role of a loved one actively participating in exercise with a younger version of themselves. Specifically, some older

adults mentioned the role of a parental figure in both their current and past exercise habits "my dad who is over 80, exercises moderately several days a week" (Female, 55-64) and "my dad liked to walk and took me along on his walks around the neighborhood when I was a little girl" (Female, 75-85). The role of friendship in maintaining exercise habits was frequently mentioned: "Two of my friends and I started walking three times a week and have kept it up" (Female, 55-64) or "[a] fitness center for women only and [having] friends that attend class with me" (Female, 55-64) were beneficial to their habits. Examples like this further emphasised the role support systems have on older adults' participation in exercise.

Community Programming – Community

The importance of community programs was evident as a major motivator for many older adults. Several participants mentioned their continued utilisation of community programs and the role it played in keeping them active now. The county extension agents offered the most referenced programs, such as Strong Women, Strong People, Healthy Tracks, and Stay Active & Independent for Life (SAIL) classes. One participant noted the actual programming as well as the importance of support within the class: "I find if I leave exercise to myself, it often goes by the wayside, but if I have a class to attend, I am much more likely to participate. Having a set program and being with others is a big motivator for me. These classes have been a real blessing "(Female, 75-85). Experiences like this highlight the impact classes have on developing a sense of community support thus encouraging older adults to continue to attend each week.

Youth Activity – Chronological

Finally, some participants noted the importance of youth activity as a facilitator of habitual exercise. They mentioned the influence of high school sports on their current engagement with exercise stating, “I was involved in activities as a high school student...I have always loved exercise, and it [has] continued throughout my life” (Female, 65-74). Additionally, some participants discussed having early examples of exercise being modeled to them as a major contributing factor in establishing their current exercise behaviours “My dad liked to walk and took me along on his walks” (Female, 75-85) and “…an uncle who taught me the biology of food and exercise” (Female, 65-74). Responses like these emphasised how early exposure can have long-lasting impacts on future exercise habits.

Discussion

In this study, the authors investigated experiences that were instrumental in the establishment of older adult's current exercise behaviours in rural areas of Montana. Many participants from this study were active, as they reported engaging in exercise for more than 30 minutes a day (48%) and exercised between 4-5 days per week (55%). The SEM was used to understand the multifaceted components promoting exercise which include interpersonal, intrapersonal, institutional, community, and public policy across their lifespan. Five themes emerged for reasons to stay engaged in exercise: health and wellness, accessibility to resources, influence of family and friends, community program availability, and involvement in youth activities.

Health and Wellness – Intrapersonal

Personal health improvement is frequently cited as a key motivator for physical activity among older adults in rural settings.[2,10,28] To date, no research has specifically examined the exercise motivators of older adults living in Montana. Literature from this region has primarily focused on chronic disease prevention through obesity reduction and weight loss interventions, largely in response to the increasing rates of cardiovascular disease and type 2 diabetes.[11,19] In contrast, relatively less attention has been directed toward the motivational factors that facilitate sustained engagement in physical activity within this population.

Evidence-based fall prevention programs such as Stepping On and SAIL*,* are low-to-moderate-intensity interventions that have demonstrated efficacy in reducing fall risk, improving balance, and supporting independence among older adults.[23,29] These programs, typically delivered over 6–12-weeks and often funded by the Department of Health and Human Resources, are available at no cost across a variety of community settings.[23] While such interventions can effectively promote initial engagement in physical activity, Fien and colleagues[29] have noted that they frequently lack multi-component exercise elements that may be important for broader health outcomes. Moreover, research remains limited to the factors that promote long-term adherence to exercise behaviors among older adult populations.

Consistent with prior research, the present study reinforces the role of intrinsic motivation—particularly the desire for personal health benefits—in promoting physical activity among rural older adults.[2,10,28] A study in Germany found that older adults' intrinsic motivation to engage in physical activity was driven by a desire to maintain independence and avoid becoming a burden to others.[28] Another study conducted in Montana found that witnessing

siblings become dependent on others was a powerful motivator for participants to stay physically active.[30] This response reflects a strong desire to maintain independence and avoid becoming a burden. Participants in the present study did not mention this. Instead, they were primarily motivated by the pursuit of long-term health benefits and a desire to age well, rather than by concerns about becoming a burden to others.

Accessible Instruction/Resources: Institutional

Rural areas are widely known to lack essential infrastructure such as gyms and walkable neighborhoods which can limit residents' opportunities for physical activity.[11,14,31] As previously noted, adults in Montana frequently engage in physical activity through recreational pursuits;[32] however, participation often declines with age, largely due to concerns about falling. In addition to recreational programs, many adults report walking as their preferred form of exercise. Despite its popularity, walking is frequently hindered by poor sidewalk conditions and adverse weather, both of which pose significant barriers to regular participation.[11]

Consistent with prior research, the findings of this analysis underscore the critical role that fitness instructors[3,33] and healthcare professionals[34] play in supporting the maintenance of physical activity among older adults. In rural areas of Montana, access to such professionals may be limited due to geographic isolation and workforce shortages. Consequently, the presence, quality, and engagement of available fitness and health professionals becomes especially influential. Their guidance, encouragement, and ability to foster trust within the community significantly affect older adults' motivation and adherence to exercise routines. During the collection phase for this research, it became evident that the involvement of local instructors

played a critical role in encouraging participation, as individuals in small or rural communities were more likely to complete the survey for this study when prompted by someone they knew and trusted. This highlights the need for targeted strategies to train and support these professionals in rural regions to ensure the sustainability of physical activity programs for aging populations.

Friends and Family – Interpersonal

Like other research, the results from this study amplify the importance family and friends have on older adults' engagement in exercise.[13,31,34] This is especially relevant to rural Montana, as Sriram et al[35] found that peers were strong motivators for older adults' engagement in exercise. Another Montana-based study underscored the significant role that family members and close friends play in influencing physical activity behaviours. The results indicated that nearly half of the participants (45%) reported their spouse as an influential factor in their physical activity behaviours, with both positive influences — such as exercising together — and negative ones, including lack of motivation or support from their partners.[30] Additionally, many participants reported forming new friendships through participation in exercise classes, suggesting that social connection with physically active peers may further encourage sustained engagement.[30] This trend was similarly observed in the present study.

In addition to the influence of family and friends, family dogs — often regarded as an integral member of the household — played a significant role in shaping exercise behaviours among participants. This finding aligns with previous research highlighting the positive impact of pet ownership on physical activity among older adults.[36] However, to date, there is limited

evidence validating this association in other rural settings, underscoring the need for further exploration in diverse geographic contexts. Together, the influence of family members, close friends, and family pets play a critical role in promoting and sustaining physical activity among older adults, particularly in rural communities where interpersonal connections often serve as motivators for engagement.

Community Programming – Community

Community-based interventions play a critical role in promoting physical activity in rural areas, offering accessible, affordable and socially engaging opportunities for older adults.[29] However, a key limitation identified in this study was the lack of program consistency. Programs delivered by local Extension were typically limited in duration, and upon completion, participants were left without ongoing support or required to wait for the next available session. This discontinuity may reflect financial constraints or other institutional barriers affecting program sustainability in rural settings. A valuable area for future research involved exploring the types of physical activities older adults pursue in the absence of structured community programs. It is possible that participants in the current study were either enrolled in or had recently completed such a program during the data collection period-potentially influencing their responses. Nevertheless, community-based programs remain a vital component to the adherence of older adult's exercise behaviours.

