Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
https://foodsystemsjournal.org

Using implementation science to understand the implementation factors in a rural Produce Prescription program

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Submitted January 30, 2025 / Revised March 24 and April 28, 2025 / Accepted April 29, 2025 / Published online July 1, 2025

Citation: Mydels, S., Schreiber, L. R. N., Colby, H., Blakeman T., Gebauer, H., & Gannett, S. (2025). Using implementation science to understand the implementation factors in a rural Produce Prescription program. *Journal of Agriculture, Food Systems, and Community Development*, *14*(3), 371–392. https://doi.org/10.5304/jafscd.2025.143.028

Abstract

Produce Prescription programs (PPRs), in which healthcare providers prescribe no- or low-cost produce, have shown promise in improving food security, health outcomes and produce consumption. However, research on essential implementation components has been limited, especially across all sectors involved in implementation and in rural settings. This study utilized the Exploration, Preparation, Implementation and Sustainment (EPIS) framework to examine factors that facilitate and hinder implementation from all sectors of a rural Minnesota PPR. Through 14 interviews conducted between October 2023 and January 2024, this study explored factors from all sectors (healthcare, food systems, and public health) that influence successful PPR implementation. Across all

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See disclosures on the next page.

sectors, three major themes were identified: (1) resources and support; (2) processes and infrastructure; and (3) staffing and roles. Within these themes we found critical factors that have implications for the future of PPR implementation, including collaboration, sustainability, rurality and the local economy. The EPIS framework proved valuable in examining these factors, providing insights to inform future planning and decision making for PPRs. Further research can enhance understanding of successful implementation and support the development of sustainable practices and funding mechanisms.

Keywords
implementation science, Produce Prescription programs, rural, food insecurity, healthcare, food system, agriculture, Food Is Medicine

Introduction and Literature Review

Produce Prescription programs (PPRs), a part of the Food Is Medicine movement, address food insecurity and nutrition-related health outcomes by enabling healthcare providers to prescribe fruits and vegetables, which patients can redeem within their communities (Centers for Disease Control and Prevention, 2024; Volpp et al., 2023). Prescriptions, in the forms of vouchers, coupons, or produce boxes, make fresh produce accessible at no or reduced cost. Numerous studies consistently document the success of PPRs in promoting produce consumption, improving food security, enhancing quality of life, and saving billions of dollars in healthcare costs through improved health outcomes (Bhat et al., 2021; Hager et al., 2023; Wang et al., 2023). However, PPR implementation varies widely, with program lengths averaging 10 weeks and produce values ranging from US$10 weekly to US$500 total for the duration of the program (Gus Schumacher Nutrition Incentive Program NTAE, 2023).

It remains unclear which elements within PPRs are crucial to successfully achieving the desired outcomes, such as improved health and food security. Utilizing an implementation science framework to understand PPR implementation offers unique insights to understand which elements are critical to success. An implementation science framework explains how to integrate evidence-based innovations into real-world environments, ensuring that benefits are achieved, barriers addressed, and resources utilized (Bauer et al., 2015). More specifically, implementation science is the scientific study of how research gets translated into evidence-based practices and applied in the real world by practitioners and policymakers. Distinct from effectiveness research, which focuses on health outcomes, implementation science focuses on how much or how well interventions are applied (University of Washington Department of Global Health, n.d.). It emphasizes contextual factors such as organizational characteristics, staff dynamics, leadership, and organizational processes and procedures, such as onboarding and training, that can predict the success of integrating evidence-based innovations. Studying evidence-based interventions through an implementation science lens enables practitioners to replicate and/or modify specific variables to fit their situation and achieve intended outcomes (Moullin et al., 2019).

Few studies have applied an implementation science framework to examine the implementation of PPR programs. Often studies collect data on program implementation but do not apply a formal implementation science framework. Among the most frequently used frameworks for this purpose are the Exploration, Preparation, Implementation, and Sustainment (EPIS) framework and the Consolidated Framework for Implementation Research (Figueroa & Houghtaling, 2024; Frank et al., 2024). According to Figueroa and Houghtaling (2024), the EPIS framework is recommended for studying the implementation of Food Is Medicine initiatives like PPR. The framework effectively combines multiple factors to determine what works, for whom, and under what circumstances, while maintaining a focus on health equity. More specifically, the EPIS framework was designed to incorporate evidence-based practices and innovations in the health service environment. The framework's focus on facilitating the adoption and sustainability of evidence-based practices makes it particularly relevant to emerging public health strategies such as PPR. This framework features four domains—inner context, outer context, innovation, and bridging factors—which include 16 constructs or determinants that are

barriers or facilitators influencing the adoption, use, and sustainability of innovations across the phases of Exploration, Preparation, Implementation, and Sustainment (Aarons et al., 2011; Crable et al., 2022; Houghtaling et al., 2023). Key factors influencing PPR implementation include provider awareness and confidence in PPR outcomes, organizational and staffing capacity, community involvement, institutional policies, and leadership support (Figueroa & Houghtaling, 2024; Frank et al., 2024; Houghtaling et al., 2024; Ylitalo et al., 2024).

Most PPR implementation science research has concentrated on clinical settings, providing limited understanding of the contributions and challenges faced by local food system partners. Additionally, PPR research primarily focuses on urban areas, leaving rural settings underexplored. Rural areas present distinct opportunities and challenges, because although there is greater agricultural production they have disproportionately higher rates of food insecurity compared to urban areas (nine of ten high food insecurity counties are rural) and have limited healthy food and transportation access (Feeding America, 2024; Food Research and Action Center, 2018; Pinard et al., 2016; Rodriguez & Grahame, 2016; Smith & Miller, 2011). While PPRs in rural areas have shown promise in reducing food insecurity and addressing factors like transportation, community perspectives, and local farming systems, these studies often fail to incorporate the perspectives of all partners (Budd Nugent et al., 2022; Kline et al., 2024; Owens et al., 2024).

This case study addresses these research gaps in evaluating rural PPR implementation by examining the perspectives of all sectors engaged in implementation. We utilized the inner context of the EPIS framework, specifically organizational characteristics, leadership, and quality and fidelity monitoring and support, to explore the contextual elements that influenced success and challenges of the PPR (Figueroa & Houghtaling, 2024). The primary aim of this study is to explore the implementation factors of a rural PPR across the various participating sectors (healthcare, food systems, and public health).

