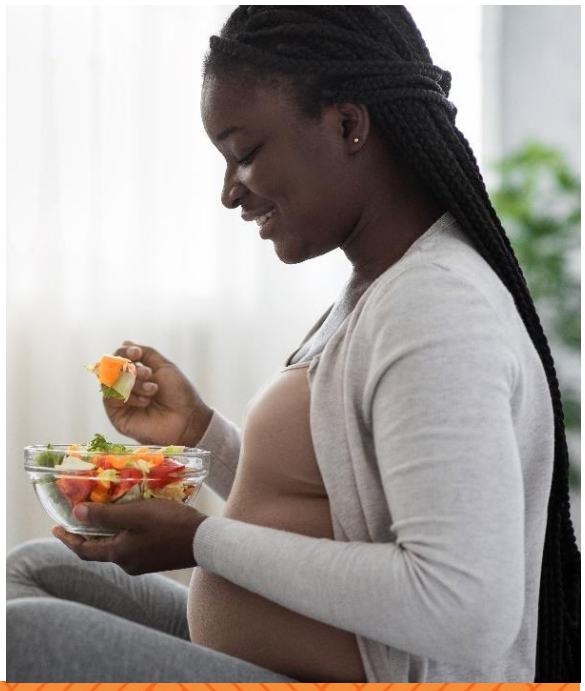
Healthy Pregnancy Home-Delivered Meals Pilot Program

2024 Evaluation Report

Authors:
Jenna Tomlinson, Wilder Research; Barite Dawud, Wilder Research; Anna Granias, Wilder Research; Christine Melko, Hennepin Healthcare; Jennette Turner, Hennepin Healthcare



MAY 2024

451 Lexington Parkway North | Saint Paul, Minnesota 55104
651-280-2700 | www.wilderresearch.org

Wilder Research®
Information. Insight. Impact.

Summary

The pilot program

The Healthy Pregnancy Home-Delivered Meals program was a pilot program offering nutritious meals delivered to the homes of patients with low incomes and who were experiencing high-risk pregnancies. This pilot was designed to address barriers to a healthy pregnancy and postpartum period for people with nutritional risk factors by providing services and resources that have the potential to reduce food insecurity, improve nutrition status, increase nutrition education knowledge, and reduce stress.

A cohort of 62 participants were enrolled in the program out of 92 patients referred. The evaluation of the program describes those who participated, and successes and learnings from this first round of implementation.

Key learnings

Twenty-one of the 62 participants completed the program through postpartum. For these women:

- Having healthy foods selected, prepared, and delivered at no cost were the main drivers of satisfaction.
- Food support during pregnancy resulted in perceived reductions in stress and better overall health.

Forty-one of the 62 participants dropped out of programming. For these women:

- The meals were not representative of participants' cultural and flavor preferences.
- Participants reported the logistics of food deliveries and storage were the greatest barrier to program completion.

Recommendations for future iterations

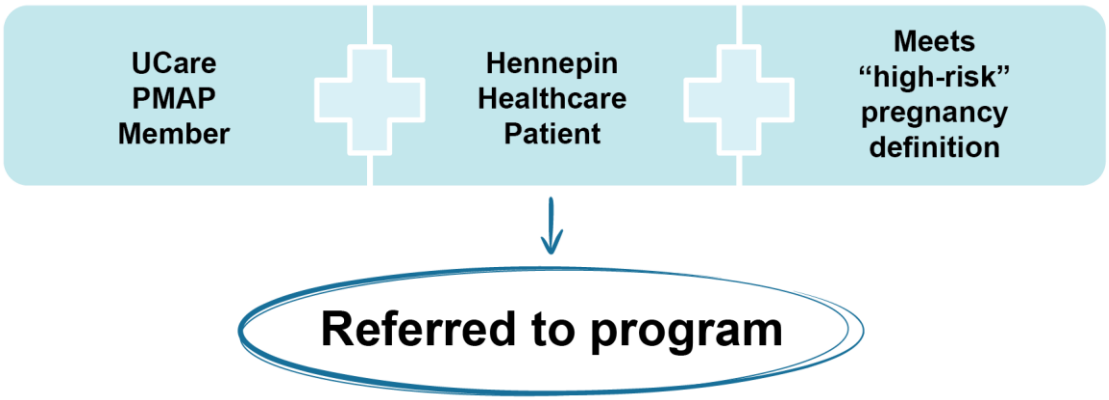
- Design a model that takes into account the learnings from this program, including:
  - Offering more choices, including culturally-relevant food
  - Providing flexible delivery schedules (time and day, frequency)
  - Connection to support and resources to address ongoing patient needs related to social determinants of health

Contents

Figures

Introduction

In 2023, Hennepin Healthcare, Open Arms of Minnesota (referred to as "Open Arms" throughout remainder of the report) and UCare partnered to create Healthy Pregnancy Home-Delivered Meals, a pilot program for patients experiencing high-risk pregnancies who were also enrolled in Medical Assistance through UCare's PMAP (prepaid medical assistance program). The goal of the program was to support the nutrition of patients who were pregnant and their babies, as there is a great deal of research that supports the connection between a healthy diet and healthy birth outcomes.



About the pilot

Meal deliveries commenced in August 2022 for the first members of the program cohort. Meal deliveries ended in early January 2024. Patients were referred to the program through Hennepin Healthcare and were identified through a variety of methods, including direct referrals during prenatal appointments, and indirect referrals through telephonic outreach using an eligibility file. The target population for the program met the following criteria at intake, or at the time of program referral:

- 8 weeks or later in pregnancy
- were receiving pregnancy-related healthcare in the Hennepin Healthcare system
- were considered low income based upon their enrollment in Medical Assistance
- were a UCare PMAP member during their pregnancy
- were considered "high-risk" by a set of clinical and social criteria agreed upon by Hennepin Healthcare obstetrics/gynecology providers
- had access to a fridge or freezer and microwave (microwaves were provided if a patient did not have one)

The program included:

- Free, healthy meals delivered to the participants once per week. Each delivery contained 14 meals (two for each day of the week) for the participant and their family. Participants and their dependents (including partners and caregivers at home) were eligible to receive meals from 8 weeks of pregnancy through approximately 8 weeks postpartum.
- Connection to other social determinants of health (SDOH) resources through a Community Health Worker.
- Nutrition education and counseling as an optional service.

Offering meals to dependents served as a measure to mitigate not only food insecurity and improve nutrition status for patients and their families, but also to reduce stress and burden for patients who are pregnant in preparing food for their households.

Patients in the program cohort were largely young, socially mobile, and typically not homebound. Participants were able to reschedule, skip deliveries, or pick up their meals in order to accommodate varied logistical needs and reduce burden on the patients. Nineteen participants' meal deliveries were paused indefinitely due to participant request or missed deliveries. This constituted a "long hold." Four participants began receiving meals again after a long hold.

Participants were offered a variety of menus from which to choose. Most women received the standard heart healthy menu, which was low in salt and saturated fats. Participants were also offered a nausea care pack, if needed. Nausea packs contained items such as applesauce, crackers, ginger chews, and tea.

See Appendix for more information about meal programming and nutrition support services.

Methods

Several sources of information were used to evaluate program successes and areas for improvement, including both qualitative and quantitative data collected from participants and administrative and healthcare data.

Participant feedback

Surveys

Both program participants who paused or ended their meal deliveries and who completed the program were invited via phone or email to complete a survey to learn about their experience with the program. Participants received a $20 gift card as a thank you. A survey was completed by 12 participants who completed the program and 18 participants who ended their participation early. The total survey completion rate for the cohort was 50%.

Interviews

Further opportunity for feedback was provided for those who fully completed the program through their date of delivery or beyond. Wilder invited these participants to complete a 30-40 minute phone interview to learn more about their experiences with the program, what they liked and didn't like, the impact it had on them and their families, and how they thought the program could be improved in the future. Participants received a $50 gift card as a thank you. Of 21 participants who completed the program, 17 completed an interview for a response rate of 77%.