Youth Activity: Chronology

Some research has identified participation in youth sports as a strong predictor of physical activity in older adulthood, largely due to the development of lifelong habits formed

through early engagement in structured physical activity.[24,37] In this study, youth activity was acknowledged by some participants as influential in shaping current exercise habits, particularly among women, and this theme emerged in participant responses. However, only 9% explicitly made this connection, making it a less commonly reported theme overall. Historically, opportunities for girls to engage in organized sports were limited, particularly prior to the passage of Title IX in 1972, which mandated support for female athletics in federally funded educational institutions. Women raised in rural areas may have encountered additional barriers, including restricted access to sports programs and cultural norms that discouraged female participation.[38] Although significant progress has been made in expanding opportunities for women, those raised in rural communities during this period likely faced unique challenges in accessing youth sports. The extent to which Title IX directly impacted the women in this study remains unclear; however, similar barriers have been documented in prior research conducted in Montana by Shaffer et al.[30]

Limitations

The current study had limitations such as: participants mainly identified as white, were educated, and from western Montana. Health disparities, socioeconomic status and the physical environment can influence motivation and exercise habits.[39] Exercise opportunities may differ among populations in rural areas. Moreover, the platform relied entirely on self-reported data which can be susceptible to biases related to social desirability and recall errors. Another limitation of this study is its incorporation within a larger survey, which constrained the development of tailored questions and methods aligned specifically with the research objectives.

A standalone study may have allowed for a more focused and comprehensive exploration of the topic. We do not yet understand the breadth of these influences across rural older adults and what might make something influential for the unique individual. This may be further explored with interviews, or with more diverse samples from different areas.

Conclusion

This study makes a meaningful contribution to the literature by exploring how factors across SEM influence exercise behaviors among older adults in rural settings. The findings show that participants engaged in physical activity due to a combination of health motivations, meaningful social connections, and access to supportive resources such as qualified instructors, community programs, and local facilities. Additionally, early-life experiences with physical activity were cited as influential, highlighting the relevance of a life-course perspective.

Compared to urban populations, rural residents often encounter more pronounced barriers to physical activity. Understanding the mechanisms that help older adults remain active in these contexts is essential for guiding effective interventions. Based on the findings, several actionable components should be considered in the design and delivery of physical activity programs in rural communities: fostering early exposure to physical activity, promoting socially supportive environments, and ensuring consistent access to community-based opportunities. These factors appear to support both initial participation and long-term adherence.

While short-term interventions (typically 6–12 weeks) have shown promise, their limited duration underscores the importance of sustained, structured options. Practitioners and program developers should prioritize program continuity and gradual progression, ensuring that activities

align with the abilities and preferences of the target population. Moreover, designing initiatives that reflect the unique social and environmental assets of each rural community may increase both relevance and effectiveness.

The findings also suggest that life-course influences, such as participation in youth sports or earlier exposure to active lifestyles, may shape current engagement, even if reported less frequently. Future research should continue to examine how different types and timings of physical activity exposure influence behavior in later life. Longitudinal research, in particular, could clarify these pathways and inform more personalized, developmentally sensitive approaches.

In applying the evidence from this study, program planners, policymakers, and researchers are encouraged to incorporate these identified enablers into the design of strategies aimed at promoting sustained physical activity among older adults in rural settings. Doing so may enhance both engagement and long-term impact, while addressing the distinct challenges these communities face.

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CHAPTER FOUR

EXERCISE AND SELF-EFFICACY: A QUANTITATIVE STUDY ON FACILITATORS AND SELF-EFFICACY AMONG RURAL OLDER ADULTS

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Abstract (300 words, 10 keywords)

Background: Physical inactivity is projected to rise by 35% by 2030 (WHO, 2024), with rural residents at higher risk. While sustained exercise provides numerous physical and mental health benefits, fewer older adults are able to maintain such behaviors. Self-efficacy, or an individual's confidence in their ability to engage in exercise, has been identified as a key factor in promoting physical activity (Szczuka et al., 2019). This study aims to assess the self-efficacy of older adults in rural areas and identify factors that facilitate their exercise behaviors.

Methods: A survey was developed to collect data on self-efficacy and the facilitators associated with physical activity behaviors in older adults. The survey items were derived from established exercise self-efficacy measures and literature on facilitators and barriers to exercise engagement among older adults (Bethancourt et al., 2014; Patei, Sheth, & Jain, 2019). To examine the relationship between self-efficacy and facilitators, statistical analyses including ANOVA, multiple linear regression, and frequency distributions were employed.

Results: Most participants identified as female (71.3%) and white (80.2%), with 39.6% aged 55-74. Over half engaged in aerobic exercise (67.3%), averaging 30-59 minutes 4-5 days per week, and 34% had maintained these habits for over 10 years. Analysis showed that individual preferences, including exercise enjoyment, perceived value, guilt when inactive, and routine integration, were significantly associated with self-efficacy ($p < .001$).

Conclusions: This research highlights the significant influence of individual preferences on exercise self-efficacy and offers a novel perspective by focusing on facilitators, rather than barriers, to exercise among rural older adults. Future interventions could benefit from

incorporating strategies that promote the establishment of exercise routines tailored to individual preferences in order to enhance physical activity engagement in this population.

Keywords: Rural, Older Adults, Exercise, Self-Efficacy, Facilitators

Introduction

Older adults are less physically active than any other age group, despite knowledge of health benefits (Fanning, Nicklas, & Rejeski, 2022; Leung, Sum, & Yang, 2021). In 2019 only 23.1% of adults aged 65 and older met the recommended physical activity guidelines (America's Health Ranking, 2021) and levels of inactivity are projected to increase up to 35% by the year 2030 (WHO, 2024). Physical activity and exercise have been shown to increase healthy aging aspects, longevity, and may mitigate certain aspects of aging (CDC, 2024; Langhammer, Bergland, & Rydwik, 2018, McPhee et al., 2016). Investigating the motives and factors that influence exercise behaviors in this age group can provide valuable insights for promoting sustained activity levels and supporting successful aging.

Perceived barriers have been shown to significantly influence exercise behaviors within this age group (Bethancourt et al., 2014; Patei, Sheth, & Jain, 2019). These common barriers e include physical limitations (i.e., pain, fatigue) (Bethancourt et al., 2014; Kosteli, Williams, & Cumming, 2016), individual preference (lack of enjoyment, dislike facility, boredom etc.), interpersonal factors (lack of guidance/support or intimidation of others) (Bethancourt et al., 2014; Cancela et al., 2021; Ng et al., 2021), and environmental or structural factors (i.e., unsafe neighborhood, weather, inadequate information, quality of instructors) (Bethancourt et al., 2014; Goins et al., 2005; Ng et al., 2021; Parsons, Gaudine, & Swab, 2021). In order to address these barriers, previous research created interventions using motivation tactics (i.e., model of behavioral change) and had success in increasing physical activity among older adults (Blom et al., 2021; Fanning, Nicklas, & Rejeski, 2022; Kim et al., 2024; Lachman et al., 2018; Neupert,

Lachman, & Whitbourne, 2009). Interventions were multifaceted to address the complexities of exercise behaviors (Di Lorito et al., 2020; Fanning, Nicklas, & Rejeski, 2022). While there was success and increased exercise during these interventions, follow-ups on the continued engagement with exercise immediately following the succession of the program are unknown. While interventions often encourage individuals to maintain exercise participation beyong the program's conclusion, the long-term sustainability of these behaviors remains limited (Izquierdo & Singh, 2023; Sansano-Nadal et al., 2019). Furthermore, various settings offer distinct opportunities for continued engagement in physical activity, making it essential to examine how these environments influence long-term maintenance of exercise among older adults.

