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Implementation of a Plant-Based, Nutrition Program in a Large Integrated Health Care System: Results of a Pilot Program

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Abstract

Introduction: Despite the proven efficacy of plant-based diets in the management of cardiometabolic diseases, most healthcare providers do not incorporate them into treatment plans. **Objective:** Conduct a post-hoc evaluation of a novel plant-based nutrition program in a large integrated health care system, including the impact on health care outcomes. **Methods:** A large integrated health care system launched an innovative 12-week plant-based nutrition program that included weekly nutrition education, peer mentoring, and support. Plasma cholesterol levels, hemoglobin A1C, blood pressure, body weight, and healthcare utilization parameters were measured before and after the program. The current study is a pre- and post-descriptive analysis of the health metrics of individuals who participated in the program and a matched comparison group. **Results:** A total of 408 patients, across a wide range of weight categories, demographics, and co-morbidities, participated in a plant-based nutrition program, and program completers experienced mean reductions in total and LDL plasma cholesterol levels of 11.0 and 8.1 mg/dL, respectively, as well as reductions in medication usage, office visits, and body weight. **Conclusion:** Implementation of a novel plant-based, nutrition program in a large integrated health care system was associated with improvements in health outcomes.

Keywords
Managed Care, Primary Care, Prevention, Lifestyle Change, Nutrition

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Introduction

Cardiovascular disease remains a leading killer worldwide.[1,2] Although risk factors for cardiovascular disease – dyslipidemia, diabetes, hypertension, obesity – are highly prevalent and strongly influenced by dietary factors, in current clinical practice, the use of dietary interventions may be eclipsed by the use of medications.

Most Americans consume less than recommended amounts of fruits, vegetables, legumes, and whole grains, while consuming higher-than-recommended amounts of processed meats, processed grains, sugar-sweetened beverages, sodium, and saturated fat.[3] Approximately 45 percent of cardiometabolic deaths (deaths due to heart disease, stroke, and diabetes) in 2012 in Americans (ages 25 or greater) are attributable to suboptimal dietary habits.[4]

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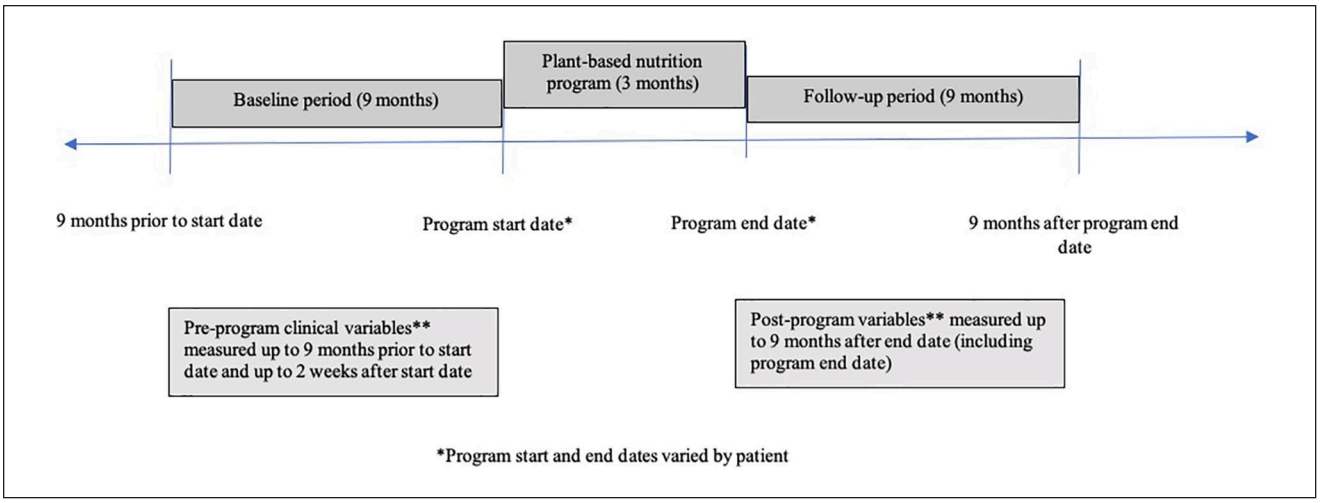

Figure 1. Program Timeline.
This figure describes the timeline of the plant-based nutrition program, as well as the time period used to assess baseline characteristics, and pre- and post-program clinical variables.