Program Overview

Background

In 2018, a rural county public health agency (CPHA) began exploring a partnership between a rural healthcare center, employing approximately 500 caregivers, and a food hub[1] to initiate a PPR aimed at addressing food insecurity in the county. The county population in 2020 was 15,697, approximately 52% aged 55 and older, 50% female, and 93% white (Wilder Research, 2025). In 2018, the county food insecurity rate was estimated at 11.5%, compared to 8.2% in the state (Feeding America, 2018). Although the CPHA lacked staff and funding to implement PPR, this early collaboration set the stage for hiring a population health manager. Meanwhile, the CPHA partnered with the Farmers Market Food Hub ("the Hub") to recruit more wholesale buyers, and during the 2020 pandemic they launched a drive-through community supported agriculture (CSA) service. The Hub also expanded sales to local schools and restaurants, demonstrating the revenue potential for farmers beyond farmers markets.

These partnerships led to the CPHA's inclusion in the Minnesota Department of Health (MDH) application to the USDA Gus Schumacher Nutrition Incentive Program (GusNIP) (National Institute of Food and Agriculture, 2025) in 2022 to enhance PPR in the region. With funding secured, the MDH, the CPHA, a rural healthcare center, and the Hub planned a PPR emphasizing local food sourcing. The main goals of the program were to (1) design and implement Produce Prescription programs tailored to community needs and resources, and (2) evaluate the impact of the PPRs on dietary consumption of fruits and vegetables, and on nutrition security. The GusNIP PPR focuses on low-income adults who screen positive for food insecurity.

PPR Program Screening and Enrollment Process

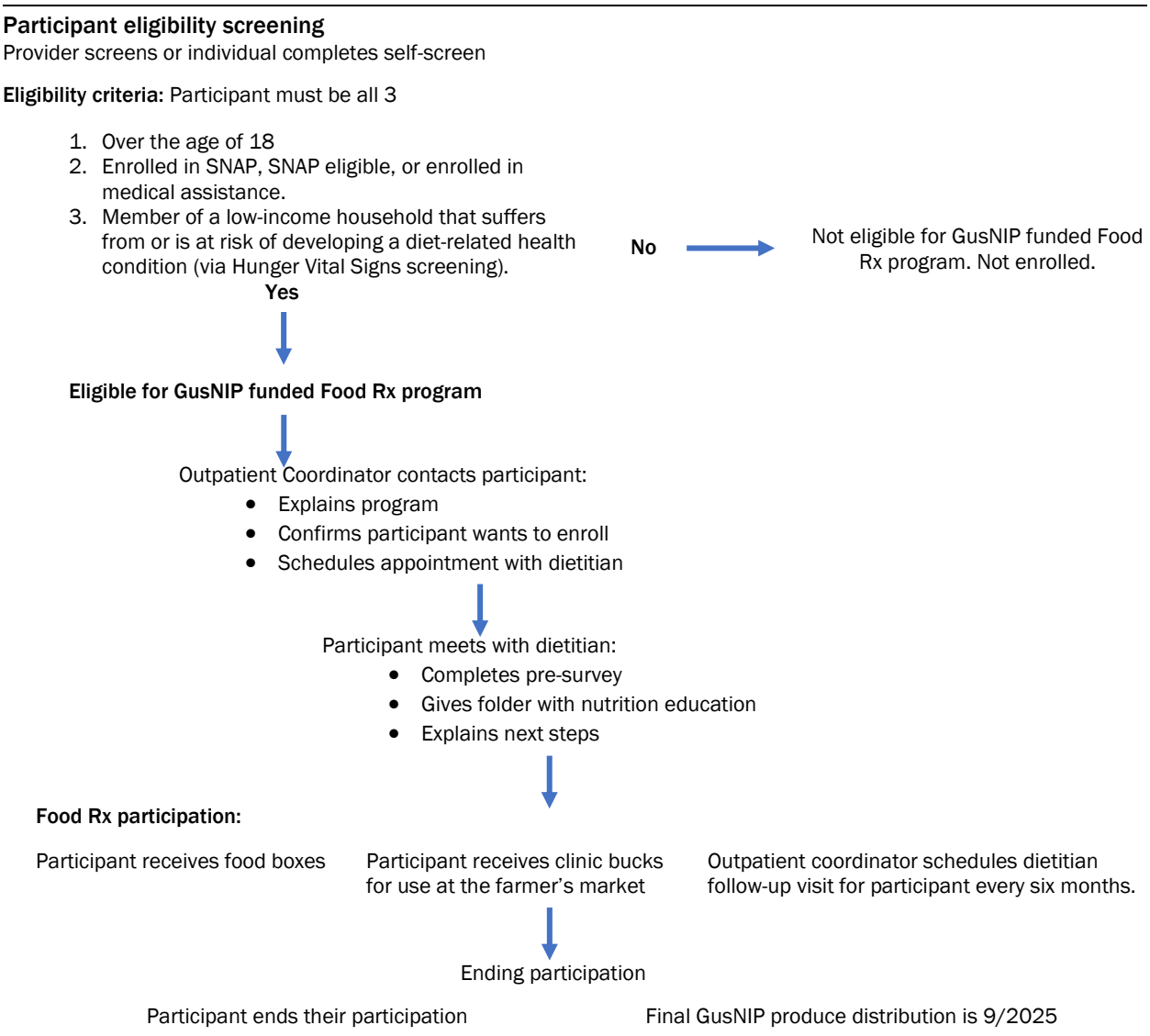
Individuals seeking to enroll in the program are screened for eligibility through either their health-

[1] A food hub is defined as a "business or organization that actively manages the aggregation, distribution, and marketing of source-identified food products primarily from local and regional producers to strengthen their ability to satisfy wholesale, retail, and institutional demand" (Agricultural Marketing Resource Center, 2022, para. 1).

care provider or by completing an online self-screening. To qualify, they must meet three criteria: (1) be over 18; (2) be enrolled in SNAP or be SNAP-eligible, or receive medical assistance; and (3) belong to a low-income household at risk of or suffering from diet-related health conditions, as indicated by the Hunger Vital Signs screening (Gattu et al., 2019; Gus Schumacher Nutrition Incentive Program NTAE, 2023).