Adults living in rural areas are less physically active than their urban counterparts (Kegler et al., 2022; Lo et al., 2017; Sriram et al., 2018). In addition to the common barriers previously mentioned, the lack of infrastructure, transportation or longer travel distances (Goins, et al., 2005; Meredith et al., 2023), financial burdens, and perceptions in a community frequently influenced the lower activity levels in rural communities (Jenson et al., 2020; Parsons, Gaudine, & Swab, 2021). While research indicates that opportunities for physical activity may be more limited in rural areas, these communities often foster a stronger sense of social cohesion and connection. Schmidt and colleagues (2021) noted that rural environments are typically described as serene, peaceful, and low stress, with individuals maintaining robust interpersonal relationships. These social connections, in turn, may play a significant role in influencing physical activity levels, particularly among older adults. A study by Jensen et al. (2020) found that health outcomes vary significantly across different rural settings. They emphasized the need

for further research to assess the resources available in these communities to better understand health and aging among rural populations. Additionally, the factors that enable older adults to sustain exercise behaviors in rural areas remain undiscovered.

Theoretical Framework

The Social Ecological Model (SEM) was used as a tool to address the multifaceted components influencing exercise behaviors. SEM includes several levels (individual, interpersonal, organizations, community, and policy) of influence on behaviors (McLeroy et al., 1988). Individual factors consider the knowledge, attitude, personal beliefs, or learned skills that affect their exercise behaviors. Interpersonal aspects include the external influence of friends, family, peers, or close networks that impact physical lifestyles. Organization (i.e., fitness structures, work related program), community (i.e., community fitness programs, parks or walking trails, cultural norms), and policy (i.e., federal, state, or local funding policy related to physical activity programs or incentives) are larger scale influences on an individual's exercise behaviors. The SEM was used in this study as a framework to identify and connect barriers and facilitators across multiple levels, with the aim of determining which factors most strongly influence individual exercise engagement among rural older adults. In addition to SEM, self-efficacy theory was incorporated to provide deeper insight and a more comprehensive understanding of the factors influencing the study design. Self-efficacy is a strong predictor of behavioral change influencing an individual's perception in their abilities to carry out their exercise behaviors despite potential barriers such as; fatigue, boredom, environment conditions etc. (Neace et al., 2020; Szczuka et al., 2019). Previous research has highlighted the relationship between self-efficacy and fitness behaviors (Medrano-Ureña, Ortega-Ruiz, & Benítez-Sillero,

2020). There are four main sources that influence self-efficacy, which include: past performance, vicarious experiences, verbal persuasion, and physiological cues (Pekmezi, Jennings, & Marcus, 2018). Past performance, such as having participated in physical activity during youth (e.g., walking, riding a bike, organized sports), can contribute to a sense of familiarity and confidence in re-engaging with exercise later in life. Vicarious experiences include observing peers of a similar age successfully participate in certain exercises. This may reinforce beliefs that sustained physical activity is both possible and beneficial. Verbal persuasion includes receiving encouragement from others such as family members, healthcare providers, or exercise instructors, which may help motivate regular activity, especially during times of physical setback or doubt. Physiological cues such as experiencing anxiety about exercising in public spaces or managing age-related discomfort, can either hinder or support behavior based on coping strategies (Pekmezi, Jennings, & Marcus, 2018). For example, using relaxation techniques or positive self-talk to overcome initial barriers to exercise participation.
. The self-efficacy theory was a valuable tool for understanding how confident older adults feel in their ability to exercise which directly influences the maintenance of those behaviors .

The integration of self-efficacy theory and the SEM offers a multidimensional framework for understanding exercise maintenance by linking personal confidence with environmental and social influences. For example, having a positive experience in childhood (individual level), encouragement from peers (interpersonal level), and access to supportive programs (community level), all interact to shape an older adult's belief in their ability to stay active (McLeroy, 1988; Sallis et al., 2008).The current study aims to understand self-efficacy levels and influences

promoting older adults' current exercise behaviors. Previous research studied self-efficacy during interventions (McAuley et al., 2011; McMullen et al., 2021; Neace et al., 2019; Neupert, Lachman, & Whitbourne, 2009) but there is a gap in the literature on the continued exercise behaviors after interventions. This study explored the self-efficacy of physically active older adults and influences in their daily exercise habits (Izquierdo & Singh, 2023; Sansano-Nadal et al., 2019). The question guiding this research includes: Do older adults with more facilitators report higher self-efficacy scores?

Methods

Participants and Recruitment

Project approval was granted by the Montana State University Institutional Review Board in May of 2024. Montana State Extension agents and professionals in the healthcare realm agreed to assist in in participant recruitment in 11 Montana communities. The project used word of mouth and multiple forms of media including social media posts, email, and newspaper advertisements to reach a variety of communities across the state. This approach was intended to effectively capture the experiences of rural individuals throughout the state. To be eligible participants must be aged 55 or older and current Montana residents. One hundred and one participants met this inclusion criteria and consented to participate.

Data Collection

Data collection commenced in early summer and continued over a four month period, concluding at the end of August 2024. Individuals who met the inclusion criteria and consented to participate were invited to complete a quantitative survey consisting of twenty-nine closed-end

questions. No incentives were offered for participation. The survey, estimated to take approximately twenty minutes to complete, was administered through a self-report format via an anonymous link, QR code, or a paper version distributed and collected by recruiting agents. Participants completing the paper survey were instructed not to include any personally identifying information. Upon completion, all surveys were entered into a secure system protected by Two-Factor Authentication. Participants were asked to complete the survey individually without assistance; however cognitive functioning was not formally assessed or screened.

Measures

Questions for this tool were developed to incorporate a previously tested exercise self-efficacy measure, the Self-Efficacy Scale (Kroll, Kehn, & Ho, 2007), along with a list of facilitators and barriers previously identified in research (Bethancourt et al., 2014; Patei, Sheth, & Jain, 2019). The exercise self-efficacy scale is reported to have a high reliability (a=.81 - .93) and validity (r =.708) when compared with similar measures for older adults such as the SF-36 (Ware, 1999). This measure included ten-items measuring participant belief in their ability to engage with various aspects of exercise (i.e., I can accomplish my physical activity and exercise goals that I set) and were asked to select an option from a four-point Likert scale (Not always true-Always true) that most accurate reflected their experience (Kroll, Kehn, & Ho, 2007). Participant responses and their corresponding values were used to calculate (addition) composite scores for each participants exercise self-efficacy score .