In clinical trials, plant-based dietary interventions have led to lower cholesterol levels, improved glycemic control, sustainable weight loss, and, as part of a program including other lifestyle changes, reversal of coronary artery disease.[5-17] Despite the benefits of plant-based diets, most physicians do not prescribe plant-based diets due to a lack of knowledge, time constraints, limits on reimbursement, or concerns regarding patient interest or adherence.[18] Moreover, nutrition counseling during a single office visit may not provide sufficient knowledge and support for patients to change lifelong dietary habits.

To address these issues, a large integrated health care system developed a novel plant-based dietary program. The current study is a retrospective analysis of the program's effect on plasma lipids, body weight, and other key clinical variables compared to a matched comparison group.

Methods

Kaiser Permanente Mid-Atlantic States provides comprehensive primary and specialty care to over 780,000 patients in Maryland, Virginia, and the District of Columbia. From March 20, 2017 through May 8, 2018, a plant-based nutrition program was offered at six Kaiser centers. All patients over the age of 18, who were enrolled in the health system at the time the program was implemented, were eligible to participate in the program at no cost. The program was advertised through print flyers in medical centers and electronic postings on the health care system's online patient portal. Participants were not pre-screened for their ability to adhere to the dietary recommendations or class attendance.

The plant-based nutrition program included 12 weekly meetings led by an internal medicine physician, a registered dietitian, and a diabetes nurse educator. Each 60-minute meeting was structured as follows: weigh-in (10 minutes), educational presentation about a nutrition topic (25 minutes), group discussion, and peer mentoring and support (25 minutes). Regular attendance was defined as presence at 6 or more out of the 12 weekly meetings. Multiple cohorts of the program ran simultaneously at two or three different locations and at various times of the year.

Participants were advised to follow a low-fat, plant-based diet emphasizing fruits, vegetables, whole grains, and legumes, and to avoid animal-based foods (including meat, dairy products, fish, and eggs). They were also encouraged to avoid added sugars and added fats (e.g., sugar-sweetened beverages, fruit juices, and fried foods). Following the recommendations was expected to produce a dietary regimen deriving approximately 75-80% of energy from carbohydrates, 10-15% from protein, and 10% from fats. All participants were advised to take an over-the-counter vitamin B12 supplement. Participants were provided suggestions about purchasing and preparing low-fat, plant-based meals, but meals and B12 supplements were not provided. Participants were educated about sensible portion sizes but were not instructed to specifically limit calories or carbohydrates. They were advised to continue their usual exercise regimens. Participants were given weekly handouts that included the week's educational presentation and low-fat, plant-based recipes. Dietary adherence was not assessed during the program.

The program team did not provide medical care or make medication changes; participants were advised to follow up with their respective primary care providers for ongoing health care and medication adjustments.

Electronic health record data were used to assess meeting attendance, and demographic and clinical characteristics before and after the program. If an individual participated in

Table 1. Baseline Demographics and Clinical Characteristics.

Characteristics	Program Participants (N = 408) Mean (SD) or N (%)	Comparison Group (N = 408) Mean (SD) or N (%)
Mean age, years	55.8 (12.7)	55.7 (13.7)
Age categories		
18 – 30 years	20 (4.9%)	20 (4.9%)
31-39 years	35 (8.6%)	35 (8.6%)
40-49 years	56 (13.7%)	56 (13.7%)
50-59 years	123 (30.2%)	123 (30.2%)
60-69 years	127 (31.1%)	127 (31.1%)
70 years or greater	47 (11.5%)	47 (11.5%)
Gender		
Female	291 (71.3%)	291 (71.3%)
Male	117 (28.7%)	117 (28.7%)
Race/Ethnicity		
White	152 (37.3%)	152 (37.3%)
African-American	144 (35.3%)	144 (35.3%)
Hispanic	38 (9.3%)	38 (9.3%)
American-Indian Alaska Native	0	0
Asian/Pacific Islander	60 (14.7%)	60 (14.7%)
Multi-race	7 (1.7%)	7 (1.7%)
Other/Missing	7 (1.7%)	7 (1.7%)
Mean body mass index, kg/m2	35.6 (8)	30.9 (7.1)
Body mass index categories		
<25 kg/m2	30 (7.4%)	75 (18.4%)
25 – 29.9 kg/m2	70 (17.2%)	102 (25%)
30 – 34.9 kg/m2 (Class I obesity)	103 (25.3%)	79 (19.4%)
35 – 39.9 kg/m2 (Class II obesity)	87 (21.3%)	50 (12.3%)
40 kg/m2 or greater (Severe obesity)	115 (28.2%)	40 (9.8%)
Missing	3 (0.74%)	62 (15.2%)
Co-morbidities		
Diabetes	155 (38%)	153 (37.5%)
Pre-diabetes	243 (59.6%)	142 (34.8%)
Hypertension	183 (44.9%)	167 (40.9%)
Disorders of lipid metabolism and other lipidemias	184 (45.1%)	161 (39.5%)
Depression	34 (8.3%)	7 (1.7%)
Coronary Artery Disease	30 (7.4%)	16 (3.9%)
Stroke	1 (0.2%)	0 (0)
Tobacco Use	2 (0.5%)	13 (3.2%)

more than one cohort of the program, data from the cohort in which they had the greatest attendance were used. Figure 1 illustrates the timeline for the program and the time periods used to assess baseline characteristics and pre- and post-program clinical variables.