Participants were eligible to participate in the program for up to two years (June 2023– September 2025) and received two food boxes per month during summer (June–October) and one food box during winter (November–May). Each box, valued at around US$50, included a selection of produce such as heirloom tomatoes, herbs, romaine lettuce, and kohlrabi. Participants also received 50 "clinic bucks," valued at US$1 each, to be spent at the local farmers market. Figure 1 depicts the PPR enrollment and participation process.

Figure 1. PPR Participation Process



Source: PPR Participation Process for Participant eligibility screening (Colby & Johnson, May 2023, personal communication).

Preliminary Program Outcome

The program will be completed autumn 2025, but the preliminary results are encouraging. Demographically, the majority of the 117 participants are white and female, with the median age of 57 (range 18–98). At baseline, in summer 2023, about half of the participants indicated that their health was good or very good. About 45% responded "yes" to the question, "In the last 30 days, have you or anyone in your household received (Electronic Benefit Transfer) EBT, food stamps or (Supplemental Nutrition Assistance Program) SNAP benefits?" and of these individuals, 79% had been on SNAP benefits for more than one year. As of autumn 2024, 55 participants completed a baseline and six-month (±2 months) survey. We found that 35% of the 55 improved their "food security" status either from "very low food security" to "low food security," or from "low food security" to "marginal food security." At baseline, participants ate on average 2.3 cups of fruits and/or vegetables per day, and we found there was an average increase of 0.16 cups per day of fruit and vegetables, which is comparable to year-four findings for a nationwide study of PPR (Gus Schumacher Nutrition Incentive Program NTAE, 2024). Studies have indicated that even small increases in fruit and vegetable consumption contribute to health (Bazzano et al., 2002; Bellavia et al., 2013; Olsho et al., 2016).

Applied Research Methods

The CPHA staff conducted semi-structured interviews with 14 individuals that implemented the program from the clinic, the Hub, local farms, and county public health (CPH) sectors. We used the EPIS framework to create interview guides that explored organizational characteristics, leadership, quality and fidelity monitoring/support, and outcome of program implementation (Aarons et al., 2011). This study was exempt from the Institutional Review Board review due to the low-risk nature of this research.

The CPHA identified participants via purposive sampling (Gill, 2020) based on their knowledge and involvement in PPR. Interviewee inclusion criteria were that the individual participated in planning and/or implementing the PPR at that location. Exclusion criteria for healthcare staff was staff not working at the main healthcare implementation site. Of the 17 potential interviewees the CPHA recruited between October 2023 and January 2024, 14 completed interviews for a response rate of 82%. Interviewees represented individuals from the clinic (7), the Hub (4), produce farmers (2) and CPH (1). Table 1 describes the sectors and roles of interviewees.

Table 1. Interviewees Sector and Roles

Sector	Description of Roles
Clinic	2 Registered Dietitians 1 Population Health Manager 1 Outpatient Coordinator 1 Public Relations and Marketing Manager 1 Intern 1 Volunteer
The Hub[a]	1 Hub Manager 1 Farmers Market Manager 1 Farmers Market Board Member 1 Hub Mentor[b]
Farmers	2 Local Produce Farmers
County Public Health (CPH)	1 CPH staff

[a] The Hub's mission is to increase local food security and food equity by providing access to all demographic groups: selling produce wholesale to schools, operating a farmers market, and supporting local businesses, thus making the farmers market one component of the Hub's broader efforts.
[b] One interviewee is counted in the Hub sector because their interview focused on that role, but they are also a farmer that supports the program.

Interviews were conducted between November 2023 and January 2024 via recorded video conference by one interviewer and one note-taker. All interviewees were interviewed individually except for the two dietitians and outpatient coordinator who were interviewed together for a total of 12 separate interviews with 14 interviewees. The interviewer asked questions about organizational characteristics, including resource and support, processes and infrastructure, and staffing and roles, as well as the outcome of implementing PPR at the time of the interview.

To analyze the interviews we used Template Analysis, a form of thematic Rapid Qualitative Analysis (Brady & Ryan, 2023), that uses a refined template to summarize each transcript by using defined themes and subthemes. All summaries were transferred for synthesis into a matrix by interviewee and theme. Using the EPIS Framework we created a template summary and a codebook. (See Appendices A and B for the summary template and codebook respectively.) Our team of six coders, four state and two county public health staff, summarized the interviews. The two lead coders created a summary template with four interviews, reconciled differences, and finalized the master template and codebook. The remaining eight interviews were summarized using a double coding procedure in pairs, achieving consensus, and putting the reconciled codes in the finalized master template. Summaries were provided to interviewees for feedback to ensure accuracy and precision. The 12 finalized summaries were then compiled into an Excel matrix (i.e., interviewee x theme/subtheme), and the two lead coders independently conducted deductive thematic analysis by sector (e.g., clinic, the Hub, farmers, CPH). This iterative summarization and feedback process enhanced the themes' validity and reliability.

Subjectivity Statement

Our research team was composed of six white women working in governmental public health, all of whom were engaged in different aspects of the project, and four of whom were dietitians. Two team members interviewed most interviewees, and one of them was directly involved in coordinating logistics in implementing PPR. The prior relationships that these two team members had with interviewees likely enabled willingness of interviewees to participate in the interviews. Of the four remaining team members, two were involved in designing the evaluation and analyzing the collected information for the project, and two were involved in managing and providing guidance for the overall project.

Results

We identified major themes and subthemes of organizational characteristics that shape the structures and processes that influence implementation in organizations. Inductively derived themes were based on interpretation of interviews. (Quoted text within brackets has been edited to maintain anonymity.) Table 2 presents organizational characteristics themes and subthemes and a summary description of each subtheme.

Resources and Support

This theme identifies the resources and supports needed to implement PPR and the methods for obtaining them. Subthemes include partnership and collaboration, implementation training, implementation challenges, feedback on resources and support, and funding.