Given the limited availability of valid and reliable scales to assess exercise facilitators, this study developed a new scale. The development of this scale was informed by the findings of Bethancourt and colleagues (2014), who identified key factors influencing exercise behavior, including intrapersonal, interpersonal, physical, and structural/organizational elements. These included options such as maintenance of balance, strength and mental acuity or convenient exercise locations (Bethancourt, Rosenberg, Beatty, & Arterburn, 2014). Participants were asked to select all relevant factors that influenced their current exercise habits as seen in appendix A. Composite scores were calculated for each previously listed category based on the number of marked facilitators. Participants were also asked to describe their current engagement with exercise by individually selecting the range of minutes per session and days per week. Finally, individuals were asked to select all the categories of exercise they currently participate in. Due to the nature of this study there are no current measures in their entirety that capture both variables. Therefore, the current measure was designed and reviewed by experts to better understand the potential relationship between exercise self-efficacy and facilitators of exercise in older rural adults.

In addition, participants were asked to indicate which singular option most appropriately described them by checking the specific box for demographics (age range, employment status, education level, and county) along with selecting which options most appropriately described their race/ethnicity(s).

Data Analysis

A quantitative approach was used to examine whether older adults with a greater number of facilitators report higher self-efficacy. Additionally, the study explored whether specific categories of facilitators have a greater impact on self-efficacy, providing insights into key areas to prioritize when designing and implementing exercise programs for older adults in rural communities. To account for statistical significance, G power was used to determine the number of participants needed to potentially show statistical significance using the proposed analysis ($n>74$). Once this number was achieved, participant responses were cleaned and analyzed using IBM SPSS Statistic (30). Cases with missing data of any key variable were excluded from the analysis using listwise deletion. To run the ANOVA, assumptions were assessed testing for skewness and kurtosis which revealed significant skewness. Therefore, self-efficacy scores and facilitator composite scores were transformed using a log transformation thus revealing a more normally distributed data set. Initial descriptive statistics were carried out to report age group, race/ethnicity, education level, and current exercise habits. An ANOVA test was initially conducted to examine whether there were statistical significant differences in self-efficacy mean scores across the various independent facilitator categories. Based on these results it was determined that further statistical analysis might reveal the specific facilitators that were predictive of self-efficacy. Therefore, a second analysis using linear regressions was carried out to determine which of the facilitators were significantly, associated with stronger self-efficacy.

Results

Descriptive statistics were conducted to summarize participant characteristics. The sample consisted primarily of adults aged 55-64 and 65-74 (39.6%), with the majority identifying as female, (71.3%) and white (80.2). Most participants reported a high level of education, with 19.8% holding a master's degree, and 39.6% indicating retirement status. Regarding exercise habits, 37.0% of participants engaged in 30-59 minutes of exercise, 4-5 days per week. The most commonly reported mode of exercise was aerobic training (67.3%), followed by flexibility and stretching (46.5%). Additionally, 34.0% of participants reported maintaining these exercise habits for over 10 years

A one-way analysis of variance (ANOVA) was conducted to examine the effect of exercise facilitators on exercise self-efficacy. The results revealed a statistically significant effect, $F(5,83) = 8.349$, $p = <.001$, $n^2 = .335$ indicating a significant difference in self-efficacy mean scores across the various independent facilitator categories. These results are presented in Table 5.

Additional linear regression analysis was conducted to predict exercise self-efficacy based on five facilitators (Structural/Organizational, Physical Environment, Individual Preference, Interpersonal, Intrapersonal). The overall model was statistically significant, $F(4,95) = 8.349$, $p = <.001$ explaining 33.5% of the variance in exercise self-efficacy scores ($R^2 = .335$, adjusted $R^2 = .295$). Among the predictors, individual preference was the only significant predictor, $B = 1.505$, $SE = .402$, $t = 3.74$, $p = <.001$, indicating that higher individual preference scores were associated with increased exercise self-efficacy. Other facilitators were not

statistically significant as seen in table 2. The assumptions were tested, and no transformations were needed for this model.

These findings suggest that individual preference is a significant predictor of exercise self-efficacy while other facilitators did not demonstrate significant effects. Full regressions results are presented in Table 6.

Table 4: Participant Descriptives

Descriptives	(n)	(n)	(n)	(n)
Age	55-65 (40)	65-74 (40)	75-85 (15)	86+ (1)
Gender	Male (26)	Female (72)	Prefer Not to Say (1)	
Race	Caucasian (81)	Latino(a) or Hispanic (4)	Asian (3)	Native American Or Alaskan Native (2)

Note. Values

Table 5: Analysis of Variance Examining the Effect of Facilitators on Self-Efficacy

Source	SS	df	MS	F	p	n^2
Between Groups	1549.42	5	309.83	8.349	<.001[b]	.335
Within Groups	3080.70	83	37.12			
Total	4630.112	88				

Note. N = 101. SS = Sum of Squares; df = degrees of freedom; MS = Mean Square; F = F-statistic; p = significance value; n^2 = effect size (eta-squared).

Table 6: Multiple Linear Regression Predicting Self-Efficacy

Predictor Variable	B	SE	β	t	p
Individual Preference	1.505	.402	.555	3.743	<.001
Intrapersonal	.189	.658	.042	.298	.774
Interpersonal	.257	.621	.053	.414	.680

Table 6: Multiple Linear Regression Predicting Self-Efficacy

Predictor Variable	B	SE	β	t	p
Physical Environment	-.168	.445	-.041	-.377	.707
Structural/Organizational	-.256	.456	-.064	-.561	.576

Model Summary: $R^2 = .335$, $F(5,83) = 8.349$, $p < .001$

Note. N = 101, B = unstandardized coefficient; SE = standard error; β = standardized coefficient; t = t-statistic; p = significance value

Discussion

Previous research has extensively explored barriers to exercise among older adults, yet relatively few studies have examined the role of facilitators in promoting physical activity. Even fewer have investigated how these facilitators influence an individual's exercise self-efficacy. The findings from this study suggest that an older adult's self-efficacy can be significantly impacted by a key facilitator: individual preference. Specifically, factors such as enjoyment of exercise, belief in its importance, feelings of guilt when inactive, and integration of exercise into daily routines emerged as strong predictors of self-efficacy.

These results align, in part, with prior research, which has suggested that self-efficacy can be enhanced through encouragement and recognition of successful performance (Bethancourt,

Rosenberg, Beatty, & Arterburn, 2014). However, contrary to previous findings, this study indicates that individual preference is the only significant predictor of self-efficacy among this population. Notably, older adults with stronger facilitators related to individual preference reported higher levels of exercise self-efficacy. These findings suggest that emphasizing individual preference may be a particularly effective strategy for enhancing self-efficacy in older adults, a factor that has been shown to be modifiable and strongly linked to increased physical activity engagement, particularly in rural communities (Ory et al., 2018; Sowle, Francis, Margrett, Shelley, & Franke, 2017).

Given the significance of individual preference, exercise programming within rural communities, particularly in Montana, could benefit from prioritizing strategies that align with personal motivators. This may include developing educational materials that emphasize exercise benefits, designing programs that integrate movement into daily routines, and promoting enjoyable or meaningful physical activities. Tailoring interventions to support individual preference may be an effective way to enhance overall exercise self-efficacy among rural older adults in Montana. However, these findings are specific to this population, and further research is needed to determine their applicability to other rural populations, including those in more remote frontier areas or tribal communities.