Programmatic and healthcare data

Hennepin Healthcare, UCare, and Open Arms provided data from various sources to describe the participant cohort and their pregnancy experiences and birth outcomes. Sources included Hennepin Healthcare Electronic Medical Records (Epic), UCare claims and case management data, and Open Arms program records.

Limitations

Based on the program design and the number of participants, using a comparison group to assess clinical outcomes as a result of participation in the pilot was not possible. Future programming that supports a quasi-experimental study design with the use of a comparison group would be a meaningful contribution to current research literature on the outcomes of meal-delivery programs for people with high-risk pregnancies or social vulnerabilities.

While there was a good response to the survey (50%) and interviews (77%), the findings may not be representative of all cohort members.

Program theory and supporting evidence

Strategies to identify and address social needs related to social determinants of health are increasingly being integrated into healthcare (Kreuter et al., 2021). Food insecurity is one of the most common social determinants of health identified through screening in healthcare settings (Kreuter et al., 2021). One of the ways healthcare systems are addressing food insecurity in their patient population is through Food is Medicine (FIM) programs. FIM programs are interventions focused on addressing chronic diseases through the provision of nutrition and diet-related resources (U.S. Department of Health and Human Services, 2024).

Pregnancy and the early postpartum period are a time of increased nutritional demand on the body. These are also times when vulnerability to certain nutrition-linked conditions is increased. Several maternal risk factors for poor outcomes during pregnancy, such as gestational diabetes and pre-eclampsia, are associated with dietary patterns (Raghavan et al., 2019a). Limited evidence points to the possible benefits of healthy maternal dietary patterns extending to the fetus; however, more research is needed in this area (Raghavan et al., 2019b). Yet, consequences of food insecurity and its dietary implications can contribute to negative health outcomes for women who are pregnant and their babies (Sosnowski et al., 2023). Therefore, it is critical that women who are pregnant are screened for food insecurity and connected to appropriate resources and programs to address their needs.

Some populations are at greater risk for adverse outcomes in pregnancy and birth than others. Notable disparities exist in maternal health and birth outcomes for people who are Black, Indigenous, and people of color (BIPOC), particularly for African Americans who also experience food insecurity at a disproportionate rate compared to the general population (Gillespie & Privitera, n.d.).

FIM interventions use strategies such as produce prescriptions or medically tailored meals to address individual social needs, reducing or removing many logistical and financial barriers to accessing healthy foods (Downer et al., 2022). While there is a significant body of research supporting interventions that address food insecurity, research examining the efficacy of healthcare-based interventions targeted at food insecurity during pregnancy is limited. A few studies suggest such interventions may affect pregnancy and birth outcomes and medical costs (Blue Cross and Blue Shield of Minnesota and Blue Plus/NourishedRx, 2023). “Existing peer-reviewed studies show the overarching efficacy of food is medicine interventions for individuals with diet-related disease. These studies are a promising indicator of potential impact for individuals with high-risk pregnancies” (Leon, 2021, p. 3).

Although this pilot does not fit the definition of an FIM intervention (i.e., does not address chronic disease), it has similar components and intent: to address barriers to a healthy

pregnancy and postpartum period for people with nutritional risk factors by providing services and resources that have the potential to reduce food insecurity, increase knowledge about nutrition education, and reduce stress. Collaboration and partnerships across government, non-government, and private sector entities such as this one will be essential to the development of effective programs that address the unique needs of communities (Gillespie & Privitera, n.d.).

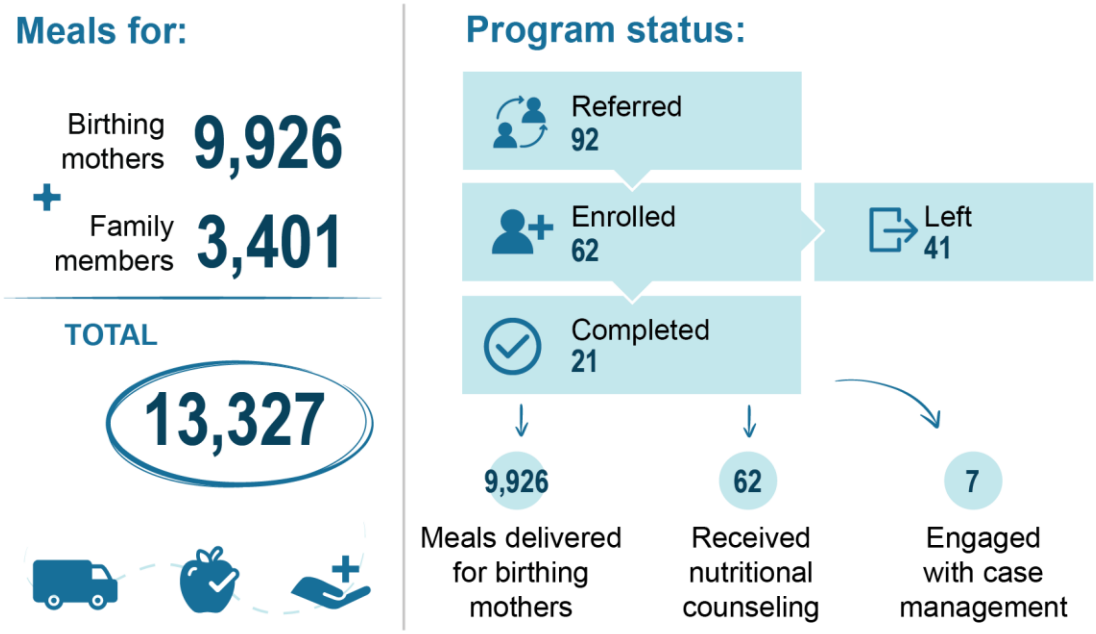
Program participants and engagement

The 62 participants who were enrolled in the program regardless of program completion are described here. These participants are referred to as the "cohort" throughout this section. For more detailed information about both enrolled patients and all patients referred to the program, see the Appendix.

Program participation

Among the 92 patients referred to the program, 62 enrolled in the program as cohort members. Of the cohort, 21 members completed the program through their delivery date or beyond (up to approximately 8 weeks postpartum) and 41 indefinitely paused or canceled their meal deliveries.

1. Program participation



Note: Although the program delivered meals up to eight weeks postpartum, program completers are defined as participants who received meals through their actual date of delivery. Three patients who were referred to the program later became ineligible due to a change in their pregnancy status. These patients were not included in the 92 total referred.