Partnerships and collaboration

Ten of 14 interviewees, and all sectors, mentioned the importance of partnerships and collaboration. The Hub interviewees emphasized the importance of having relationships with farmers, a Hub coordinator to connect farmers and create a farmer network, and support from the farmers market board for PPR implementation. Similarly, farmers suggested that peer-to-peer support between farmers, although not included in the program, would be valuable for PPR. From the clinic population health manager's perspective, understanding the broader impact of PPR on the organization was important, and ensuring communication about its role within the clinic—especially with leadership—can enhance collaboration. CPH echoed this sentiment, suggesting that by educating decision makers (i.e. county commissioners, legislators, the healthcare agency CEO) on PPR, they could increase awareness and foster support for cross-

Table 2. Organizational Characteristics Themes, Subthemes and Description

Themes	Subthemes	Description
Resources and Support	Partnership and collaboration	All sectors relied on partnerships and collaboration to implement PPR.
	Implementation challenges	All sectors mentioned implementation challenges; the most frequent were transportation, space, staffing, and drought.
	Feedback on resources and support	The clinic and CPH mentioned needing support around building an implementation framework, PPR implementation training, clarity of roles and responsibilities, transportation, and needing volunteers.
	Funding sources for sustainability	All sectors indicated that more funding for staffing and infrastructure was needed for PPR to be sustainable.
Processes and Infrastructure	Existing processes	The Hub was the only sector to explicitly mention this subtheme. They had most of the foundational infrastructure and some processes in place at the start of PPR.
	New processes	All sectors had to adopt new processes to a certain extent; both the clinic and the Hub needed to update redemption systems and the clinic needed to update their electronic tracking system to allow for patient screening and enrollment. Farmers changed the type of produce grown to fit in the produce boxes.
Staffing and Roles	Recommended roles	All sectors needed dedicated full-time equivalents (FTE). (Table 3 gives more information.)
	Coordination of staff	The clinic and Hub mentioned the importance of coordinating staff efforts to support collaboration between sectors.
	Important skills in leadership	All sectors mentioned the importance of interpersonal skills such as ability to collaborate, relationship building, active listening, and communication.
	Organizational culture	The clinic, Hub, and CPH mentioned the importance of leadership support as a key component to implementing PPR.

sector initiatives, such as PPR. The CPH staff also noted that such intersectoral collaboration was vital to address complex problems like food insecurity. These partnerships and collaboration between organizations, in addition to collaboration among staff working on the project, were necessary for a successful PPR. The clinic's public relations and marketing manager summarized this well: "So, it's not just one entity doing all the great work, its multiple entities doing the great work. … It all takes manpower, dollars, partnerships, and collaboration."

Implementation challenges

All sectors mentioned implementation challenges, most frequently transportation, space, staffing, and drought. Transportation was the most mentioned challenge for the clinic, by four Hub and CPH. The program's rural setting and geographically large service area created lengthy travel times that were exacerbated during winter. For example, the Hub manager stated: "Winter narrows everything. It narrows our roads; it narrows our window of time to be outside …"

Transportation challenges seemed to impact each step of the program: transporting produce to the clinic for aggregation, transporting food boxes to satellite clinics, delivering food boxes to participants (both participants getting to the clinic and the clinic delivering to participants), and getting participants to the farmers market. For example, the Hub manager sometimes picked up produce when farmers couldn't drop it off due to scheduling or lack of transportation. Additionally, the clinic's population health manager delivered produce boxes to participants outside of work hours when necessary due to transportation challenges participants faced. Unfortunately, even with these

efforts, some participants missed their produce box pick-up. The clinic's intern said this about transportation challenges:

> It was a little tricky just because our area is very rural and so participants that didn't have transportation, we offered transportation for them where we drop off the boxes at their residence. And we also made sure that each location of our [three clinics] had a place for pick up. And there were some examples where patients didn't have transportation so that maybe they skipped a week of boxes or other life things going on.

Physical space for food aggregation and storage was also a challenge, mentioned by four interviewees from both the Hub and clinic. Both the Hub and the clinic needed additional refrigerated space to store produce to maintain its quality until it was packed into boxes. The clinic interviewees also commented on the need for space to aggregate the produce into boxes and then store them until PPR participants picked them up. Nearly half the clinic interviewees (three of seven) saw value in having a larger, centralized location for food storage and aggregation, and carts for transporting produce.

Both farmers' responses focused on farming related challenges, such as drought, lack of consistent rainfall, problems with growing certain produce, and getting better at adapting to weather:

> The workload was pretty heavy this past year. But I sincerely believe that that was extremely exacerbated by the drought because we had to spend so much time day-to-day trying to get enough moisture on plants that were growing that it was very difficult to find time for weeding.

Feedback on resources and support

The clinic and CPH provided feedback on resources and support. All clinic interviewees (seven) provided feedback for changes to resources and support, including developing a framework for program implementation from the beginning, training for PPR implementation, getting more volunteers for food aggregation, and transportation support. CPH had similar feedback, stating that more explicit roles and responsibilities with resources during implementation would be helpful. Regarding a program implementation framework, the public relations and marketing manager stated:

> I think a framework, having a really strong framework right out of the gate, you know, flow charts, strategic plans, you know, spreadsheets, tracking systems, all of that leads to a really effective program, nothing willy-nilly. It has to be really dialed in right out of the gate.

Funding sources for sustainability

The importance of funding was raised by six of 14 interviewees, with discussion of financial needs for staffing, mileage, infrastructure (such as a food storage trailer), and sustainability from GusNIP and other sources. While money from the GusNIP grant was necessary for program start up and initial implementation, additional funding was still needed outside of GusNIP funding. For instance, one farmer emphasized that resources other than from GusNIP, such as educational training and equipment (i.e., irrigation equipment), are necessary to support farmers. The GusNIP funding model would not be enough to solely financially support farmers.

Five interviewees mentioned securing funding sources for PPR sustainability, with three underscoring the importance of multiple funding streams to maintaining long-term viability of programming. In addition to using food price mark-ups as a revenue strategy, the Hub was actively seeking grants to build a local and sustainable food system which would in turn support PPR. Although the Hub manager position was only partially factored into the price of PPR produce, one farmer stressed the importance of additional funding to support this role. CPH was hopeful that as the PPR program grows the increased produce sales could eventually cover the entire cost of the Hub manager position. The Hub mentor emphasized the importance for diverse funding streams:

> And we're really encouraging the Hubs to not put all their eggs in one basket and to have

> diversified income streams. So, you know what percentage is ideal for earned income versus contract type work versus, you know, direct granting to the Hubs is something we're still trying to figure out.