Although this study did not find strong support for other categories of facilitators, further exploration is warranted to better understand the broader influences on exercise engagement within the social-ecological model. This is particularly important as it is generally accepted that there is an interaction between and interdependence of factors within and across all levels of a

health behavior (Glanz & Rimer, 2005). This emphasizes the potential for bidirectional influence between various levels of the SEM and individual preferences for physical activity. This is particularly important, as health behaviors are widely understood to results from the interaction and interdependence of factors operating within and across multiple levels of iinfluence (arner, Schuz, Knittle, Ziegelmann, & Wurm, 2011). Additionally, community-level initiatives—such as improving walkability, creating accessible green spaces, and ensuring safe, well-maintained sidewalks—could play a critical role in supporting physical activity (Lo, et al., 2017). Finally, continued efforts to implement policies that enhance access to exercise, such as affordable fitness programs, widespread dissemination of low-cost or free exercise opportunities, and investments in safe, well-lit public exercise spaces, remain essential in promoting physical activity among older adults.

Limitations

This study is not without limitations. First, the sample was predominantly white and highly educated, a common limitation in voluntary response research that may affect the generalizability of the findings. Additionally, participant recruitment was limited to communities with professional contacts or extension agents, which restricted responses from rural areas, particularly in the northeastern and southeastern regions of the state. Moreover, the study relied exclusively on self-reported data, which introduces the potential for biases such as over- or underreporting of activity levels, heightened sense of confidence to participate in exercise, or misinterpretation of survey questions. To address these limitations, future research should incorporate objective measures of physical activity, such as accelerometers, to enhance data

accuracy. Additionally, conducting qualitative interviews could provide deeper insights into the factors influencing exercise self-efficacy among diverse rural populations.

Given the trusted role that Extension agents hold in rural communities, they are well-positioned to deliver these tailored messages and serve as role models for healthy behaviors. However, addressing individual-level factors alone may not be sufficient. Broader community and policy-level support in rural communities' support individuals in sustained behavior change. For instance, investment in rural health initiatives and the provision of no-cost, year-round exercise opportunities, grounded in health policy, are critical to promoting physical activity among older adults. Prior research indicates that older adults in rural Montana are more likely to participate in regular exercise when programs are affordable, consistent and aligned with their preferences (O'Leary, Shaffer, Tarabochia, & Routh, 2025).

In conclusion, these findings highlight the importance of targeting individual-level facilitators to support exercise engagement among rural older adults in Montana. Specifically, Extension programs may enhance their effectiveness by tailoring interventions that not only improve exercise self-efficacy but also reflect individual preference. Recommended strategies include promoting the integration of physical activity into daily routines year-round, ensuring activities are both enjoyable and accessible to the individual, and designing programs that align with the specific interests and needs of community members. Additionally, providing clear, relevant, and easily understandable information about the health benefits of regular exercise may support informed decision making and long-term engagement. When health promotion efforts

are tailored to both the contextual realities and personal preferences of rural populations, they may be more likely to yield meaningful and lasting outcomes.

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AI was used for grammar and clarity purposes only.

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CHAPTER FIVE

CONCLUSION

Discussion

This dissertation examined three aspects of health behavior change in rural communities: 1) food security improvement through produce prescription programs, 2) factors influencing older adults' exercise behaviors, and 3) the role of facilitators in shaping exercise self-efficacy for rural older adults. While each study addressed distinct research questions, together they highlighted the interconnected nature of individual, social, and structural systems influences on health behavior change in rural settings. The findings underscore the reach and impact potential of tailoring interventions based on individual and community specific factors of influence when supporting behavior change.

The first study identified trends toward improved food security across three programs sites, though the degree of change varied. Previous research has demonstrated sustainable reductions in food insecurity following participation in produce prescription programs (Fischer, et al., 2022)/. This study also showed modest improvements, with most participants remaining in the low food security category. Patterns similar to previous research indicated participants were increasing whole fruit and vegetable intake across the intervention time period, regardless of delivery style (Hager, et al., 2023). Differences in program engagement, participant demographics, and voucher distribution models likely contributed to site-specific variations (Burrington, Hohensee, Tallman, & Gadomski, 2020; Lyonnais, Kaur, Rafferty, Johnson, & Jilcott Pitts, 2022). These findings emphasize the need for further investigation into program

implementation strategies that optimize engagement, particularly in rural areas where food access remains a persistent challenge (Dean & R, 2011). Current levels of participation in supplemental educations components may be suboptimal due to barriers such as limited transportation, time constraints, or lack of awareness. Greater participation in these components has the potential to enhance nutritional knowledge, improve cooking confidence, and ultimately increase the effectiveness of voucher-based interventions. Future efforts should explore innovative approaches, such as digital education platforms and community-based cooking courses, to expand access, strengthen program impact, and improve long-term dietary behavior change among rural populations (Burrington, Hohensee, Tallman, & Gadomski, 2020).

The second study explored key experiences that shaped older adults' exercise behaviors in rural communities, using SEM to assess influences on the individual, institutional, community, and policy levels. Five primary facilitators emerged: personal health and wellness, access to resources, family and peer influence, community program availability, and past involvement in youth activities. While intrinsic motivation and recognition of long-term health benefits were strong drivers of exercise adherence, access to structured fitness resources and support from professionals and peers played a critical role in sustaining engagement. The study also highlighted gaps in community program availability, particularly in terms of consistency and accessibility, which may impact long-term adherence. These findings suggest that future interventions should focus on expanding structured exercise opportunities and leveraging interpersonal networks to encourage lifelong physical activity, especially among rural older adults (Shaffer, Vaterlaus, Tarabochia, Heriza, & Hojnacki, 2024).

The final study examined the role of facilitators in shaping exercise self-efficacy, identifying individual preference as a key predictor. Factors such as enjoyment perceived importance, and integration of exercise into daily routines significantly influenced self-efficacy levels, reinforcing the idea that personal motivation is a critical component of sustained physical activity. Unlike prior studies that emphasized external reinforcement, these findings suggest that interventions should be designed to align with personal motivators, making exercise both meaningful and accessible. Beyond individual preferences, community and policy-level strategies – such as improving walkability, ensuring safe exercise spaces, and expanding affordable fitness programs – remain essential for fostering long-term engagement (Lo, et al., 2017). Future research should further explore the bidirectional relationship between personal motivation and environmental conditions withing the SEM framework, ensuring that interventions are both adaptable and sustainable in diverse rural communities.

In sum, this dissertation contributes valuable insights into the complexities of health behavior change in rural communities, emphasizing the need for multilevel, community-driven approaches. Addressing food security, promoting lifelong exercise engagement, and enhancing self-efficacy require integrated efforts that consider individual, social, and structural factors. These findings reinforce the utility of the SEM as a guiding framework for understanding how interconnected layers of influence, ranging from individual behaviors to broader policy environments, shape health outcomes. By leveraging evidence-based strategies and fostering local partnerships, future initiatives can more effectively improve health outcomes and quality of life for rural populations, ensuring that programs are both impactful and sustainable.

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APPENDICES

APPENDIX A: GUSNIP PRE SURVEY

Q42 Thank you for your willingness to participate in this survey. If you are an adult (at least 18 years of age) and currently participating in [name of nutrition incentive program], you are eligible for this survey. If you complete this survey, it will be included in a research study evaluating the program. Participation in this study is voluntary and anonymous. Your name and contact information will not be linked with your responses. You can choose not to answer any questions you do not want to answer and/or you can stop at any time. We will protect the information that you provide by not attaching your name to your responses and safely storing this information. The information provided will be combined with responses from other individuals. You may contact our program manager at ____if you have any questions about this research. You may also contact a representative at ____ with any questions about your involvement in this study at [e-mail]. By participating in this survey, I agree to my survey responses being part of a research study.

