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The Delaware Food Farmacy:

Integrating Medically Tailored Groceries and Community Health Workers into Chronic Disease Management

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Abstract

Objective: This study evaluates whether a medically tailored grocery intervention supported by community health workers improves clinical, behavioral, and social outcomes among patients with diet-related chronic conditions. The Delaware Food Farmacy (DFF), a six-month program implemented by ChristianaCare, targeted adults with diabetes, hypertension, or heart failure. **Methods:** This retrospective pre-post quasi-experimental study analyzed intake and six-month data for 185 participants enrolled between 2021 and 2024. Participants received weekly home deliveries of groceries aligned with the DASH diet, cooking tools, and ongoing support from community health workers (CHWs). Outcomes included food security, depression (PHQ-9), anxiety (GAD-7), BMI, blood pressure, and HbA1c. **Results:** Results indicated significant improvements in food security ($p = 0.008$), depression (–2.19 points, $p < 0.001$), anxiety (–1.76 points, $p = 0.001$), BMI (–1.44 kg/m^2, $p = 0.020$), and HbA1c (–0.52%, $p = 0.027$). Goal completion averaged 84%, and satisfaction exceeded 90% across all program components. **Conclusions:** Findings demonstrate that medically tailored grocery programs supported by community health workers can produce measurable improvements in health and social outcomes among medically complex, low-income adults, offering a scalable, equity-oriented model to address chronic disease and inform value-based reimbursement pathways.

Introduction

Suboptimal diets and food insecurity contribute to more than $1.1 trillion in US healthcare spending and lost productivity each year.[1,2] Six in ten adults live with one chronic condition, and four in ten experience two or more.[3,4] Half of all adults live with diabetes or pre-diabetes and three in four adults are overweight or obese.

Delaware mirrors these national trends, with 61% of deaths in 2020 attributable to chronic diseases.[5] The state ranks fifth nationally in per capita healthcare spending at $12,899 per resident.[6] Nearly 12% of adults (approximately 95,100 individuals) have been diagnosed with diabetes, contributing to $1.1 billion in annual costs, and 37.9% of adults (approximately 311,000) live with obesity.[7] These data highlight the urgent need for upstream strategies that integrate nutrition into healthcare delivery.

The emerging field of Food is Medicine (FIM) offers a pathway to better align diet with healthcare. Defined by the American Heart Association as the "provision of healthy foods

prescribed within a healthcare setting to prevent, manage, and treat diet-related chronic conditions," FIM interventions include medically tailored meals, medically tailored groceries, produce prescriptions, and culinary medicine education.[8] Research demonstrates that healthy food subsidies through Medicare and Medicaid could prevent 3.28 million cardiovascular events and 120,000 diabetes cases while saving $100.2 billion in healthcare costs.[9] Medically tailored meals alone could avert 1.6 million hospitalizations each year and generate $13.6 billion in savings.[10] Available studies have reported up to 1.5 percentage points decrease in HbA1c reductions,[11,12] with each 1-point decrease associated with $500–$950 lower medical spending per patient per year.[13] Individual programs have documented HbA1c reductions of up to three points, translating to roughly $24,000 in healthcare cost savings per patient.[14]

Despite growing evidence and investment, payers have not yet institutionalized the provision of healthy foods as a routine component of care for patients with diet-related chronic conditions. This study adds to the evidence base by evaluating a regional healthcare system's implementation of a medically tailored grocery intervention designed to improve health outcomes and reduce hospital utilization.

The Delaware Food Farmacy (DFF) is a six-month program administered by ChristianaCare, a northeast regional health system. The intervention provides weekly home deliveries of medically tailored groceries through a partnership with community-based organization Lutheran Community Services (LCS), guided by the evidence-based Dietary Approaches to Stop Hypertension (DASH) eating plan and complemented by Community Health Worker (CHW) support. Each delivery includes enough food to prepare approximately 10 meals per week for both the participant and their household members. Eligible participants are ChristianaCare primary or specialty care patients aged 18 or older with diabetes, hypertension, or congestive heart failure who are Medicaid-insured or uninsured residents of New Castle County, Delaware.