The population health manager also said that the clinic was working with leadership to determine the sustainability of PPR after GusNIP funding ends. They plan to explore grants but are mainly considering value-based contracts (an alternative payment model) and securing funding for more staff to grow the program beyond 117 participants.

Processes and Infrastructure

This theme involves processes and infrastructure that were needed to implement PPR. Subthemes include existing processes and new processes.

Existing processes

All four interviewees from the Hub stated that in addition to new processes discussed below, they built the PPR on top of their existing processes and infrastructure. The Hub manager stated, "We're all trying to leverage what already exists, and so hopefully it's not too burdensome. … I think with the Hub's experience, we had a lot of what we needed."

New processes

The Hub interviewees explained that new processes and infrastructure included adding PPR processes to the redemption system such as tracking the amount of produce the clinic needs, what produce farmers have, paying farmers, and opening a separate checking account for revenue tracking. The Hub manager also discussed creating a regional farmer network to procure sufficient produce for the boxes, emphasizing that five to ten small farms and a food hub are needed in rural Minnesota to support the program of 117 participants. Three of seven clinic interviewees and the CPH interviewee also discussed updating the tracking of grant revenue and creating a PPR redemption system at pick-up/delivery.

Both farmers also stated that PPR impacted selling processes. One noted that PPR increased the percentage of their sales to the Hub while requiring different planning for larger produce quantities. The other farmer stated that they are considering installing additional irrigation to address annual drought.

Six of seven clinic interviewees mentioned creating new processes, such as developing the overall program framework, the patient enrollment processes, and produce storage and aggregation infrastructure and processes. Specifically, for the latter the logistics of transportation and space were important new processes to establish, as discussed in the implementation challenges section. Not only did these processes have to be established between the Hub and the clinic, but also between the clinic and a local grocer. During winter, the produce procurement process changed because local farmers were not able to provide enough produce to support PPR boxes due to Minnesota's growing season and farmer storage infrastructure. Thus, during winter months the clinic's population health manager decided to procure additional produce from a local grocer and to reduce the number of boxes from two boxes per month to once a month per participant due to staff and farmer capacity. CPH noted that establishing these new processes were important to successfully implement PPR.

Finally, the new collaboration between the Hub and clinic to implement PPR was crucial. Interviewees stated that although this collaboration was new, they used their existing partnership network to further build those partnerships for PPR, which demonstrates the interplay between new and existing processes.

Staffing and Roles

This theme includes what staff and roles are needed to implement PPR, the coordination of staff, important skills in leadership, and organizational culture.

Recommended roles

Most of the interviewees (11 of 14) mentioned that staffing and role clarification was important to implement PPR. The Hub and clinic interviewees focused on the staffing and roles required in their own organization, while the farmers emphasized the importance of the Hub manager, and CPH provided information on all roles. In total, PPR

implementation involved approximately 13–18 staff members across all partners, with varying levels of time commitment. Table 3 outlines the recommended roles by interviewees for implementing PPR for up to 117 participants.

Coordination of staff

Four of 14 interviewees mentioned the subtheme of coordination of staff, stating that the coordination of roles between staff, interns, and volunteers allowed successful PPR implementation with this number of staff. If the coordination of these roles and responsibilities could not be shared between the 6–7 clinic staff, one interviewee recommended having a full FTE at the clinic solely responsible for PPR implementation. Clinic interviewees highlighted the need for dedicated staff and time to fulfill program responsibilities, emphasizing the value of volunteer support in produce aggregation and delivery. Clearly defined and complementary roles across sectors were reported to enhance coordination and communication, enabling efficient implementation of program responsibilities. Furthermore, coordination between the Hub and clinic was crucial for PPR implementation, many mentioning that the Hub manager and clinic outpatient coordinator played essential roles in managing and aligning efforts within their sectors. The public relations and marketing manager discussed the importance of building strong cross-sector partnerships:

> [We] have worked together for a really long time and it's just those really strong partnerships, not operating [in a] silo, just working together as a county-wide team to make things even better and just having the right leaders in place and the buy-in, having really strong support and buy-in for rich programs such as Food Rx.

Two interviewees mentioned partnership with CPH as key to staffing and roles as well. CPH staff stated that "[P]ublic health is an important stakeholder in that just because they have that in-kind time and capacity that they can help during that first year when you're really trying to figure out the logistics."

Important skills in leadership

All sectors but farmers mentioned this subtheme. CPH stated that the Hub manager and population health manager are central leaders for PPR implementation, noting their collaboration and coordina-

Table 3. Recommended Roles by Interviewees for Implementing PPR

Clinic	Food Hub	Farmers	CPH
• The Population Health Manager is a key role responsible for most administration and coordination. • Implementation required time from 6–7 staff at the clinic for a total of 0.8 FTE, which includes the Population Health Manager, dietitians, outpatient coordinator, and intern. • An intern spent 0.2–0.4 FTE to support the Population Health Manager with administrative tasks, food aggregation, and food box delivery. • Volunteers were impactful and supported aggregation and delivery. • More staff will be needed if the program grows.	• The Hub Manager is critical for coordinating efforts. • The Farmers Market Board supported the Hub Manager, without which they recommended a 0.5 FTE devoted to the program. • More staff will be needed if the program grows.	5–10 produce farms are needed.	CPH dedicated 0.3–0.4 FTE toward the program.

tion were essential. The population health manager also mentioned how support and trust from the clinic's leadership created an environment for effective program management. Five interviewees stated that interpersonal skills like collaboration, relationship building, and active listening are important, while CPH remarked on the value of fostering partnerships without assuming the program had all the answers:

> And then making those connections and the collaborations is a good leadership skill to have; not being like "oh … we can do it all, we know best" kind of thing cuz we don't know best all the time. Sometimes we think this idea will work, but then we're missing that other key part of the process that's gonna make it work successfully.

Communication was mentioned by four interviewees as important, particularly regarding consistency and clarity. Other important skills listed were organization, flexibility, problem solving, setting goals, and using data to make decisions.