ID Participant ID

_____

- Someone read me the questions in person
- Someone read me the questions over the phone/zoom
- I took the survey in-person, but I read the questions to myself
- I took the survey at home using an electronic link
- Prefer not to answer

Q34 Including you, how many people currently live in your home?

- Children under 18 _____
- Adults 18+_____

Q35 Are you 18 years of age or older?

- Yes
- No

Q36 Do you plan to be within our service area for the next year?

- Yes
- No
- Unsure

Q57 Are you currently pregnant?

- Yes
- No
- Unsure

Q37 Have you ever been diagnosed with diabetes or pre-diabetes

- Yes
- No
- Unsure

Q38 Have you ever been diagnosed with (mark all that apply)...

- Overweight/Obesity
- Pre Diabetes
- Diabetes
- Cardiovascular/Heart disease (including hypertension, myocardial infarction, stroke)
- Dyslipidemia (high cholesterol)
- Cancer
- Osteoporosis
- Renal Disease/Failure (kidney)

Q39 Are you currently taking medications to manage:

- Overweight/Obesity
- Pre Diabetes
- Diabetes
- Cardiovascular/Heart disease (including hypertension, myocardial infarction, stroke)
- Dyslipidemia (high cholesterol)
- Cancer
- Osteoporosis
- Renal Disease/Failure (kidney)

2. Please write the name of the clinic where your are currently receiving and/or enrolled in [insert incentive program (e.g., Double Up Food Bucks)].

- Name of site: _____
- Don't know/Prefer not to answer

Q4 The first set of questions are about your participation in the Supplemental Nutrition Assistance Program, or SNAP, and about your participation in the name of [SNAP Incentive program]

benefits 3. In the last 30 days, have you or anyone in your household received EBT, food stamps or SNAP benefits?

- Yes
- No
- Don't know/Prefer not to answer

4. How long have you been receiving EBT, food stamps, or SNAP benefits?

- I just started
- Less than a year
- More than a year
- Don't know/Prefer not to answer

5. How many times have you used your insert PPR redemption type (e.g., Food Bucks Rx vouchers) to get fruits and vegetables?

- I have never used it/them
- 1-2 times
- 3-10 times
- More than 10 times
- Don't know/Prefer not to answer

Q8 The next set of questions is about the different kinds of foods you ate or drank during the past month, that is, the past 30 days. When answering, please include meals and snacks eaten at home, at work or school, in restaurants, and anyplace else.

6. During the past month, how often did you drink 100% PURE FRUIT JUICES such as orange, apple, grape, etc.? DO NOT INCLUDE fruit-flavored drinks with added sugar like Capri-Sun, Sunny D, or other fruit-flavored drinks.

Never

- 1 time last month
- 2-3 times last month
- 1 time per week

- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day
- Don't know/Prefer not to answer

7. During the past month, how often did you eat FRUIT like apples, bananas, oranges, melon, or any other fruit? INCLUDE fresh, frozen, canned, or dried fruit. DO NOT INCLUDE juices.

Never

- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day
- Don’t know/Prefer not to answer

8. During the past month, how often did you eat a GREEN LEAFY OR LETTUCE SALAD, with or without other vegetables?

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day
- Don’t know/Prefer not to answer

9. During the past month, how often did you eat any kind of FRIED POTATOES like French fries, tater tots, hash brown potatoes, or other fried potatoes?

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day
- Don't know/Prefer not to answer

10. During the past month, how often did you eat any OTHER KIND OF POTATOES that aren't fried, like baked, boiled, mashed, or potatoes used in soups and stews?

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day
- Don't know/Prefer not to answer

11. During the past month, how often did you eat refried beans, baked beans, pinto beans, black beans, beans in soup, or any other type of COOKED BEANS? INCLUDE canned or dry beans. DO NOT INCLUDE green beans or string beans.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week

- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day
- Don’t know/Prefer not to answer

12. During the past month, how often did you eat other VEGETABLES that were not deep-fried? These are vegetables like carrots, broccoli, collards, green beans, corn, or other vegetables that are not deep-fried. INCLUDE canned, frozen, or fresh vegetables. ALSO INCLUDE vegetables that are raw, boiled, broiled, baked, grilled, stir-fried, or microwaved.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day
- Don’t know/Prefer not to answer

13. During the past month, how often did you eat packaged or homemade SALSA made with tomato?

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day
- Don’t know/Prefer not to answer

14. During the past month, how often did you eat PIZZA? INCLUDE frozen pizza, fast food pizza, and homemade pizza.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day
- Don’t know/Prefer not to answer

15. During the past month, how often did you eat TOMATO SAUCE in recipes such as spaghetti, lasagna, or other dishes? DO NOT INCLUDE tomato sauce on pizza.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day
- Don’t know/Prefer not to answer

Q19 The next set of questions is about the food eaten in your household in the last 30 days, and whether you were able to afford the food you need.

16. The food that we bought just didn’t last, and we didn’t have money to get more. Was that often, sometimes, or never true for your household in the last 30 days?

- Often true
- Sometimes true
- Never true

- Don’t know/Prefer not to answer

17. We couldn’t afford to eat balanced meals. Was that often, sometimes, or never true for your household in the last 30 days?

- Often true
- Sometimes true
- Never true
- Don’t know/Prefer not to answer

18. In the last 30 days, did you or other adults in your household ever cut the size of your meals or skip meals because there wasn’t enough money for food?

- Yes
- No
- Don’t know/Prefer not to answer

19. In the last 30 days, how many days did this happen? (Please respond with a whole number (no decimal points) between 1 and 30)

_____

20. In the last 30 days, did you ever eat less than you felt you should because there wasn’t enough money for food?

- Yes
- No
- Don’t know/Prefer not to answer

21. In the last 30 days, were you ever hungry but didn’t eat because there wasn’t enough money for food?

- Yes
- No
- Don’t know/Prefer not to answer

Q31 The last section is about you.

22. Would you say that in general your health is poor, fair, good, very good, or excellent?

- Poor
- Fair
- Good
- Very good
- Excellent
- Don't know/Prefer not to answer

Q40 In the past 12 months how many days have you seen a... (excluding child birth related services)

- Primary or Family Care Provider/General Practitioner for Out-patient Care
  _____
- Specialist for Out-patient Care (not overnight)
  _____
- Emergency Room for Out-patient Care (not overnight)
  _____
- Hospital/In-Patient care
  _____

23. How old are you? (e.g. 46)

- Age _____
- Prefer not to answer

24. How do you describe yourself?

- Man
- Non-binary/third gender
- Woman
- Prefer to self-describe: _____
- Prefer not to answer

25. Are you of Hispanic, Latino/a, or Spanish origin?

- Yes
- No
- Prefer not to answer

26. How would you describe your racial or ethnic background? Check all that apply.

- American Indian or Alaska Native
- Asian
- Black or African American
- Native Hawaiian
- Other Pacific Islander
- White
- Some other race: _____
- Don't know/not sure
- Prefer not to answer