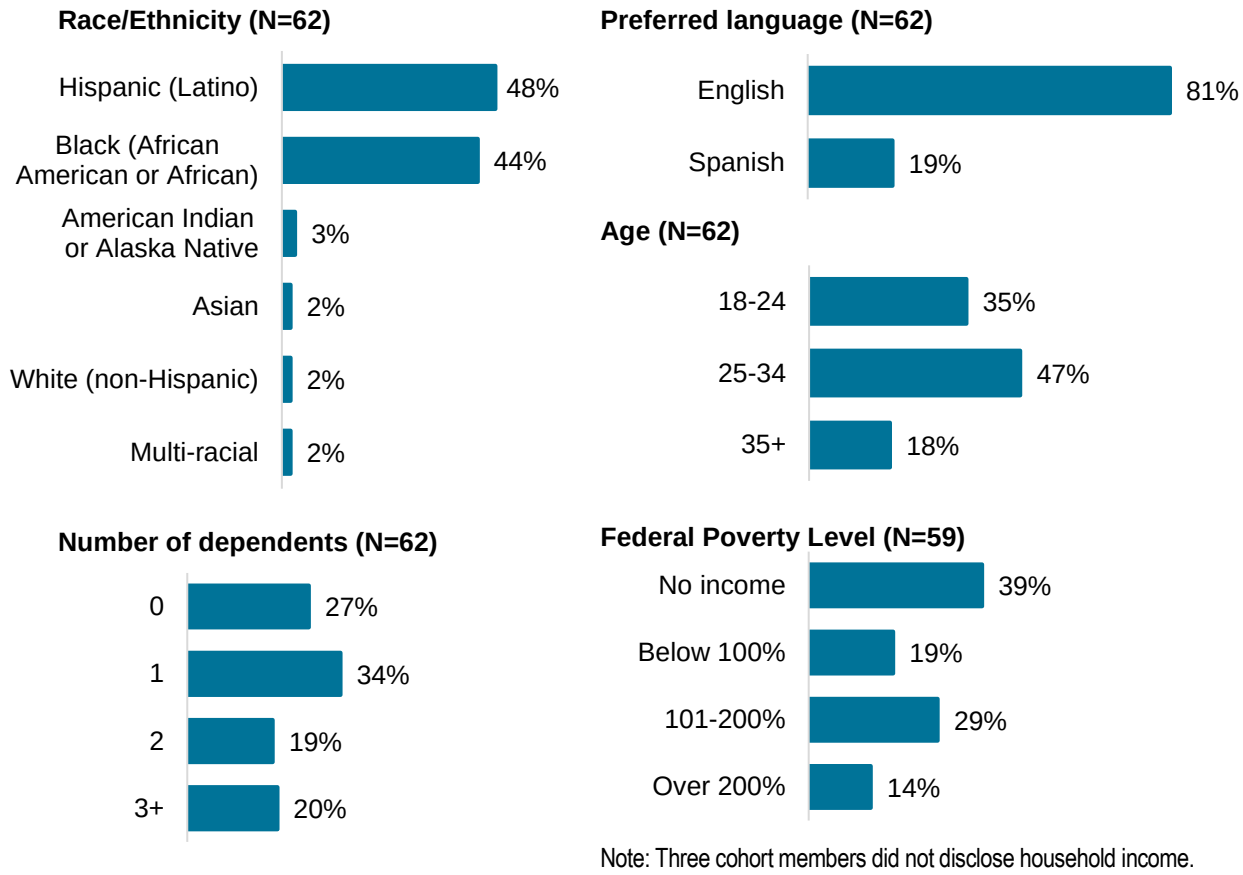
Open Arms provided flexibility in the amount of food provided and participants could modify their delivery schedule from weekly deliveries to bi-weekly, or receive 7 meals each week instead of 14. Six participants who completed the program reduced the frequency of meal deliveries from weekly to bi-weekly, or decreased the number of people receiving meals in their household. Of the participants who switched to a bi-weekly delivery schedule, none cancelled nor paused their programming.

Descriptive data from Hennepin Healthcare EHR

Key demographics

The majority of cohort members identified as Hispanic (Latino) or Black (African American or African), a population at higher risk for adverse birth outcomes (Njoku et al., 2023). Research has also linked poverty to higher risks of adverse birth outcomes (Bumenshine et al., 2010). Over one-half of cohort members reported a household income below the Federal Poverty Level (FPL) or no income at all, and the majority (86%) reported an income below 200% of the FPL. Nineteen percent preferred to speak Spanish. All cohort members were 18 years or older, with the largest share aged 25-34. Most members (73%) had at least one dependent (Figure 2).

2. Demographics of cohort members

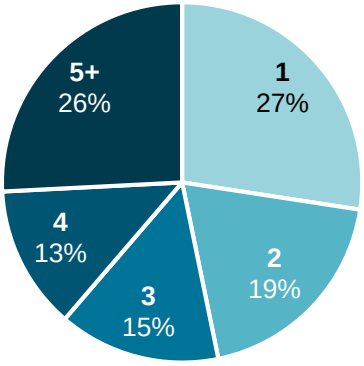


Note: Three cohort members did not disclose household income.

Birth risks

Patients were eligible for the Healthy Pregnancy Home-Delivered Meals program based on pre-existing medical conditions, risk factors that arose during pregnancy, and/or a history of gestational risk factors that put them and/or their baby at risk for poor birth outcomes. Nearly three in four cohort members had more than one medical condition or risk factor coming into the program (Figure 3). One in four had five or more medical conditions or risk factors.

3. Percentage with one or more medical conditions or nutritional risk factors (N=62)



Note: Birth risks documented included medical conditions or presenting at the time of program enrollment with prediabetes, type 2 diabetes mellitus, hypertension, gestational diabetes mellitus, BMI <18.5 or >30 (pre-pregnancy), anemia, high blood pressure, advanced maternal age, gestational hypertension, and/or a gestational history of high blood pressure, preeclampsia, premature birth, gestational diabetes mellitus, or low birth weight. Four of the individuals with one risk factor were referred to the program for other concerns such as "lack of weight gain in the past X weeks" or a family history of a medical condition.

The largest share of cohort members presented with the following birth risks at intake: preeclampsia (53%), a pre-pregnancy BMI of less than 18.5 or greater than 30 (52%), and gestational diabetes mellitus (48%). See the Appendix for more detailed information about the types of risk factors among cohort members.

Key findings

[The meal delivery] lightened my stress/worry. With the healthier option it was easier for me to eat [and] that helped with recovery. It gave me more time with my baby because I didn't have to go to the store. It was easier to heat and eat while giving her a bottle. It definitely cut time down. – Program participant

- Overall satisfaction with the program and the food was high among participants, with high value placed on the convenience and nutritious nature of the food. Almost all survey respondents were "satisfied" (52%) or "very satisfied" (45%).
- Ninety percent of respondents would recommend the program to another person who is pregnant, with a further 10% saying they would "maybe" recommend it.
- While some participants lacked enthusiasm for the type of food provided, the logistics of food deliveries and storage were reported as the greatest barrier to program completion.
- Many participants found that the program and meals helped them feel healthier and increased their self-perceived level of health. Twenty-nine percent said the program improved their health "a lot" and 45% said it improved their health "a little."
- Most respondents (84%) agreed they felt less stress and 74% spent less money on food because of their participation in the program.
- The evaluation findings revealed several areas for consideration to improve programming for more robust program participation in the future.

For the report sections of program satisfaction, program challenges, and program impact, the data reported include survey data both from those respondents who completed the program (N=16) and those who did not (N=15), unless a specific group is noted. The group that did not complete the program comprises both those who canceled and went on a long hold. All interview respondents completed the program (N=17). Program completion is defined as participants who completed the program through their actual date of delivery, regardless of whether they received meals post-partum.

Program satisfaction

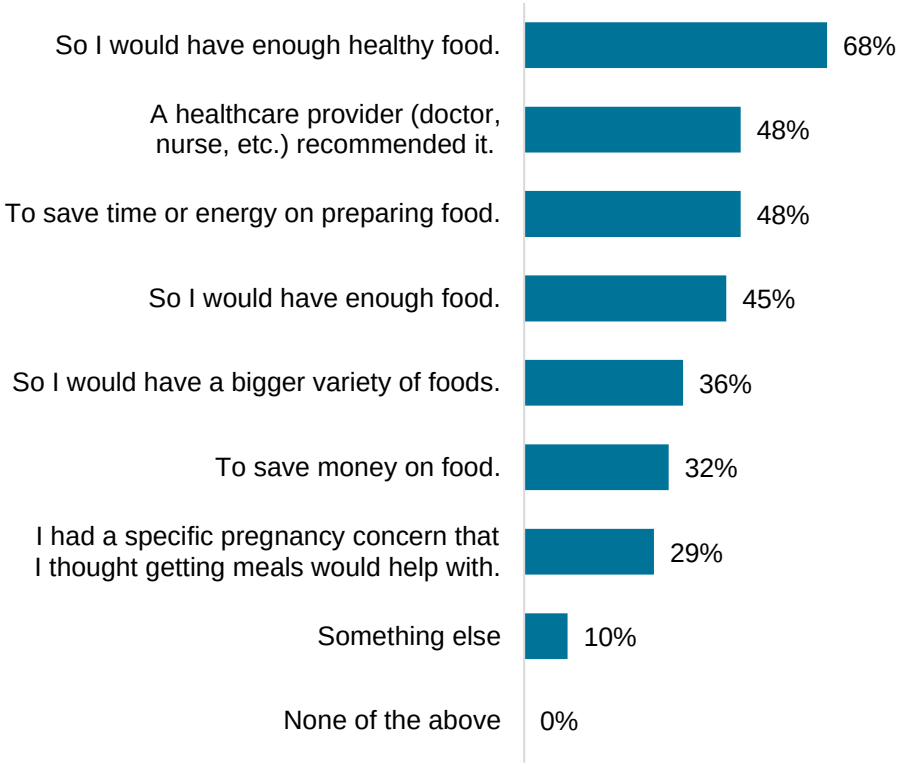
A desire for healthy food and convenience motivated patients to participate

Participants chose to enroll in the Healthy Pregnancy Home-Delivered Meals program for a variety of reasons. Some reasons were related to food insecurity—particularly the desire to access more healthful options, general ease of financial strain, and reducing stress. The three most common reasons reported were to ensure that they had enough *healthy* food (68%) as well as to save time and energy on food preparation (48%) and because a healthcare provider recommended it to them (48%).