As part of the program, plasma lipids (total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides) and hemoglobin A1C (A1C) were measured during the first and eleventh weeks using the Roche/Hitachi Cobas and Roche Diagnostic Whole Blood Assays. In addition, the following pre- and post-program clinical variables were assessed using patients' electronic health records: body weight, blood pressure, tobacco use, medication usage, email and telephone encounters, and the number of outpatient (inclusive of primary and specialty care visits), inpatient, emergency department, and primary care physician visits. Pre-program values were measured 9 months prior to start date and up to 2 weeks after the start date. Post-program values were measured on the end date and up to 9 months following the end date.

For context in interpreting descriptive characteristics, the program participants were matched by age, race, sex,

Table 2. Pre- and Post-Program Clinical Variables.

	Regular Attendees (N=214)			All Program Participants (N=408)			Comparison Group (N=408)		
	Pre-Program	Post-Program		Pre-Program	Post-Program		Pre-Program	Post-Program	
Clinical Variable	Mean (SD) or Median (IQR)		Change	Mean (SD) or Median (IQR)		Change	Mean (SD) or Median (IQR)		Change
Weight (kg)	94.4 (23.6)	92.2 (23)	−2.2	97.7 (24.4)	96.2 (24.3)	−1.5	84.9 (22.4)	84.1 (22.2)	−0.8
A1C (%)	6.6 (1.4)	6.5 (1.3)	−0.1	6.63 (1.4)	6.61 (1.5)	−0.02	7 (1.4)	6.8 (1.7)	−0.2
Total cholesterol (mg/dL)	180.4 (43.6)	169.4 (39.4)	−11.0	181 (44.3)	172.4 (41.1)	−8.6	178 (40.5)	174.5 (45.4)	−3.5
LDL cholesterol (mg/dL)	98.5 (39.7)	90.4 (35.4)	−8.1	100.8 (39.9)	93.7 (37.4)	−7.1	94 (33)	92.3 (34.5)	−0.7
HDL cholesterol (mg/dL)	56.4 (17.3)	54 (16.2)	−2.2	54.8 (16.3)	54 (16.7)	+0.8	56.8 (18.4)	55 (17.3)	−1.8
Triglycerides (mg/dL)	129.5 (79.8)	123.9 (61.2)	−5.6	131.5 (80.8)	127.2 (62.7)	−4.3	138.3 (100.9)	149.7 (255.7)	+11.5
Systolic blood pressure (mm Hg)	125 (13.7)	125.4 (13.7)	+0.4	124.1 (13.4)	125.2 (14.1)	+1.1	127.1 (15.8)	127.9 (16)	+0.8
Diastolic blood pressure (mm Hg)	70.1 (9.6)	69.8 (10.6)	−0.3	71 (10)	71 (10.6)	0	71.9 (11.3)	72.5 (11.7)	+0.6
Outpatient visits per 9-month period*	12 (7,21)	11 (5,22)	−1	12 (6,20.5)	10.5 (5,20)	−1.5	6 (3,12)	6 (3,13)	0
Inpatient visits per 9-month period	0 (0,0)	0 (0,0)	0	0 (0,0)	0 (0,0)	0	0 (0,0)	0 (0,0)	0
ED visits per 9-month period	0 (0,0)	0 (0,0)	0	0 (0,0)	0 (0,0)	0	0 (0,0)	0 (0,0)	0
Email or telephone encounters per 9-month period**	9 (4,16)	9 (5,16)	0	8 (3,16)	9 (5,17)	+1.0	4 (1,8)	4 (2,8)	0
PCP visits per 9-month period	6 (4,8)	3 (2,6)	−3	5 (4,7)	3 (2,5)	−2	1 (1,3)	1 (1,3)	0
Number of unique medications filled per 9-month period	15 (7,26)	12 (6,24)	−3	13 (5,26)	12 (6,24)	−1.0	11 (3,20)	11 (3,21)	0
Current Tobacco Use (No.)	1	0	−1	2	2	0	13	10	−3

*Includes outpatient visits to all primary and specialty care providers within the large integrated healthcare system.
**Includes email and telephone encounters with all primary and specialty care providers within the large integrated healthcare system.

diabetes, hypertension, dyslipidemia, and medical center to a concurrent comparison group of current health system members who did not participate in the nutrition program in a 1:1 manner. Descriptive statistics (means [standard deviations], or percentages) were estimated and compared for program participants and the comparison group. A sensitivity analysis was done among patients who maintained regular attendance defined as participation in 6 or more of the 12 weekly sessions.