Organizational culture

Organizational culture also played a significant role in successful PPR implementation according to nine of 14 interviewees, and with all sectors but farmers mentioning it. Six of the nine said that leadership support was a key component to create a culture conducive to PPR success, consistent with the alignment of PPR with the organization's values of community outreach, collaboration, and addressing food insecurity. Four interviewees stated that organizational support was shown by funding roles and giving staff autonomy to implement the program. An organizational culture that supports collaboration also supports successful PPR implementation; as the public relations and marketing manager stated:

> So, for me just looking back on the success of the program, I'm going to say here's … why we were successful. [The clinic] is very innovative, so is [CPH], very innovative, very visionary also very community minded about health and wellness. And so, the success of the program came from those partnerships, us all dreaming the importance of this obviously having funding to support our mission and vision, and also hiring the right people and getting the right people in place to lead the program.

Outcome of the Implementation Process

This theme describes interviewees' understanding of how their roles and their organizations contributed to the PPR, and how roles and organizations evolved to support implementation. The implementation of PPR did not markedly alter the roles of CPH and clinic staff, as the responsibilities it required were already embedded in their work and were supported by existing organizational structure. For example, CPH indicated that PPR is similar to other projects they have worked on, and their time shifted to work on PPR for 0.3–0.4 FTE. Similarly, both the population health manager and the clinic intern were hired to work on PPR, so their roles incorporated PPR from the start. The dietitians also indicated that their role did not change as their role commonly includes asking food related questions.

Alternatively, Hub interviewees explained how PPR impacted the farmers market and their roles and workload at the Hub. The Hub manager noted that they compiled three times as many produce boxes for PPR compared to retail sales. According to three interviewees, PPR boosted farmers market sales, which could support reinvesting in Hub infrastructure, increasing farmers sales, and attracting more interest and participation in Hub programming. Additionally, the Hub provided farmers with the opportunity to grow produce for a PPR. Due to the Hub's networking and the organizational infrastructure it had built, it could still function without PPR, but it would be less robust. The Hub manager articulated this well:

> So, without the farmers market hub project, there wouldn't be a hub in [the county] … to work with [the clinic] on a Food Rx program. And I really hope that our existence makes the program easier for them overall. … It benefited all of us. I mean the farmers market had more sales and was able to make more of a

> markup that they will then put back into infrastructure. Our farmers made more sales for these boxes because we were there at the right time.

Farmers discussed how PPR brought in more business, and expressed their continued support. One farmer stressed the value of partnerships created through PPR and recommends continued funding for the Hub manager position to support regional economic development:

> So, finding some new partnerships because our partnership with [the clinic] … and with public health has been so good this year. Like, I want to keep doing that, those kinds of partnerships to continue to promote the whole food system.

Discussion

The purpose of this case study was to explore and outline the implementation factors of a rural PPR across healthcare, food system, and public health sectors using the EPIS framework. Through exploring the themes of resources and support, processes and infrastructure, and staffing and roles we identified critical factors that have implications for the future of PPR implementation: the presence of collaboration, funding and implementation sustainability, the unique challenges and opportunities presented by rurality, and the impact on the local economy. In the following discussion, we discuss these factors and situate our findings within the existing literature, indicate new contributions our study contributes, and consider the relevance of these results to the ongoing national conversation about sustainable, community-based nutrition interventions.

Collaboration and partnership were critical to successful implementation of PPR, as this concept was threaded throughout all three themes. The PPR offered a new collaboration that was built on the existing partnerships between public health, the clinic and the Hub. These relationships not only facilitated securing GusNIP funding but also provided a robust foundation for resource sharing and coordinated efforts during implementation. The interviews highlighted the central role of public health in convening across sectors, including for coordinating logistics between partners, supporting collaboration, and initiating partnerships. This aligns with the literature demonstrating that collaborative partnerships are an effective strategy to promote community health and public health's unique capacity to collaborate to implement evidence-based, community-tailored interventions (DeSalvo et al., 2017; Roussos & Fawcett, 2000). Thus, proactive investment in public health infrastructure and programs can better support public health collaboration with communities to promote health.

Interviews across all sectors also revealed that continued funding, staffing, and infrastructure are critical to PPR sustainability. While GusNIP funding is secured for three years, its temporary nature created uncertainty for PPR's future. Lack of funding is a commonly cited barrier to sustaining PPRs, with funding needed to support staffing, program infrastructure, and food, (Houghtaling et al., 2024; Stotz et al., 2022). To address this, the Hub is actively seeking diverse and complimentary funding sources to sustain PPR, while healthcare partners are aligning the program with organizational goals and exploring value-based contracts for long-term viability. This demonstrates both the value and the challenge of embedding PPR in organizational operations in both sectors and underscores the importance of collaboration. Furthermore, investing in the sustainability of PPR not only benefits the program, but also supports the overall capacity of each sector outside of PPR.

Addressing sustainable funding for PPR is closely linked to ensuring adequate staffing capacity and infrastructure, both of which emerged as critical for all sectors to be able to coordinate and implement a sustainable PPR. Interviewees stated that growing the PPR beyond 117 participants would require additional investments in staffing, farms, and infrastructure. Infrastructure was a recurring theme across all sectors, especially in terms of space and transportation to store, move, and aggregate produce. Each sector is considering ways not only to sustain but to strengthen their participation in PPR through updated, new, or creative uses of infrastructure. For example, the Hub is exploring large, refrigerated produce storage for PPR and all

regional farmers, the clinic is looking into more space for produce storage and aggregation, and farmers are pursuing better irrigation systems to combat drought.

Although research has found correlations between local foods and health-related outcomes, evidence about the economic impacts of local food systems is inconclusive (Deller et al., 2017; Enthoven & Van den Broeck, 2021). This PPR study, while primarily health-focused, showed the program's role in fostering economic growth, which in turn supported its sustainability. For instance, the Hub enhanced its capacity to buy and sell produce independently, and one farmer was inspired to consider launching a new business. Interviews demonstrated the program's alignment with values of supporting local farmers, boosting the economy, and reducing hunger, emphasizing the role of passion and shared goals in successful implementation.

Sustainability proved particularly relevant for a rural environment, where weather and climate variability posed barriers to implementation. This mirrors findings from a similar rural PPR study (Budd Nugent et al., 2022), that recommended allocating dedicated resources and funding to weather-related challenges. A notable example of resilience was the clinic partnership with a local grocer during winter shortages, showing the program's adaptability and commitment to keeping money local. These examples illustrate how PPRs can stimulate local economies while addressing health disparities, particularly when economic measures are prioritized.