Among those who completed the program and participated in a phone interview, similar themes emerged as reasons to participate and best aspects of the program. Access to healthier food and convenience were the most cited areas. Almost one-third of these participants said that the meals had potential to improve their health during pregnancy.

> I sometimes had lots of nausea so I knew something was wrong so I accepted this help in a heartbeat. I was not eating due to the anemia and other things that I later found out I had during my pregnancy. … I was able to gain my strength and eat properly and healthy. I got better again. - *Interview respondent*

4. Reasons for participating in the program (N=31)



Note: Respondents were able to select multiple responses.

In addition to the question in Figure 4, survey respondents were asked which of the reasons they had selected was their *main* reason for joining the program. The top reasons mirrored those in the original question; having enough healthy food (35%) and to save time or energy on preparing food (25%).

Most survey respondents found signing up for the program "easy" (55%) or "very easy" (39%).

Despite a large percentage of participants leaving the program before completion, the vast majority of survey respondents (90%) stated that they would recommend the program to someone else who is pregnant. Among those survey respondents who indicated that they ate half of the meals or less, many still saw value in the program with 42% reporting they would recommend the program to others. This sentiment was echoed among interview respondents.

> I would let [other people who are pregnant] know how great this program is and that it helped me get rid of my [condition] and back to normal. Also, that the meals were tasty and delicious. Very good program.
> *- Interview respondent*

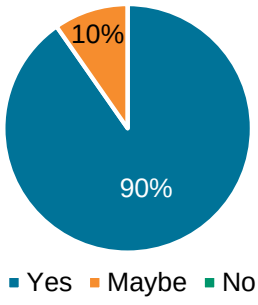
> I would say take a shot at it because [of what] it would help them health wise and with everything and will give them more energy.
> *- Interview respondent*

Across survey respondents, 87% said that they would use the program again for future pregnancies if offered. Nearly all (94%) of completers said they would use the program again compared to 80% of non-completers, suggesting that the program still had perceived value among those who dis-enrolled (Figure 5).

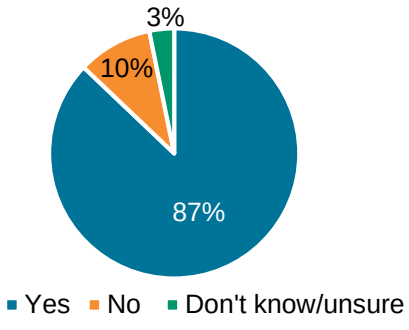
> A lot of why I didn't eat [the meals] was because I'm a picky eater. I feel like I should have gave it more effort. I'm glad it was available.
> *- Survey respondent*

5. Would recommend the program to others and would use the program in the future (N=31)

Would you recommend the Healthy Pregnancy Home-Delivered Meal Program to someone else who is pregnant?



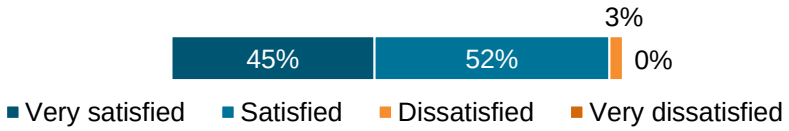
Would you use the Healthy Pregnancy Home-Delivered Meal Program again for future pregnancies if it was offered?



Satisfaction with the program was almost universal

Overall program satisfaction was high among survey respondents whether they completed the program or not, with 97% reporting "very satisfied" or "satisfied" (Figure 6).

6. Program satisfaction (N=31)



Interview respondents mentioned a high level of satisfaction with communication from Open Arms staff regarding deliveries. They expressed appreciation for their flexibility to accommodate taste preferences and changing schedules for deliveries. Many respondents also cited the helpfulness of case management through UCare in participating in this program and connecting them to other resources relevant to pregnancy and having a newborn.

> Their communication was very good. They would send emails and phone calls. It was effective and good.
> *- Interview respondent*

Participants enjoyed the convenience and quality of the meals

The convenience of the meals was the most appreciated aspect of the program among interview respondents. Participants valued how quick and easy the meals were to prepare, which benefited the participants and their family members.

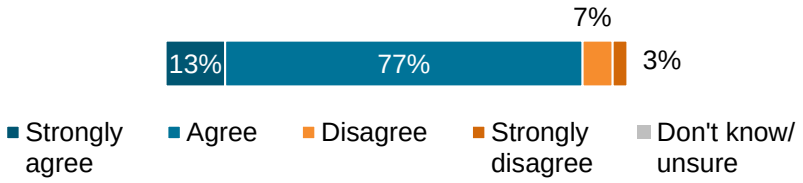
> It … cut down time on going out for the groceries. It helped my husband too. … When he was doing his one he would pop mine and his in there, and then done. So, that's what I really liked, that it was all there for you, and you just had to put it in my microwave, or just grab a spoon and eat.
> *- Interview respondent*

Many interviewees praised the diverse, healthy meals, noting the variety of vegetables, fruits, grains, and meal types, including vegetarian and meat dishes. Several participants appreciated the well-balanced portions and freshness of the seemingly homemade meals, with some expressing gratitude for accommodating dietary preferences and special requests.

> Because of my morning sickness, they catered to my needs with a morning sickness package (came with ginger, crackers, tea, etc.) and that helped for the most part. Sometimes my morning sickness lasted longer, so it really helped with those days.
> *- Interview respondent*

In line with many participants saying they wanted enough healthy food, the majority of respondents agreed that getting these meals delivered to their home gave them more variety in the food they ate (Figure 7).

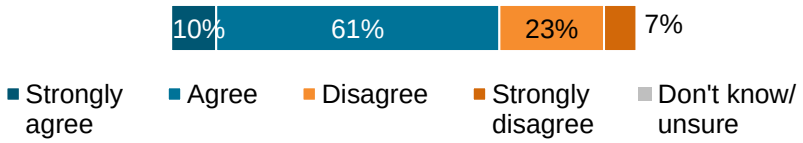
7. Getting meals delivered to your home gave you more variety in the food you ate (N=31)



Satisfaction with the food varied

Survey respondents had mixed opinions about the desirability of the food, highlighting an area for potential improvement (Figure 8).

8. The meals delivered to your home included foods you wanted to eat (N=31)



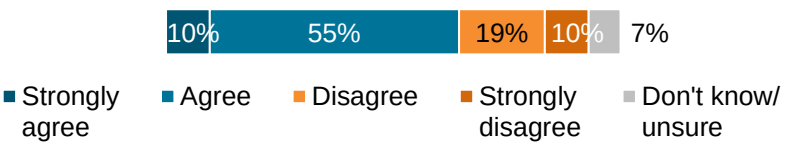
The percentage of delivered meals eaten in a typical week varied widely among cohort members who completed a survey (Figure 9).

9. Percentage of meals that participants ate in a typical week (N=31)

	Number	Percent
100% of the meals	7	23%
About 75% of the meals	10	32%
About 50% of the meals	8	26%
About 25% of the meals	4	13%
None of the meals	2	7%

Participants were candid about the food's ability to satisfy their individual cultural preferences; 29% reported that the food did not fit with their cultural preferences (Figure 10).