Serve-safe certified CHWs conduct initial kitchen assessments to identify barriers to food preparation and safety, such as limited access to basic cooking tools or storage capacity. Based on individual needs, participants receive essential kitchen equipment such as pots, pans, measuring cups, or blenders to support safe and effective meal preparation. CHWs engage weekly with participants to complete menus, set goals, address social needs, and strengthen nutrition knowledge and cooking skills. Participants could also receive self-monitoring tools such as blood pressure cuffs and scales and may access additional support from pharmacists, dietitians, and behavioral health consultants.

This study evaluates whether participation in a medically tailored grocery intervention supported by CHWs improves health outcomes and reduces food insecurity among patients with diet-related chronic conditions. Specifically, the research examines changes in glycemic control, blood pressure, body mass index, behavioral health symptoms, and food security status, along with patient centered goals achievement, and program satisfaction among participants in the DFF program over a six-month period.

Methods

This pre-post study employed a retrospective quasi-experimental evaluation design to assess the impact of the DFF program among its first 150 graduates. Participants were enrolled between March 2021 and March 2024 and followed for six months. The study utilized intake and post-

intervention assessments to measure changes in food security, behavioral health, biometric outcomes, and patient satisfaction.

Eligible participants were ChristianaCare patients aged 18 or older with at least one of the following chronic conditions: diabetes, hypertension, or congestive heart failure. Participants were required to be either Medicaid-insured or uninsured and residing in New Castle County, Delaware. Patients were referred to the program by their clinical care team, through ChristianaCare's care coordination system.

Program data were extracted from ChristianaCare's REDCap system and included participant enrollment, declination, retention, and completion information. Patient-centered goals and goal achievement were obtained from REDCap and ChristianaCare's healthcare electronic health record (EHR) platform. Biometric outcomes (BMI, HbA1c, blood pressure) were extracted from the EHR at baseline and approximately six months post-enrollment. Behavioral health screenings and food security assessments were administered by the program coordinator and recorded in REDCap.

Participant satisfaction and self-reported behavior changes were assessed through a post-program survey administered by program staff and entered into REDCap. All data were de-identified prior to analysis. The study protocol was reviewed and approved by the ChristianaCare Institutional Review Board (IRB).

Measures

Biometric Outcomes. Hemoglobin A1c (HbA1c), blood pressure (systolic and diastolic), and body mass index (BMI) were extracted from participants' EHRs at baseline (within 90 days prior to enrollment) and post-intervention (within 90 days following program completion). HbA1c values were analyzed for participants with diabetes; blood pressure values were analyzed for participants with hypertension.

Behavioral Health. Depression symptoms were assessed using the Patient Health Questionnaire-9 (PHQ-9), a self-administered 9-item screener that scores patients on a scale from 0 (not at all) to 3 (nearly every day).[15] Total scores range from 0 to 27, with scores categorized into five severity levels: none-to-minimal (0–4), mild (5–9), moderate (10–14), moderately severe (15–19), and severe (20–27). A reduction of 5 points or more is considered clinically meaningful.[15,16]

Anxiety symptoms were assessed using the Generalized Anxiety Disorder-7 (GAD-7), a self-administered 7-item screener scored on the same 0–3 scale.[17] Total scores range from 0 to 21 and are categorized into four severity levels: minimal (0–4), mild (5–9), moderate (10–14), and severe (15–21). A reduction of 4 points or more is considered clinically meaningful.

Food Security. The 2-item Hunger Vital Sign (HVS) was used to assess food insecurity.[18] The HVS is derived from the 18-item USDA U.S. Household Food Security Survey Module. Each item is scored as "often true," "sometimes true," or "never true" in reference to the past 12 months. Participants who respond "often true" or "sometimes true" to either item are categorized as at risk for food insecurity, while those responding "never true" to both items are categorized as food secure.

Social Determinants of Health. CHWs conducted structured assessments to identify social care needs across domains including food access, transportation, housing, and utilities. The number of reported needs was summed for each participant at baseline.

Goal Setting and Achievement. CHWs worked with participants to establish individualized health goals related to nutrition, chronic disease management, and health behaviors. Goals and completion status were documented in the EHR and REDCap throughout the six-month program period.