These results also offer timely and actionable insights for shaping national conversations concerning PPR, particularly in relation to the infrastructure, resources, and staffing needed for successful implementation. For example, national efforts to promote sustainability are driven in part by Medicaid 1115 demonstration waivers which allow states to experiment with nontraditional services and payment approaches aimed at addressing health-related social needs, including nutrition interventions like produce prescriptions (Hanson et al., 2024). As of March 2025, 13 states have approved 1115 waivers that provide food directly (CA, CO, DE, HI, IL, MA, NC, NJ, NM, NY, OR, PA, WA), while three states (DC, NV, RI) are still awaiting approval. Of these 16 states, 11 states (CA, HI, IL, MA, NC, NY, OR, PA, WA, DC) have either proposed or already have included produce prescriptions in their covered services (Centers for Medicare & Medicaid Services, n.d.; Kaiser Family Foundation, 2025). These findings can guide language for inclusion of key supportive services—such as transportation, staffing, and infrastructure—within Medicaid-covered benefits under the 1115 waivers to increase the efficacy of PPR implementation.

This case study also offers new insights into factors for implementation success that are underexplored in the existing literature, as well as supporting previous research in this area. A key new insight is that cross-sector collaboration was critical within this rural context to sustain the PPR program. Consistent with a review of "Food Is Medicine" programs within the healthcare setting using the EPIS framework, we found that clear staffing roles and capacity across all sectors was a critical factor for implementation (Houghtaling et. al., 2024). Stotz et al. (2022) also reported that clinical providers identified key strategies, such as employing full-time PPR staff, allocating a one-year pilot planning period with associated funding, and bundling clinic visits for participants. Similarly, Folta et al. (2023) noted that flexibility in integrating PPR into clinic workflows facilitated implementation. While this study corroborates these findings, it also reveals additional implementation factors as discussed in the results section, further contributing to the understanding of PPR success.

However, as part of a broader effort to address food insecurity and improve public health through dietary changes, PPR is only one of several community nutrition intervention programs. These programs have attracted attention for their potential to achieve positive outcomes; however, there is a distinct lack of research comparing PPR implementation and effectiveness with other community nutrition interventions. Without such comparisons, it is challenging to determine which strategies yield the best results in diverse settings or among different populations. While PPR has shown positive results in various cases, gaining a better understanding of how it operates and performs relative to similar programs could aid in more effective resource

distribution and shape the direction of future interventions.

Strengths

A major strength of this case study is that it captured a holistic view of PPR implementation, learning from all sectors involved in implementing PPR to provide rich qualitative data and a representative sample. Using the EPIS framework, which is designed to understand the adoption and sustainability of evidence-based practices, allowed us to explore and outline the facilitators and challenges of PPR and use those findings for continued program improvement. Additionally, the iterative process of summarizing, coding, and receiving interviewee feedback allowed reviewing and verifying themes and interpretations, thus adding validity and reliability to the findings.

Limitations

Our case study focused on a rural healthcare model that harnessed partnerships with a farmers market food hub and a county public health agency to serve a primarily white, female, and middle-aged population (median age = 57). The setting also presented unique environmental factors, such as climate and snow-related challenges, that may not be encountered in other regions. Despite its strengths, this study's generalizability is limited. It may not apply to PPR models involving grocery stores, urban healthcare systems, diverse climates, or more heterogeneous populations. Furthermore, although standardized procedures and multiple data collectors were employed to minimize bias, the authors' experiences may have influenced study interpretation.

Conclusion

This case study explored and described factors in implementing a rural PPR across all sectors through applying the implementation science EPIS framework. Through applying this framework, we gained valuable insights into the critical organizational characteristics and processes necessary to implement a rural PPR. One of the main factors that emerged is the importance of cross-sector partnerships and collaboration, involving healthcare, the local food system, and public health. The strong relationships and communication between these sectors were a thread found throughout all interviews and were utilized to navigate implementation challenges.

Key implementation challenges included transportation, space, staffing, and environmental concerns like drought. Interviewees emphasized the need for adequate resources and support, including funding, staffing, and physical infrastructure. While existing processes were leveraged, new processes needed to be developed, particularly methods for the program redemption system and enrollment process. The study also underscored the importance of clear role definition and coordination among staff, with recommendations for specific roles across different sectors. Notably, our findings revealed the potential for PPR to strengthen local food systems by creating new market opportunities for small-scale farmers and fostering closer ties between healthcare providers and local farmers.

Our findings also underscore the value of the EPIS framework, and contribute to the literature by providing a multi-sector perspective on PPR implementation, an area less explored compared to clinical outcomes. The EPIS framework can serve as a practical framework for public health or other convening organizations to design and adapt PPRs across sectors in rural areas. Additional research is necessary to identify implementation factors across diverse PPRs to facilitate not only successful implementation but to connect implementation factors with health outcomes and to develop policies and funding models that sustainably support PPR. Future studies should explore how the other constructs and factors of the EPIS framework could be utilized for further exploration of PPR. While this paper focused on the inner context, future research should investigate how external factors in the outer context, such as political climate, climate change, and food prices impact implementation.

Strengthening the connections between local farmers and PPRs supports more resilient local food systems for improved environmental and human health (Rahman et al., 2024). The lessons from this case study will inform future planning, addressing potential barriers and fostering sustainable partnerships within local food systems.

Acknowledgments

We would like to thank Emily Becher of the Minnesota Department of Health for providing supervision, guidance of this evaluation, and feedback on the manuscript. We also extend our gratitude to Patrick Brady of the University of Minnesota for providing expertise on the Template Analysis method used in our data analysis. Finally, we sincerely thank the interviewees for their valuable contributions to this research.