10. The meals delivered to your home fit with your cultural preferences (N=31)



When participants were asked what changes they would recommend to make the program better for other patients who are pregnant, a few meal recipients suggested a better variety of foods provided in the meals (e.g., more diversity and less of the foods they dislike). Expanding the variety of foods could alleviate the monotony and repetition of foods that some participants expressed dissatisfaction with.

Program challenges

The amount of food and lack of storage space were the greatest challenges for participants

Participants expressed various challenges that they encountered with the program. Satisfaction with the food itself was moderately high. However, logistics issues proved to be a significant challenge for many respondents—in particular, freezer space.

> I think my main concern is just space. If there's a way to let the food be in the refrigerator for the week instead of just the freezer or the size of it, because some moms just pump and they'll use the freezer to store their milk. So that's also something practical moms that are postpartum might go through. *- Interview respondent*

When it came to the food itself, some interview respondents highlighted the lack of variety with the dishes provided. They felt that some meals were repetitive. In addition, some participants discussed the blandness of the food and their desire for more flavor or spices to be added. Some participants desired meals that align with their cultural preferences (e.g., more Hispanic meals).

> Well it was mostly because for me the food was a bit bland. I would still eat it, but it wasn't what I'm used to. - Interview respondent
>
> The meals were good but I would have preferred more diversity. I come from a Hispanic background. ... I would have liked some different backgrounded food. What they served was good, but more variety would also have been good. *- Interview respondent*

Survey respondents who did not complete the program stated similar challenges as their reason for canceling or requesting a long hold on their meals. According to administrative data from Open Arms, those who canceled or requested a long hold did so because they did not like the food, had too much food or no longer needed food, delivery was inconvenient or they had a series of missed deliveries, or they had an address change.

The most common reason (cited by 4 people out of 12) for choosing not to continue the program was that they were receiving too much food. When asked the main reason among all the reasons selected, 2 people out of 6 reported they did not have the space or equipment, such as a freezer, to store the food.

Some participants suggested incorporating a system that allows individuals to choose their own meals. This change would allow them to choose the content and quantity of their meals.

Survey respondents had the following suggestions:

- I would love if they have more fresh fruit options.
- I'm used to foods with more flavor/seasonings.
- Ask how many meals they need before doing another order.
- I didn't eat a lot of the food that was sent. A lot of it was stuff/ingredients I've never heard of. I tried it, I just didn't like it. I tried things I was familiar with. I did like the tuna and other foods I had tried before.
- I'm a very on-the-go person so I always missed the deliveries. If something comes up, then I'm no longer available on the days I said I was for delivery.
- More variety of food and no quinoa.

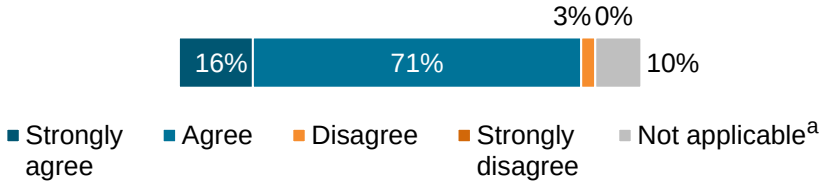
Program impact

Addressing hunger risk and nutritional needs

The program addressed food needs in two ways: it improved food access in general to those at risk of not having enough to eat, and it improved the nutritional quality of food available to participants. Many participants saw value in both having enough to eat as well as eating more healthfully.

A large majority of survey respondents "agreed" (71%) or "strongly agreed" (16%) that that the nutrition information they received from Open Arms staff helped them understand the importance of nutrition during pregnancy (Figure 11).

11. Nutrition information from Open Arms helped me understand the importance of nutrition in pregnancy (N=31)

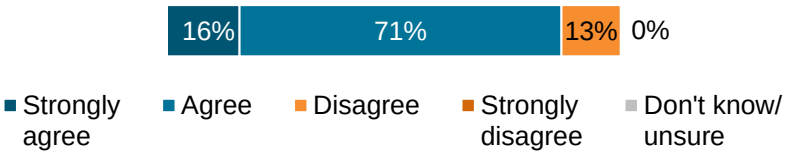


[a] Participant did not receive nutrition information from Open Arms staff

A large majority of participants surveyed agreed that getting meals delivered to their home ensured that they had enough food to eat (Figure 12).

> It was great. It helped us a lot. My kids actually enjoyed a lot of the meals that came in there. They were excited to see them come. Yes – I started gaining the weight that I wanted to see. My kids were healthier and happier with these options as well. I'll miss the instant satisfaction you get when you have food ready in the house. I love to cook, but having that extra option – I don't have to cook in this very second – it's kind of good.
> *- Interview respondent*

12. Getting meals delivered to your home ensured you had enough food to eat (N=31)



Meal recipients expressed how the meals allowed them and their family to eat healthier during and after their pregnancy. These meals helped them feel healthier and, in some cases, achieve specific health goals (e.g., weight maintenance or reducing anemia). Participants were able to mimic these meals on their own to continue to eat more healthfully after their time in the program ended.

Participants described how the convenience of the meals benefited their lives by allowing them to have quick, easy, and pre-portioned and packaged meals readily available. This allowed them to dedicate their time to their families and other needs.

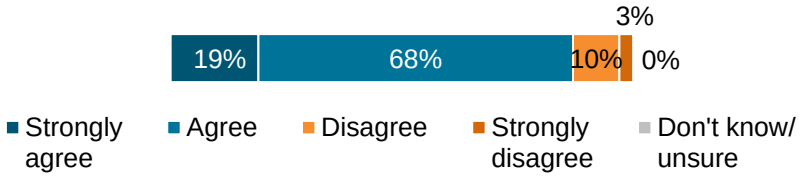
> We had healthier options, the convenience of heating something up instead of having to figure out what to eat. Not having to figure out what to eat. That was a huge help for me. [With the type of pregnancy issues I had], not having to figure out what to eat made it so much easier. [I] didn't have to grocery shop, make lists. [It] was so convenient.
> - *Interview respondent*

Increasing access to healthful food

Cohort members placed value on the health aspect of the meals. This is illustrated both in the reasons participants chose to enroll in the program and in their perceived health improvement from their participation in the program. Over two-thirds (68%) of survey respondents "agreed" that getting meals delivered to their home helped them eat healthier foods and 19% "strongly agreed" (Figure 13).

> I'd say it was helpful because we had different things to eat and healthier options. I miss having the meals delivered – if I don't want to cook having something there was nice. - *Interview respondent*
>
> I was eating healthier food because it was good because of the [condition] I had. It helped my health.
> - *Interview respondent*

13. Getting meals delivered to your home helped you eat healthier foods (N=31)



Improving overall health

Participation in the program had a positive impact on most participants' self-perception of health. The majority of survey respondents and many interview respondents shared that the program had a positive impact on their overall health (Figure 14).

14. To what extent did the Healthy Pregnancy Home-Delivered Meal program impact your health overall? Would you say it… (N=31)

	Number	Percent
Improved your health a lot	9	29%
Improved your health a little	14	45%
No impact on your health	4	13%
Worsened your health	0	0%
Unsure/Don't know	4	13%

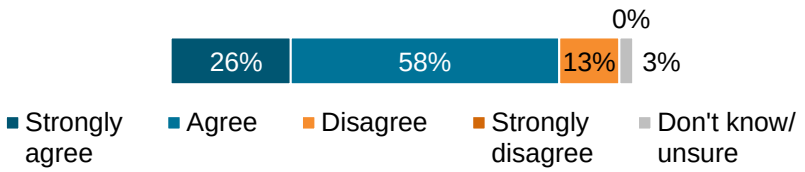
Participants also mentioned how it helped their physical health by reducing their sugar levels, assisting with morning sickness, and had them feeling generally healthier. Interview participants also described how the program benefited their family's diets.