This data-only study to conduct a retrospective analysis of the nutrition program results was approved by the Institutional Review Board of Kaiser Permanente Mid-Atlantic States. Informed consent was waived

Results

A total of 408 individuals participated in the program and their baseline characteristics are listed in Table 1. Over 60 percent were between the ages of 50 and 69. Most (71%) were female. The majority were white (37.3%) or Black (35.3%). Most were overweight (17.2%) or obese (74.8%). The majority had diabetes (38%) or pre-diabetes (59.6%). Hypertension and dyslipidemia were present in 44.9 and 45.1 percent of the participants, respectively.

The comparison group was well matched for age, sex, race, ethnicity, and the prevalence of diabetes, hypertension, and dyslipidemia (Table 1). However, the mean BMI and prevalence of certain co-morbidities was greater in program participants than in the comparison group (mean BMI 35.6 kg/m^2 vs. 30.9 kg/m^2, respectively).

Of the 408 participants who enrolled in the plant-based nutrition program, 214 attended regularly and experienced a greater decrease in total cholesterol (-11.0 mg/dL), LDL-cholesterol (-8.1 mg/dL) and triglycerides (-5.6 mg/dL) than total participants or the comparison group (Table 2). Regular attendees also experienced a greater decrease in primary care physician (PCP) visits (-3) and unique medications filled (-3) per 9-month period compared to all participants and the comparison group. Individuals who attended the program regularly experienced a mean weight loss of 2.2 kg compared to 1.5 kg and 0.8 kg for all participants and the comparison group, respectively. Regular attendees, total participants and comparison group experienced no significant changes in A1C.

Discussion

Cardiometabolic conditions are leading causes of morbidity and mortality. Small-scale randomized clinical trials have shown that plant-based dietary interventions can be highly effective in the prevention and treatment of cardiometabolic conditions. Recently, a 16-week cross-over trial comparing a Mediterranean diet with a plant-based diet showed significant reductions in body weight (-6 kg), total cholesterol (-18.7 mg/dL), and LDL cholesterol (-15.3 mg/dL) in the plant-based group compared to little or no change in the Mediterranean group.[17] However, plant-based diets are underutilized in clinical practice due to a lack of knowledge, time constraints, limits on reimbursement, and concerns regarding patient interest and adherence. The present study demonstrates that it is possible to overcome these barriers in a large integrated health care system, thus bridging the gap between research findings and patient care. As seen in randomized clinical trials, participation in a novel plant-based nutrition program was associated with lower mean total and LDL cholesterol levels, PCP visits, medication use, and body weight, compared to a matched comparison group.

This study also has important limitations. This was a post-hoc analysis of a program that had already been implemented by the health care system – participants were not randomized, and there was no standardized protocol for participant selection. While the current study includes a comparison group, it is imperfect, and no causal associations can be made. The electronic health record may not accurately reflect clinical outcomes. Nonetheless, the present study has several strengths. It included a diverse patient population in a large integrated health care system. Because participants were not pre-screened for their ability to adhere with the dietary recommendations and adherence to the prescribed diet was not assessed, the program is representative of real-world clinical situations.

Plant-based diets are a low-cost, low-risk intervention that have the potential to lead to significant health improvements and cost savings in the management of cardiometabolic conditions. Nutrition education and nutrition-based approaches should be an essential component of medical education and medical practice, respectively.[18,19]

Conclusion

This study demonstrates successful implementation of a novel plant-based intervention program in a large integrated health care system, providing a useful model for buttressing medical care with improved nutrition. The results of the current study are consistent with findings of smaller randomized trials investigating the effects of plant-based diets and bring a plant-based nutrition intervention into the environment of patient care. Future studies should assess the effectiveness of this model in a large hybrid effectiveness-implementation trial, assessing clinical outcomes, feasibility, adherence to the intervention, scalability, buy-in and cost savings.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Dr. Rahman works for the Physicians Committee for

Responsible Medicine, a non-profit that advocates for nutrition research, policy, and education. She has also authored several books on nutrition.

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