27. What is the zip code where you currently live?

- Enter 5-digit zip code: _____
- Don't know/Prefer not to answer

Q41 HbA1c (e.g. 00.0)

_____

Q42 Date taken (e.g. mm.dd.yyyy)

_____

Q43 Fasting glucose

_____

Q44 Date taken (e.g. mm.dd.yyyy)

_____

Q45 Total cholesterol

_____

Q46 Date taken (e.g. mm.dd.yyyy)

_____

Q47 LDL cholesterol

_____

Q48 Date taken (e.g. mm.dd.yyyy)

_____

Q49 HDL cholesterol

_____

Q50 Date taken (e.g. mm.dd.yyyy)

_____

Q51 Triglycerides

_____

Q52 Date taken (e.g. mm.dd.yyyy)

_____

Q53 Blood pressure (Systolic)

_____

Q54 Date taken (e.g. mm.dd.yyyy)

_____

Q55 Blood pressure (Diastolic)

_____

Q56 Date taken (e.g. mm.dd.yyyy)

_____

Q74 Fasting Insulin

_____

Q75 Date taken (e.g. mm.dd.yyyy)

_____

APPENDIX B: GUSNIP POST SURVEY (CONDENSED)

Q47 Since starting the food Rx program (4-6 months), have any of your medications or treatments changed?

- Yes
- No
- Unsure

Q48 If any have changed, please explain which medications or treatment changed and how (increased, decreased, added, etc.)

_____

2. Please write the name of the clinic where you are currently receiving and/or enrolled in<span style [insert incentive program (e.g., Double Up Food Bucks)].

- Name of site: _____
- Don't know/Prefer not to answer

Q4 The first set of questions is about your participation in the Supplemental Nutrition Assistance Program, or SNAP, and about your participation in the [insert name of PPR program]

3. In the last 30 days, have you or anyone in your household received EBT, food stamps or SNAP benefits?

- Yes
- No
- Don't know/Prefer not to answer

4. How long have you been receiving EBT, food stamps, or SNAP benefits?

- I just started
- Less than a year
- More than a year
- Don't know/Prefer not to answer

5.How many times have you used your [insert PPR redemption type (e.g., Food Bucks Rx vouchers)] to get fruits and vegetables?

- I have never used it/them
- 1-2 times
- 3-10 times
- More than 10 times
- Don't know/Prefer not to answer

6. Did you participate in any nutrition or food education activities as part of [PPR program name] such as insert nutrition education activities offered by your program – e.g., a healthy food table, cooking class, consultation with a registered dietitian, diabetes education class, grocery store tour, etc.

- No, I did not participate in any activities
- Yes, I participated in 1 activity
- Yes, I participated in 2 or 4 activities
- Yes, I participated in 5 or more activities
- Don't know/Prefer not to answer

Q49 Have you (re)newly accessed any of the following food resources suggested by your provider or as part of education activities that you recall? (Please check all that apply)

- WIC, Women Infants and Children
- TANF, Temporary Assistance for Needy Families
- EBT, food stamps, or SNAP
- Commodity food program or FDPIR
- Local food bank
- School free or reduced lunch
- MSU or Tribal Extension resources or SNAP-Education
- Community meal programs, senior meals, summer school lunch
- Non-food specific public assistance programs like utilities supports, child care scholarship?
- Other

7. Overall, how would you rate your experience with [insert name of PPR program]

- Very negative
- Negative
- Neutral

- Positive
- Very positive
- Don't know/Prefer not to answer

APPENDIX C: ADHERENCE SURVEY COMPLETE

Q1 SUBJECT CONSENT FORM FOR PARTICIPARTION IN HUMAN RESEARCH AT MONTANA STATE UNIVERSITY Study Title: Factors Associated with Exercise Adherence in Older Adults Aged 55-85: A Qualitative Study. Investigators: Bryant O'Leary, Tasha Shaffer, and Dawn Tarabochia, PhD Summary of the Research Project: You are being asked to volunteer as a participant in a research study exploring your experiences with exercise. We are interested in what motivates you to exercise, what challenges your experience in exercise, and as well as other experiences you have had while participating in exercise. Our goal is to identify the factors associated with participation in exercise as well as factors that make exercise a challenge. In order to better understand the factors associated with exercise, we have created a 27-question survey. The survey questions contain some standard questions (e.g., age), questions about your confidence exercising, and about your experience with exercise. If you agree to participate, the survey will be sent to you by email. Purpose of the Study: The purpose of this study is to understand your experiences in participation in exercise. Specifically, we are interested in understanding your confidence in participating in exercise and what factors impact your engagement in exercise. Participants in the study: You have been asked to participate in this study because you have expressed interest in participating, have current and/or past experience participating in exercise and meet the age requirements of the study. Procedures: Participation in this study is voluntary. If you agree to be a participant, you will be asked to complete an online survey that will be sent to you via email. The survey consists of 27 questions. Some questions ask for all that apply and some are open-ended, so we ask that you type your responses in whichever format is best for you (e.g., paragraph, bulleted sentences). We anticipate that the survey will take approximately 20 minutes to complete. Benefits: This study provides you the opportunity to explore your experiences with exercise. Your participation will help the researchers work to better understand the factors that influence exercise participation. The long-term goal is to create exercise programming to encourage participation and limit challenges to exercise to increase participation in exercise. Risks: The risk of participation in this study is minimal. It is possible that a specific question or questions could bring up a memory of a past event that could result in an emotional reaction. Please note that you can skip any questions that you are not comfortable with and you have the right to end your participation in this study at any time for any reason. We will send two reminder emails at one week and two weeks after we have sent the link to survey. It is possible that reminder emails could be an annoyance to you. We will not send out more than two (2) reminder emails. It is possible that time to complete the survey is longer than the anticipated 20 minutes. Compensation: There is no compensation for this study. Freedom of consent: You have the right to withdraw from participation in this study at any time with no questions asked. You may withdraw in writing (or email), or in person. Participation in this study is completely voluntary. Funding: There is no funding associated with this research project. Please ask any questions: We encourage you to ask any and all questions that you may have regarding this study. Our team will work to answer your questions as quickly and completely as possible. Confidentiality: All data and information collected as a component of this study will be kept confidential. You will be given a subject number that will be associated

with all data you contribute. This information will be kept in a locked compartment in the office of the faculty mentor. If you decide to withdraw from the study at any time, your data will be erased from the study record without question. Adverse Effects: No adverse effects are expected from this study. Any other questions regarding your rights as a participant in this study can be directed to the chairman of Human Subjects Committee – Mark Quinn. (406-994-4707) mquinn@montana.edu. STATEMENT OF AUTHORIZATION Study Title: Factors Associated with Exercise Adherence in Older Adults Aged 55-85: A Qualitative Study. AUTHORIZATION: I have read the above and understand the potential discomforts and risks associated with this study, I agree to participate in this research. I also agree that all my information can be collected and used by the researchers and staff for the research study described in this consent form. I understand that I may later refuse participation and that I may withdraw from the study at that time. I have received a copy of this consent form for my own records.

- Yes
- No

Q2 Are you currently over the age of 55?

- Yes
- No

Q3 Do you currently live in Montana?

- Yes, please include your zip code.
  _____
- No

Q4 Please select your age group.

- 55-64
- 65-74
- 75-85
- 86+

Q5 What gender do you identify with?