Patient Satisfaction. A post-program satisfaction survey assessed participants' experiences across four domains: food quality, satisfaction with the partnering organization (i.e., LCS), satisfaction with CHWs, and overall program satisfaction. Each item was rated on a 5-point Likert scale: very satisfied, satisfied, neutral, dissatisfied, or very dissatisfied.

Statistical Analysis

Descriptive statistics were calculated for participant characteristics, program reach, and satisfaction outcomes. Paired t-tests were used to assess pre-post changes in continuous outcomes (i.e., HbA1c, blood pressure, BMI, PHQ-9, and GAD-7). McNemar's test was used to evaluate changes in the dichotomous food security outcome. Statistical significance was set at $p < 0.05$. To control for multiple comparisons, the Benjamini–Hochberg false discovery rate correction was applied to primary outcome analyses. All analyses were conducted using appropriate statistical software.

Results

A total of 307 patients were referred to DFF between March 2021 and March 2024. Of those referred, 230 patients (75%) were successfully contacted, and 200 (87%) consented to participate in the program. Among those who consented, 15 participants (8%) did not engage with their assigned community health worker prior to the first grocery delivery and were classified as early dropouts. The final analytic sample included 185 participants. Table 1 presents all participant characteristics.

Table 1. Patient Characteristics

	N = 185
Race	
Black or African American	110 (59%)
White	48 (26%)
Other	16 (8.6%)
Multiple Races	7 (3.8%)
Refused	2 (1.1%)
American Indian or Alaska Native	1 (0.5%)
Asian or Asian American	1 (0.5%)
Ethnicity	
Non-Hispanic or Non-Latino	149 (81%)
Hispanic or Latino	34 (18%)
Refused	1 (0.5%)
Missing	1

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Home Language	
English	161 (87%)
Spanish	20 (11%)
Other	4 (2.2%)
Gender Identity	
Female identified	111 (60%)
Male identified	73 (40%)
Missing	1
Marital Status	
Single	83 (46%)
Divorced	28 (15%)
Married	27 (15%)
Living with a partner	18 (9.9%)
Separated	16 (8.8%)
Widowed	10 (5.5%)
Missing	3
Education Level	
High school diploma or General equivalency diploma or GED	78 (43%)
Some college beyond high school or a 2-year college degree	39 (21%)
Some high school (Grades 9 through 11)	33 (18%)
8th grade or less	13 (7.1%)
4-year college degree or higher	11 (6.0%)
Business, trade, or technical license, certificate, or degree beyond high school	8 (4.4%)
Missing	3
Employment Status	
Not employed but not looking for work (student, retired, home-maker, disabled, etc.)	106 (58%)
Unemployed but looking for work	31 (17%)
Employed full time (35 hours a week or more year-round)	22 (12%)
Employed part-time	21 (12%)
Refused	2 (1.1%)
Missing	3
Medicaid Payer	
Health Options	90 (50%)
AmeriHealth Caritas	55 (30.6%)
Medicaid TraditionDE (Medicaid DE)	28 (15.5%)
Other	7 (3.9%)
Missing	5
Chronic Conditions	
Diabetes and Hypertension	92 (50%)

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Diabetes	31 (17%)
Hypertension	25 (14%)
Diabetes, Hypertension, and Heart Failure	18 (9.7%)
Hypertension and Heart Failure	12 (6.5%)
Heart Failure	5 (2.7%)
Diabetes and Heart Failure	2 (1.1%)

Most participants identified as Black or African American (59%), followed by White (26%), and smaller proportions identified as Other (8.6%), multiple races (3.8%), American Indian or Alaska Native (0.5%), or Asian or Asian American (0.5%). Nearly one in five participants (18%) identified as Hispanic or Latino. English was the primary home language for most participants (87%), with 11% reporting Spanish and 2% another language.

The majority of participants identified as female (60%), while 40% identified as male. Almost half were single (46%), with smaller proportions reporting they were divorced (15%), married (15%), living with a partner (9.9%), separated (8.8%), or widowed (5.5%). Educational attainment varied, with 43% reporting a high school diploma or GED, 21% having some college or an associate degree, and 18% having some high school education. A smaller number had completed a four-year degree (6%) or held a trade or technical certificate (4%).