> It was keeping my sugar levels good and everything was so healthy. It made me feel good and healthy. - *Interview respondent*
>
> What I liked was always being able to have a regular meal – it helped me get to the weight I wanted. - *Interview respondent*

Alleviating stress and worry and reducing financial strain

Prenatal stress is associated with both pregnancy and birth complications (e.g., pre-eclampsia, low birthweight) (Traylor et al., 2020). Reducing stress and saving time and energy were cited as reasons for enrolling in the program and elements of participation that were impactful. Of those who responded to the survey, 26% strongly agreed that participating in the program helped them feel less stressed and 58% agreed (Figure 15).

15. Participating in the Home-Delivered Meal program helped me feel less stressed (N=31)



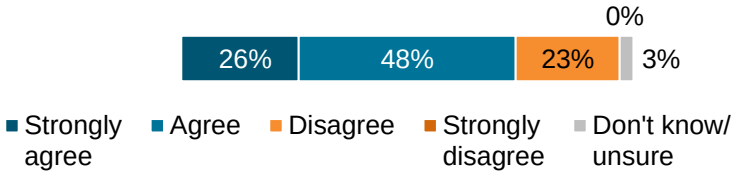
One participant described how having prepared meals allowed them to rest more and focus on their kids.

> It was good because I got time to rest, [be] with my kids, breastfeed … instead of worrying about [having to] make food for everyone. - *Interview respondent*

The convenience factor of the meals also played a part in reducing stress by giving participants more time and energy to spend on their families and other needs. Combined with the diminished financial strain, programs like this have the potential to positively impact overall quality of life for participants.

In addition to the convenience and nutritional value of the meals, respondents in the survey and interviews highlighted how the meals reduced financial strain for those struggling to feed their households (Figure 16). Financial stress during pregnancy has been linked to low infant birth weight (Sosnowski et al., 2023).

16. Getting meals delivered to your home meant you were able to spend less money on food (N=31)



Families were able to save on groceries and ensure that they had meals to eat when their funds were low. The meals alleviated some financial burden as well as the burden of figuring out what to feed themselves and their families. Participants highlighted that not having to worry about this was very beneficial to reducing stress during their pregnancies.

> I was having a hard time getting enough food for me and my kids at first, so it really helped out with spending money on groceries and stuff. Also … because I knew that they were healthy meals and I was trying to eat more healthier and trying to get [my family] to eat a little bit more healthier as well. It met my expectations and my needs pretty well.
> *- Interview respondent*

Hennepin Healthcare and UCare data

In addition to the evaluation data collected and analyzed by Wilder Research, Hennepin Healthcare and UCare provided further data for understanding the program and its impact.

Social determinants of health resource connection

One objective of the program was to identify additional SDOH needs among program participants and connect them to resources. Of the 62 cohort members, 14 (23%) were screened for SDOH needs, 7 (11%) worked with UCare Case Management, and 15 (24%) were offered connection to resources such as Special Supplemental Nutrition Program for Women, Infants and Children (WIC), Supplemental Nutrition Assistance Program (SNAP), or help with transportation.

Healthcare utilization and birth outcomes data

Due to the small sample size and lack of a comparison group, the data below do not allow attribution of clinical outcomes to the program. Rather these are descriptive data that can be used to better understand those who were referred to and participated in the pilot program.

Birth complications

Overall, 48% of cohort members experienced no maternal complications during or after birth. Eighty-six percent of cohort members' newborns experienced no fetal complications during labor and delivery. The largest proportion of cohort members (26%) experienced "other complications" which, by themselves, accounted for less than 10% of complications experienced by all 92 patients referred to the program. Post-partum hemorrhage was the second most common complication, experienced by 16% of cohort members.

Newborn APGAR scores

An APGAR score includes five measures that are scored on a scale of 0-2, with 2 being the best score. Measures include **A**ppearance (skin color), **P**ulse (heart rate), **G**rimace response (reflexes), **A**ctivity (muscle tone), and **R**espiration (breathing rate and effort). These measures, in combination, help healthcare providers determine whether a newborn may need extra medical care shortly after birth. Among newborns of cohort members born at Hennepin Healthcare, 100% had an "excellent condition" 5-minute APGAR score (7-10). Eleven percent of newborns of cohort members did not deliver at Hennepin Healthcare system and their score was unknown.

See the Appendix for more detailed information about birth outcomes and complications among cohort members and their infants reviewed as part of the evaluation.

Program learnings

Based on the experiences of program participants and examination of the process among partner organizations, the following recommendations will improve future meal delivery programs for individuals with high-risk pregnancies.

- A large number of eligible patients referred to the program did not end up enrolling. Proactively collect data to understand any barriers to enrollment. This information will assist in increasing the number of enrollees for future programming.
- Have a robust resource connection plan in place to address SDOH-related needs for participants. Ensure case management services and supportive referrals are offered to and utilized by participants to provide comprehensive support of health, social, and financial needs during and after the program ends.
- Understand and plan for appropriate modes of communication with program participants (e.g., text messaging may be necessary depending on the population).
- A large number of participants canceled deliveries or requested to put a hold on their meal delivery. Modify the program eligibility criteria or program design to address the primary reasons participation declined.
  - Explore the food preferences of participants and their dependents to increase satisfaction and consumption of the food provided. Consider offering meal options that are more tailored to various cultural preferences of the focal population.
  - Ensure that food storage facilities are not a barrier for participants or increase flexibility in the number of meals per delivery, especially for participants who were accepting meals for entire households.
  - Review and potentially modify the meal delivery schedule to accommodate participants' preferences. Participants receiving meals biweekly were more likely to complete the program compared to participants with a weekly delivery schedule.

Opportunities for future exploration

- Create a comprehensive support model with multiple resource options so that, when the meal programming ends, program participants are set up for success for future health, finances, and healthcare engagement. This could include existing food support and educational programs (WIC, SNAP, etc.), programs for healthy parents and healthy babies through insurance providers, and reminders to get recommended prenatal care with a healthcare provider.
- Explore the impact of addressing food insecurity during pregnancy and postpartum on patients' utilization and engagement in healthcare, such as completion of prenatal visits and screenings and use of the emergency department.
- Use more robust eligibility criteria to focus on patients with the greatest need in terms of food insecurity. This may increase participation rates as those who are the most food insecure will likely find the most value in the program.
- Provide medically tailored foods for those with specific conditions (e.g., anemia or gestational diabetes). This may increase engagement levels for patients looking to treat or improve a particular condition and have more quantifiable results for patients, providers, and researchers. This might include patients who are on bedrest or have been recommended to make significant lifestyle modifications during pregnancy.
- Use a large enough sample size and a comparison group so that clinical outcomes identified in the program evaluation can be assessed. (See Appendix for clinical outcomes reviewed as part of the evaluation).

Disparities in pregnancy and birth outcomes are an increasing concern for payors, providers, and communities. Novel interventions such as this program have the potential to address health gaps and improve quality of life for patients during a period of increased vulnerability. Finding a program format that meets the needs of a high-risk population with complex needs and addresses the unique desires of the participants has the potential to increase health equity by contributing to a reduction in negative health outcomes for both the person who is pregnant and their baby.

References

Blue Cross and Blue Shield of Minnesota and Blue Plus/NourishedRx. (2023). *Maternal health food and nutrition pilot.* https://www.bluecrossmn.com/sites/default/files/DAM/2023-12/maternal-health-food-nutrition-pilot.pdf

Blumenshine, P., Egerter, S., Barclay, C. J., Cubbin, C., Braveman, P. A. (2010). Socioeconomic disparities in adverse birth outcomes: A systematic review. *American Journal of Preventive Medicine, 39*(3), 263-272.

Downer, S., Clippinger, E., & Kummer, C. (2022). *Food is Medicine research action plan*. Aspen Institute & Harvard Law School Center for Health Law & Policy Innovation. https://www.aspeninstitute.org/wp-content/uploads/2022/01/Food-is-Medicine-Action-Plan-Final_012722.pdf

Gillespie, J. J., & Privitera, G. J. (n.d.). *Food for health: The positive economic, medical, and social impact of maternal nutrition as an intervention.* Umoja Food for Health. https://umojafoodforhealth.com/wp-content/uploads/2023/04/White-Paper_Food-For-Maternal-Health.pdf

Kreuter, M. W., Thompson, T., McQueen, A., & Garg, R. (2021). Addressing social needs in health care settings: Evidence, challenges, and opportunities for public health. *Annual Review of Public Health, 42*, 329-344.