- Male
- Female
- Non-binary / third gender

- Prefer not to say

Q6 What is your current employment status?

- Employed full time (~40 hours/week)
- Employed part time (~20 hours/week)
- Self Employed
- Seeking Opportunities
- Retired
- Volunteer
- Other _____

Q7 What is the highest level of education you have completed?

- Some high school
- High school diploma
- Associate degree
- Some college
- Trade school
- Bachelor's degree
- Master's degree
- PhD or professional degree
- Other _____

Q8 Please select your races/ethnicities (select all that apply).

- Caucasian
- African American
- Latino or Hispanic
- Asian
- Native American or Alaskan Native
- Native Hawaiian or Pacific Islander
- Other _____
- Prefer not to say

Q10 The next set of questions are related to your exercise habits over the past twelve (12) months. Exercise is a planned, repetitive, and intentional movement intended to improve or maintain physical fitness (Matud & Diaz, 2020).

Q11 What types of exercise do you or have you participated in within the last twelve (12) months. (Select all that apply)

- Aerobic training (this includes movements that increase heart rate and breathing frequency like dancing, walking, hiking, biking, swimming, running, etc.)
- Strength training (this includes exercises focused on building muscle mass and may include exercises like squats, pushups, planks, machine weight training, resistance band training, etc.)
- Balance training (this includes exercises or activities designed to challenge your balance and may include Tai Chi, yoga, walking on uneven surfaces, Bosu ball exercises, etc.)
- Flexibility and stretching (this includes exercises or activities focused on increasing or maintaining range of motion and may include dynamic stretching, static stretching, yoga, etc.)
- None of these
- Other _____

Q32 What types of exercise do you or have you participated in within the last twelve (12) months. (Select all that apply)

- Aerobic training (this includes movements that increase heart rate and breathing frequency like dancing, walking, hiking, biking, swimming, running, etc.)
- Strength training (this includes exercises focused on building muscle mass and may include exercises like squats, pushups, planks, machine weight training, resistance band training, etc.)
- Balance training (this includes exercises or activities designed to challenge your balance and may include Tai Chi, yoga, walking on uneven surfaces, Bosu ball exercises, etc.)
- Flexibility and stretching (this includes exercises or activities focused on increasing or maintaining range of motion and may include dynamic stretching, static stretching, yoga, etc.)
- None of these
- Other _____

Q12 In a typical week, how often do you participate in exercise per day?

- Less than 30 minutes
- 30-59 minutes
- 60-89 minutes
- Greater than 90 minutes

Q33 In a typical week, how often do you participate in exercise per day?

- Less than 30 minutes
- 30-59 minutes
- 60-89 minutes
- Greater than 90 minutes

Q34 In a typical week, how often do you participate in exercise per day?

- Less than 30 minutes
- 30-59 minutes
- 60-89 minutes
- Greater than 90 minutes

Q13 In a typical week, how many days do you exercise per week?

- 0-1 days
- 2-3 days
- 4-5 days
- 6-7 days

Q28 How many years have you been exercising in your current practice?

- Less than 1 year
- 1-3 years
- 4-9 years
- 10+ years

Q15 In the last ten (10) years, are there certain exercises you no longer participate in? If yes, what are they and why do you no longer participate?

- Yes _____
- No

Q31 The items listed below are designed to assess your beliefs in your ability to continue exercising. Using the scales listed below please indicate how confident you are that you will be able to continue to exercise in the future. For example: if you have complete confidence that you could exercise at a moderate intensity for 40+ minutes three (3) times per week for the next four (4) weeks without quitting, you would select always true.

Q16 I am confident...

	1 Not always true	2 Rarely true	3 Moderately true	4 Always true
1. that I can overcome barriers and challenges with regard to physical activity and exercise if I try hard enough	•	•	•	•
2. that I can find means and ways to be physically active and exercise	•	•	•	•
3. that I can accomplish my physical activity and exercise goals that I set	•	•	•	•
4. that when I am confronted with a barrier to	•	•	•	•

physical activity or exercise I can find several solutions to overcome this barrier				
5. that I can be physically active or exercise even when I am tired	•	•	•	•
6. that I can be physically active or exercise even when I am feeling depressed	•	•	•	•
7. that I can be physically active or exercise even without the support of my family or friends	•	•	•	•
8. that I can be physically active or exercise without the help of a therapist or trainer	•	•	•	•
9. that I can motivate myself to start being physically active or exercise again after I've stopped for a while	•	•	•	•
10. that I can be physically active or exercise even if I had no access to a gym, exercise,	•	•	•	•

training, or
rehabilitation
facility

Q20 The next set of questions are related to barriers and facilitators of exercise and how they influence your current exercise behaviors. Barriers are factors that hinder, limit, or prevent you from engaging in certain behaviors. Facilitators are factors that act on, in, or around a person to encourage engaging in certain behaviors (Dijkstra et al., 2022).

Q21 What barriers affect your current exercise behaviors? (Select all that apply)

- Pain
- Decreased endurance and balance
- Increased recovery time
- Risk of injury
- Fear of falling
- Dislike of exercise
- Dislike of gyms or indoor group activity
- Dislike of organization/group or physical activity
- Lack of motivation
- Intimidation or embarrassment
- Unsure of appropriate physical activity for self
- Boredom
- Not accustomed to doing a specific activity
- Lack of guidance from a professional
- Not receiving or able to access information on appropriate exercise programs
- Being pushed too hard
- Presence of others perceived as intimidating
- Other _____
- None of these

Q22 What, if any, environmental or structural factors act as barriers to your current exercise behaviors? (Select all that apply)

- Hills and stairs
- Uneven walkways
- Bad weather

- Unsafe neighborhood
- Unappealing environment to exercise
- Inconvenient exercise locations
- Difficult parking
- Expense to drive or use facilities
- Lack of quality instructors
- Programs that are not engaging or too challenging
- Providers who are not knowledgeable about programs
- Other _____
- None of these

Q23 What facilitators influence your current exercise behaviors? (Select all that apply)

- Prevention of health conditions
- Management of existing conditions
- Maintenance of balance, strength, mental acuity
- Potential weight loss
- Mood boost
- Enjoyment of exercise
- Belief that exercise is important
- Feeling guilty when not active
- Awareness of benefits from exercise
- Exercise as part of a routine
- Sense of confidence
- Proactive pursuit of exercise programs
- Daily activities that provide exercise
- Exercise combined with enjoyable/useful activities
- Companionship of others
- Guidance from a professional
- Friendships from exercise classes/gym time
- Social contact
- Others as a role model or incentives
- Support from a dog companion
- Other _____
- None of these

Q24 What environmental or structural facilitators influence your exercise behaviors? (Select all that apply)

- Living in a walkable area
- Proximity to stores
- Places to rest
- Even walkways
- Alternative options to bad weather
- Exercise options at home
- Convenient/nearby exercise locations
- Pleasurable weather
- Free/low-cost programs
- High-quality instructors
- Flexible program schedules
- Engaging classes
- Programs appropriate for different fitness levels and physical limitations
- Distribution of information
- Other _____
- None of these

Q26 Did you have a past experience that was instrumental in helping to establish your current exercise habits? (anyone, any organization, any policy)

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_____

_____

_____

_____

Q27 How did you hear about this survey?

- Montana State University Extension Agent
- Fitness Instructor
- Social media
- Other _____