Employment rates were low, with 58% not employed and not seeking work (such as retirees, students, homemakers, or those living with disabilities). Seventeen percent were unemployed but seeking work, while 24% reported part- or full-time employment.

Most participants were Medicaid beneficiaries, either as their primary or secondary insurance (97%). Among Medicaid recipients, the largest share were enrolled in Highmark Health Options (50%) or AmeriHealth Caritas (30.6%), with a smaller number covered under Delaware Traditional Medicaid (15.5%), or other plans (3.9%). The remaining participants were uninsured (3%).

All participants had at least one chronic condition, with half (50%) managing both diabetes and hypertension. An additional 17% had diabetes alone, 14% had hypertension alone, and 10% had all three conditions: diabetes, hypertension, and heart failure. Smaller proportions had combinations of hypertension and heart failure (6.5%), heart failure alone (2.7%), or diabetes and heart failure (1.1%).

These data indicate that DFF primarily served low-income, medically complex adults managing multiple chronic conditions, most of whom were insured through Medicaid and identified as Black or African American. The demographic profile underscores the program's focus on addressing health inequities and supporting populations disproportionately affected by diet-related chronic diseases. A total of 307 patients were referred to DFF between March 2021 and March 2024. Of those referred, 230 patients (75%) were successfully contacted, and 200 (87% of those contacted) consented to participate in the program. Among those who consented, 15 participants (8%) did not engage with their assigned CHW, never completing their menu prior to first grocery delivery and were classified as early dropouts. The final analytic sample included 185 participants who completed the six-month program.

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Chronic Conditions

All participants had at least one chronic condition, with half (50%) managing both diabetes and hypertension. An additional 17% had diabetes alone, 14% had hypertension alone, and 10% had all three conditions: diabetes, hypertension, and heart failure. Smaller proportions had combinations of hypertension and heart failure (6.5%), heart failure alone (2.7%), or diabetes and heart failure (1.1%).

Program Reach and Satisfaction

Across 185 households, DFF served a total of 473 individuals, including patients and household members, providing enough food for 115,560 meals over the course of the six-month intervention. Overall satisfaction was consistently high across all assessed domains (n=185). Regarding food quality, 135 participants (73%) reported being very satisfied, 33 (18%) satisfied, 17 (9%) neutral, and 2 (1%) dissatisfied. Satisfaction with the partnering organization (LCS) was similarly strong, with 167 participants (90%) very satisfied, 15 (8%) satisfied, and 3 (2%) neutral. For community health workers (CHWs), 176 participants (95%) were very satisfied, 9 (5%) satisfied, and 1 (<1%) neutral. Overall program satisfaction remained high, with 172 participants (93%) very satisfied, 11 (6%) satisfied, and 2 (1%) neutral. No participants reported being dissatisfied with LCS, CHWs, or the overall program experience.

Goal Setting and Completion

Of 150 participants with recorded health goals, a total of 344 goals were established and 290 were completed, yielding an overall goal completion rate of 84.3%. When analyzed at the individual level (n=147, excluding three participants with zero recorded goals), graduates established an average of 2.34 goals and completed 1.97, resulting in an average completion rate of 83%. The majority of participants (74%) achieved full completion of their goals.

Health and Social Outcomes.

Health and social outcomes data is presented in Table 2.

Food Security. Among the 105 participants with paired data, food insecurity decreased significantly from 80% at baseline to 65% at six months (χ^2=7.03, df=1, p=0.008). Correspondingly, food-secure participants increased from 20% to 35%, representing a 15 percentage point improvement in household food access.

Behavioral Health. At baseline, 166 participants completed the GAD-7, with the majority presenting with minimal (36%) or mild (31%) anxiety, while 17% reported moderate and 16% severe anxiety symptoms. Among the 98 participants with paired data, mean GAD-7 scores decreased from 7.16 at baseline to 5.41 at six months (t=3.34, p=0.001), a reduction of 1.76 points. Among the 33 participants presenting with moderate or greater anxiety at baseline (GAD-7 ≥10), 61% achieved clinically significant improvement of at least four points, with a mean reduction of 5.03 points.