Leon, J. (2021). *Food is Medicine as a part of prenatal care for high-risk pregnancies.* Food is Medicine Massachusetts. https://foodismedicinema.org/fim-research-1

Njoku, A., Evans, M., Nimo-Sefah, L., & Bailey, J. (2023). Listen to the whispers before they become screams: Addressing Black maternal morbidity and mortality in the United States. *Healthcare (Basel). 11*(3), 438.

Raghavan, R., Dreibelbis, C., Kingshipp, B. L., Wong, Y. P., Abrams, B., Gernand, A. D., Rasmussen, K. M., Siega-Riz, A. M., Stang, J., Casavale, K. O., Spahn, J. M., & Stoody, E. E. (2019a). Dietary patterns before and during pregnancy and birth outcomes: A systematic review. *The American Journal of Clinical Nutrition, 109*(Supplement_1), 729S-756S.

Raghavan, R., Dreibelbis, C., Kingshipp, B. L., Wong, Y. P., Abrams, B., Gernand, A. D., Rasmussen, K. M., Siega-Riz, A. M., Stang, J., Casavale, K. O., Spahn, J. M., & Stoody, E. E. (2019b). Dietary patterns before and during pregnancy and maternal outcomes: A systematic review. *The American Journal of Clinical Nutrition, 109*(Supplement_1), 705S-728S.

Sosnowski, D. W., Ellison-Barnes, A., Kaufman, J., Hoyo, C., Murphy, S. K., Hernandez, R. G., Marchesoni, J., Klein, L. M., & Johnson, S. B. (2023). Financial stress as a mediator of the association between maternal childhood adversity and infant birth weight, gestational age, and NICU admission. *BMC Public Health*, *23*(1), 606.

Traylor, C. S., Johnson, J. D., Kimmel, M. C., & Manuck, T. A. (2020). Effects of psychological stress on adverse pregnancy outcomes and nonpharmacologic approaches for reduction: An expert review. *American Journal of Obstetrics & Gynecology MFM*, *2*(4), 100229.

U. S. Department of Health and Human Services. (2024). *Food is Medicine: A project to unify and advance collective action*. https://health.gov/our-work/nutrition-physical-activity/food-medicine#:~:text=Food%20is%20Medicine%20approaches%20that,across%20many%20communities%20and%20systems

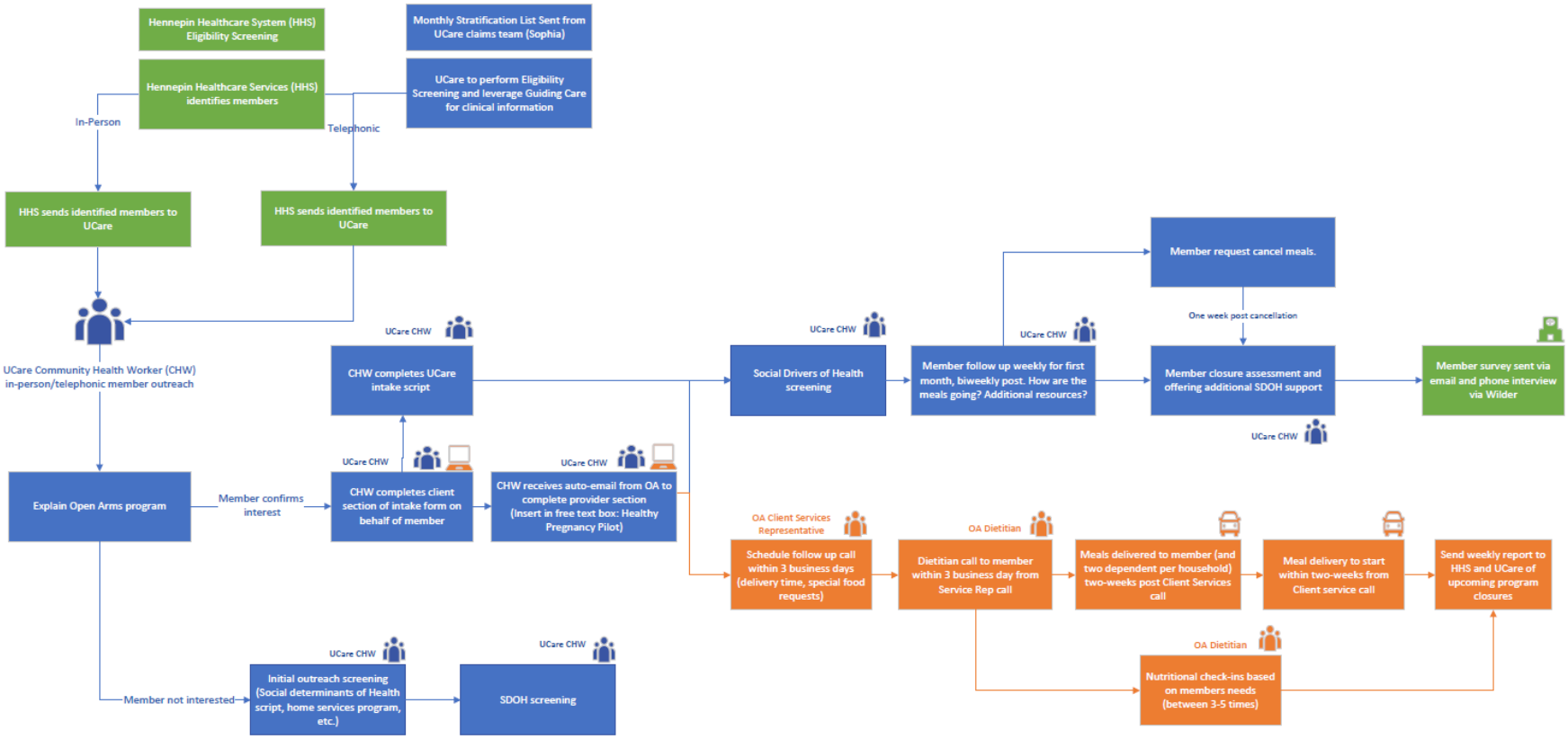
Appendix

The following information includes programmatic and healthcare data provided and analyzed by Hennepin Healthcare and UCare. In several cases, data have been reviewed using the following three categories: 1) referred to the program, but did not enroll, 2) requested a long hold or canceled their food deliveries, and 3) completed the program.

A. Process flows/tools

The UCare Community Health Worker (CHW) process flow illustrates both the process by which pregnant patients received resources and got enrolled in the program, and the steps for participants once enrolled through evaluation activities.

A1. UCare CHW process flow



B. Open Arms Meal Programming and Nutrition Support Services

The following tables describe the type of meals that were provided and the frequency of meal deliveries by group.