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Appendix

Appendix A. Food Rx Summary Interview Template

Prepared by: _____

Interviewer: _____

Interview date: _____

Interviewee name: _____

Themes	Subthemes	Summary and Important Quotations	Memos
Introduction Questions			
Interviewee role and responsibilities			
Length in current position			
Previous experience			
How Food Rx works			
Interest in volunteering for Food Rx			
Motivation to participate in project			
Organizational Characteristics			
	Resources and support (including process for obtaining)		
	New processes and/or infrastructure		
	Sourcing food for Food Rx in winter		
	Staffing and roles		
	Implementation training		
	Redemption system and revenue tracking		
	Funding sources to sustain Food Rx		
	Project impact on work		
	Feedback on resources and support		
	Optional: Project time estimation process		
	Storage space determination		
	Other		

continued

Themes	Subthemes	Summary and Important Quotations	Memos
Leadership			
	Important skills and duties in your role		
	Competing priorities in decision making		
	Impact of organizational culture on implementation		
	Other		
Quality and Fidelity Monitoring/Support			
	Implementation challenges		
	Decision making		
	Participant feedback		
	Lessons learned		
	Other		
Outcome of Implementation Process			
Other/Anything Else Want to Share			

Appendix B. Food Rx Template Analysis Codebook

Codebook: this was created to define themes and subthemes, their theorical background, and what information we want to capture.

Memos: in each template summary there is a column for memos (not seen in this table). Memos are a place for insights, your interpretation of what the person is saying, and elaborating what you're seeing in that theme and finding. A memo may be simple and descriptive or deeper than that.

Note on terms:
Food Prescription = Food Rx

Theme	Subtheme	Description/Definition/Examples
Introduction Questions		These are questions to introduce the interviewee, their background in this type of work, how they would describe Food Rx, and their motivation to participant in the project. This will not be used for theming, but to understand where each interviewee is coming from, if there are differences/ similarities in answers, and if any of this information sheds light on those differences/similarities.
Interviewee Role and Responsibilities		This identifies the interviewee's role within Food Rx and their responsibilities associated with that role.
Length in current position		How long the interviewee has been in their current position.
Previous experience		Outlines what experience(s) the interviewee has had working on similar projects.
How Food Rx works		Explains how the GusNIP-funded Food Rx program works from the perspective of the interviewee.
Motivation/Interest to participate in project		This informs why the interviewee was/is interested in or motivated to participate in the Food Rx project.
Organizational Characteristics		From the Inner Context of the EPIS framework, this theme outlines structures or processes that take place and/or exist in organizations that may influence the process of implementation.
	Resources and support	Identifies the resources and supports needed to implement the Food Rx program and the processes for obtaining them.
	New processes and/or infrastructure	Outlines new processes and infrastructure that was needed to implement the Food Rx program and how they were created.
	Sourcing food for Food Rx in winter	This explains how and where food was sourced for Food Rx in the winter. It also explains, if applicable, how it was determined that, during the winter, the Food Hub couldn't support the Food Rx program and that food would be purchased from a local grocery store.
	Staffing and roles	Explains how many staff and what roles are needed (and why) to plan, design, and implement the Food Rx program.
	Implementation training	Explains how staff were trained on implementing the Food Rx program and adjustments to training and resources interviewees recommend.
	Redemption system and revenue tracking	Outlines how the redemption system was set up and the processes for revenue tracking for the GusNIP-funded Food Rx program.

continued

Theme	Subtheme	Description/Definition/Examples
	Funding sources to sustain Food Rx	Identifies what funding sources are being investigated to sustain the Food Rx program.
	Project impact on work	Informs how the Food Rx program impacted the interviewees' work. Specific areas include how the program impacted produce aggregation, growing produce, farming practices, and how much additional work time the program added to the interviewees' workload (if at all). Sometimes interviewees answer this in the "Quality and Fidelity" section as well.
	Feedback on resources and support	Identifies adjustments or modifications the interviewee would make to the resources and support they received.
	Optional: Project time estimation process	Identifies how the interviewee determined how much time it was needed for the project and if they feel that amount of time is still accurate.
	Optional: Storage space determination	Informs how the interviewee determined how much storage space was needed to store produce boxes.
	Other	Any other organizational characteristics that don't fall under the above subthemes and provide information about structures or processes that take place and/or exist in organizations that may influence the process of implementation.
Leadership		From the Inner Context of the EPIS framework, this theme outlines characteristics and behaviors of individuals involved in oversight and/or decision-making related to Food Rx program implementation within that organization.
	Important skills and duties in your role	Identifies important skills and duties of the interviewee's role that facilitate the implementation of the Food Rx program.
	Competing priorities in decision making	Outlines what competing priorities (if any) impacted how the interviewee made decisions for implementing the Food Rx program.
	Impact of organizational culture on implementation	Outlines how the organizational culture supported and/or hindered the design and implementation of the Food Rx program.
	Other	Any other characteristics and behaviors of individuals involved in oversight and/or decision-making related to Food Rx program implementation within that organization that don't fall into the above subthemes.
Quality and Fidelity Monitoring/Support		From the Inner Context of the EPIS framework, this theme outlines processes or procedures undertaken to ensure adherence to active delivery of the Food Prescription program and/or an implementation strategy.
	Implementation challenges	Explains any implementation challenges, how those challenges were worked through, and any remaining challenges. Interviewees may discuss this in the "Resources and Support" section(s). Also, there are similarities between implementation challenges and lessons learned, align responses with the subtheme as best you can and know duplicates are okay.

continued

Theme	Subtheme	Description/Definition/Examples
	Decision making	Explains what information or feedback was used to make decisions about the implementation of the Food Rx program, examples of informed decision-making, and any helpful information and feedback that is missing for informed decision making.
	Participant feedback	Describes participant feedback about the Food Rx program and how that feedback impacted the implementation of the program.
	Lessons learned	Identifies lessons interviewees have learned since the start of the Food Rx program that they have or plan to apply for future implementation. It also identifies how the interviewee's idea of how to implement Food Rx has changed along the way and if so, how. There are similarities between implementation challenges and lessons learned, align responses with the subtheme as best you can and know duplicates are okay.
	Other	Any other processes or procedures undertaken to ensure adherence to active delivery of the Food Prescription program and/or an implementation strategy that are not captured in the subtheme above.
Outcome of Implementation Process		This theme informs how the interviewee feels their role and organization contributed to the implementation of the Food Rx program and how their role and organization changed to support the program.
Other/Anything else want to share		Any other information that relates to the implementation of the Food Rx program that wasn't captured in the themes and subthemes above that helps describe how the Food Rx program was implemented.