One hundred sixty-three (163) participants completed the PHQ-9 at baseline, with more than one-third (36%) reporting none-to-minimal symptoms, 29% mild depression, 14% moderate, 13% moderately severe, and 8% severe depression. Among the 96 participants with paired data, mean PHQ-9 scores decreased from 7.80 at baseline to 5.61 at six months (t=3.85, p<0.001), a reduction of 2.19 points. Among 31 participants with moderate or greater depression at baseline

(PHQ-9 ≥10), 62% achieved clinically meaningful improvement of five points or more, with a mean reduction of 6.74 points. Only one participant (3%) experienced worsening symptoms.

Glycemic Control. Among participants with diabetes and paired laboratory data (*n*=63), mean hemoglobin A1c decreased from 9.16% at baseline to 8.64% at six months (t=2.27, *p*=0.027), representing a 0.52 percentage point reduction.

Body Mass Index. Baseline BMI data were available for 149 participants, with 66% meeting clinical criteria for obesity, 22% classified as overweight, and 12% as healthy weight. Among the 84 participants with paired BMI data, mean BMI decreased from 35.95 at baseline to 34.51 at six months (t=2.37, *p*=0.020), a reduction of 1.44 kg/m^2. Among all participants with complete weight data (*n*=108), 55% lost weight during the intervention, with an average loss of 15.3 pounds among those who experienced weight reduction.

Blood Pressure. For participants with hypertension and paired data (*n*=84), mean systolic blood pressure decreased from 136.5 mmHg at baseline to 133.4 mmHg at six months, a reduction of 3.1 mmHg. Mean diastolic pressure decreased from 80.9 mmHg to 78.5 mmHg, a reduction of 2.4 mmHg. Changes did not reach statistical significance.

Social Determinants of Health. At baseline, participants reported an average of 3.68 social care needs across domains including food access, transportation, housing, and utilities. CHWs provided referrals and support to address these needs throughout the intervention.

Statistical Adjustment for Multiple Comparisons.

After applying the Benjamini–Hochberg false discovery rate correction to control for multiple comparisons, improvements in food insecurity, depression (PHQ-9), anxiety (GAD-7), BMI, and HbA1c remained statistically significant (adjusted $p<0.05$). Blood pressure reductions did not reach significance following adjustment.

Table 2. Summary of Health and Social Outcomes

Outcome	n	Baseline	6-Month Follow-up	Change	p-value	Adjusted p*
Food Security						
Food insecure (%)	105	80%	65%	–15%	0.008	<0.05
Behavioral Health						
GAD-7 anxiety, M (SD)	98	7.16 (5.91)	5.41 (5.23)	–1.76	0.001	<0.05
PHQ-9 depression, M (SD)	96	7.80 (6.48)	5.61 (5.54)	–2.19	<0.001	<0.05
Biometric Outcomes						
HbA1c (%), M (SD)	63	9.16 (2.01)	8.64 (1.95)	–0.52	0.027	<0.05

BMI (kg/m^2), M (SD)	84	35.95 (8.20)	34.51 (7.89)	–1.44	0.020	<0.05
Systolic BP (mmHg), M (SD)	84	136.5 (20.1)	133.4 (18.7)	–3.1	0.187	NS
Diastolic BP (mmHg), M (SD)	84	80.9 (12.3)	78.5 (11.6)	–2.4	0.098	NS

*Benjamini–Hochberg correction applied; NS = not significant after adjustment; M = mean; SD = standard deviation

Discussion

The Delaware Food Farmacy (DFF) evaluation adds meaningful evidence to the emerging science on healthcare system-integrated, medically tailored grocery interventions. Results indicate that participation in the DFF program, grounded in the Food Is Medicine framework, was associated with improvements in food security, glycemic control, body mass index, and psychological well-being among patients with chronic conditions. These findings reinforce and extend prior studies demonstrating that structured nutrition interventions embedded in clinical care can improve diet-related outcomes and mitigate health disparities.[9,19,20] Similar to other Delaware-based Food Is Medicine initiatives, such as the Feeding Families program at Westside Family Healthcare,[21] the DFF findings suggest that pairing medically tailored groceries with behavioral and care coordination support create measurable benefits in dietary behaviors and overall health status. The DFF's incorporation of community health workers (CHWs) as key facilitators reflects growing recognition that CHWs enhance patient engagement, adherence, and self-efficacy in nutrition and chronic disease management interventions.[22,23] This approach also highlights the value of culturally responsive coaching in building healthy eating skills, reducing key participation barriers, and extending the benefits of the intervention to the entire household.