B1. Makeup of Open Arms meals (Heart Healthy, Vegetarian, Flavor Neutral) and delivery schedule

	Long Hold / Cancelled	Completed / Receiving Meals	Grand total
Meal type			
Flavor Neutral	6	1	**7**
Heart Healthy	35	19	**56**
Vegetarian	0	1	**1**
Delivery frequency			
Bi-weekly	0	5	**5**
Weekly	41	16	**57**
Total	**41**	**21**	**62**

B2. Delivery frequency/method and meal type by group

Frequency	Long Hold / Cancelled	Completed / Receiving Meals	Grand total
Bi-weekly	**--**	**5**	**5**
Delivery	**--**	**4**	**4**
Flavor Neutral	--	1	1
Heart Healthy	--	3	3
Shipping	**--**	**1**	**1**
Heart Healthy	--	1	1
Weekly	**41**	**16**	**57**
Delivery	**36**	**13**	**49**
Flavor Neutral	5	--	5
Heart Healthy	31	12	43
Vegetarian	--	1	1
Pick-Up	**1**	**--**	**1**
Heart Healthy	1	--	1
Shipping	**4**	**3**	**7**
Flavor Neutral	1	--	1
Heart Healthy	3	3	6
Grand Total	**41**	**21**	**62**

B3. Open Arms Nutrition Support Services

One in five cohort members (21%) participated in nutrition services. Nutrition services consisted of telephone calls with a Registered Dietitian at Open Arms. These individuals had at least one phone call where they discussed topics related to nutrition during pregnancy (e.g., iron-rich foods, carbohydrate portions, mercury concerns and fish consumption, how to manage blood pressure/low sodium eating, healthy options for breakfast). Participants with gestational diabetes had two to three follow-up calls with the dietitian to check their blood sugar levels and discuss how best to eat for their condition. In addition to these conversations, handouts from the Academy of Nutrition and Dietetics were provided to participants with guidance for managing other conditions such as preeclampsia and iron deficiency anemia.

C. Hennepin Healthcare and UCare patient data

Due to the study design, small sample size, and absence of a comparison group, it is not possible to draw conclusions about the cause of any differences in clinical outcomes between patients (and their newborns) who were referred to the program but did not enroll, program participants who canceled their meals or requested a long hold, and program participants who completed the program. It is possible that these differences were due to confounding variables; therefore, it is important to use caution when interpreting the data presented in this section.

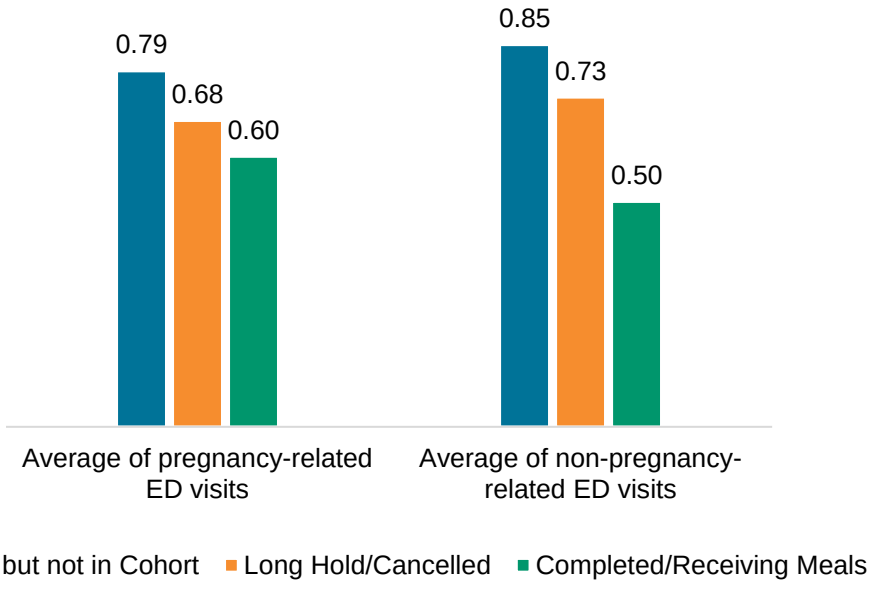
Figure C1 describes the number and percentage of the newborns of cohort members who experienced NICU admits by group type.

C1. Neonatal Intensive Care Unit (NICU) admits

	Number	Percent
Referred but not in cohort (N=30)	3	10%
Long Hold/Cancelled (N=41)	2	5%
Completed/Receiving meals (N=23)	3	13%
Total (N=93)	**8**	**9%**

Figure C2 illustrates the average number of visits to an emergency department by group.

C2. Average number of emergency department (ED) visits by group



Note: One participant was excluded from the completed/receiving meals group, non-pregnancy-related ED visits numbers as an outlier. When included, the number increases to 0.90. Negligible impact on pregnancy-related ED visits.

C3. Most common reason for emergency department visit

The most common reasons for an emergency department visit among all patients referred to the program (N=92) included:

- Symptoms, signs, and other abnormal clinical/lab findings, not elsewhere classified (18%)
- Maternal care for other conditions predominantly related to pregnancy (17%)
- Excessive vomiting in pregnancy (9%)

Figure C4 reports the number of patients referred to the program (N=92) who received and accepted resources or referrals from UCare case management.

C4. UCare Case Management support

Accepted resource/referral	Number
Medical transportation/HealthRide	2
WIC	4
Second Harvest Heartland/SNAP	7
Other (Financial help with utilities, rent)	1
Total	**14**

Note: This table includes individuals who were referred but did not enroll in the program.

Figure C5 includes the number and percentage of cohort members who had pre-existing medical conditions, risk factors at intake, and/or gestational history of risk factors.

C5. Clinical profile at intake (N=62)

	Number	Percent
Medical conditions		
Iron deficiency anemia	11	18%
Type II diabetes mellitus	7	11%
Advanced maternal age	5	8%
Prediabetes	2	3%
Hypertension	2	3%
Risk factors at intake		
Pre-eclampsia	33	53%
BMI <18.5 or >30 (pre-pregnancy)	32	52%
Gestational diabetes mellitus	30	48%
High blood pressure	18	29%
Iron deficiency anemia	17	27%
Gestational history		
Pre-eclampsia	11	18%
Premature birth	11	18%
Iron deficiency anemia	8	13%
High blood pressure	7	11%
Gestational diabetes mellitus	7	11%
Low birth weight birth	1	2%

Figure C6 includes clinical fetal birth outcomes that were reviewed for the newborns of the cohort members. Due to the small sample size and lack of a comparison group, conclusions could not be drawn from program participation to clinical outcomes. These outcomes are listed here as suggestions for examination in future programming.

C6. Fetal birth outcomes

Birth Outcomes
No complications
Abnormal fetal heart rate/rhythm
Infant respiratory distress
Premature birth
Neonatal Intensive Care Unit (NICU) admit
Low birth weight

Figure C7 includes maternal birthing encounter complications that were reviewed for participants by program group. Due to the small sample size and lack of a comparison group, conclusions could not be drawn from program participation to clinical outcomes. These outcomes are listed here as suggestions for examination in future programming.

C7. Maternal birthing encounter complications

Birthing Outcomes
No complications
Acute blood loss anemia
Chronic hypertension (cHTN)
Gestational hypertension (gHTN)
Pre-eclampsia (during birth)
Post-partum hemorrhage (PPH)
Intrauterine infection, inflammation, or both (Triple I)
Preterm Premature Rupture of Membranes (PPROM)

Acknowledgments

We would like to thank the members of this program cohort who participated in this evaluation of this program. Their time and thoughts are valuable in understanding, propagating, and improving programs like this one. Many participants made time to fill out a survey or participate in a phone interview while recovering from giving birth and caring for a newborn, which is especially appreciated.

We are also grateful for everyone who made this program and evaluation possible. Every role from recruitment to service delivery was vitally important.

The authors would also like to thank team members at Hennepin Healthcare who helped shape the evaluation, including Christine Melko, Jennette Turner, Isabella Bennett, Amy Harris, and their clinical advisors, Dr. Diana Becker Cutts and Jessica Holm (APRN, CNM, FACNM). And thank you to the many staff at Wilder Research who contributed to this project or report.

Suggested citation: Tomlinson, J., Dawud, B., Granias, A., Melko, C., & Turner, J. (2024). *Healthy Pregnancy Home-Delivered Meals pilot program: 2024 evaluation report*. Wilder Research.

Wilder Research, a division of Amherst H. Wilder Foundation, is a nationally respected nonprofit research and evaluation group. For more than 100 years, Wilder Research has gathered and interpreted facts and trends to help families and communities thrive, get at the core of community concerns, and uncover issues that are overlooked or poorly understood.

451 Lexington Parkway North
Saint Paul, Minnesota 55104
651-280-2700 | www.wilderresearch.org

Wilder Research®
Information. Insight. Impact.

ucare

openarms

Hennepin Healthcare