Recent systematic reviews and scientific statements reinforce that medically tailored meals (MTMs), groceries (MTGs), and produce prescriptions improve critical prerequisites for health including diet quality and food security, which are foundational to chronic disease prevention.[10,19,20,24,25] The American Heart Association's (AHA) 2025 synthesis of Food Is Medicine randomized controlled trials found consistent support for improved nutrition and food security, with favorable trends in biomarker outcomes such as hemoglobin A1c and blood pressure, although effect sizes vary by study duration and sample size.[26] The growing portfolio of pragmatic trials, state Medicaid demonstrations, and implementation-science projects led by Health Care by Food™ exemplifies the field's maturation and commitment to closing evidence gaps.[26,27]

Economic analyses further strengthen the case for FIM integration as a health equity and cost-containment strategy. Massachusetts Medicaid data demonstrated a 23% reduction in inpatient admissions and a 13% reduction in emergency department utilization among MTM participants, delivering net healthcare savings exceeding program costs.[28] National modeling extrapolates that widespread implementation could prevent over 1.6 million hospitalizations per year, generating upwards of $13 billion in savings while improving health equity.[29] These findings align with Delaware's current Food Is Medicine Task Force goals and Medicaid 1115 waiver reforms,

which contemplate value-based reimbursement mechanisms like "In Lieu of Services" (ILOS) to expand sustainable nutrition interventions.

Recent state-level analyses indicate that medically tailored meals are cost-saving interventions across 49 of 50 U.S. states, with estimated savings per patient ranging from $6,299 in some states to several hundred dollars in others.[30] Given Delaware's high per capita healthcare spending and chronic disease burden, expanding MTM programs could provide substantial fiscal and clinical benefits locally, reinforcing the state's commitment to upstream nutrition-based care models.

Although the effectiveness of MTMs, MTGs, and produce prescriptions as Food is Medicine interventions has been established, implementation success increasingly depends on how these interventions are embedded within clinical systems rather than on the intervention content alone. DFF's hybrid grocery-based design, emphasizing patient autonomy through skills-building within the household environment, distinguishes it from conventional MTM models reliant on fully prepared meals. This distinction between MTG and MTM models matters because grocery-based design can build durable self-efficacy and household-level habits that persist after program end, potentially reducing relapse and improving long-run HbA1c and diet quality without continuous subsidy. The model's integration of CHWs delivering tailored coaching, home kitchen assessments, and essential culinary resources facilitates actionable behavior change and addresses practical barriers to healthy eating.[22,31] Embedding these services in a regional health system serving primarily Medicaid recipients illustrates the feasibility of scaling community-nutrition interventions that address both clinical outcomes and social determinants of health. This systems-based approach further supports the argument within the Food is Medicine framework that the complementary combination of program design, implementation mechanisms, and resource allocation, operationalized through an integrative policy approach rather than food access alone, drives adherence and sustained behavior change in Food is Medicine initiatives.[32]

Limitations and Next Steps

The pre–post evaluation design limits causal inference, and reliance on electronic health record data introduces variability in biometric timing. However, the directionality of observed improvements is congruent with evidence synthesized in rigorous reviews.[26] Planned quasi-experimental analyses incorporating propensity score–matched comparison groups and difference-in-differences methods are underway to bolster causal inference, assess intervention dose-response, and evaluate long-term sustainability. Return-on-investment analyses are also planned to quantify economic value and inform payer engagement strategies.

Conclusion

The Delaware Food Farmacy represents a scalable and system-integrated FIM model that leverages MTGs and CHW support to advance nutrition security, chronic disease self-management, and health equity within a Medicaid-insured population. While larger, controlled studies are needed to fully establish comparative effectiveness, current evidence from Delaware and nationwide demonstrates that FIM approaches are an essential component of value-based, prevention-focused healthcare. Continued rigorous evaluation and policy alignment remain critical to realizing the full potential of Food Is Medicine as a foundational health intervention.

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