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A Primary Care-Based Early Childhood Nutrition Intervention: Evaluation of a Pilot Program Serving Low-Income Hispanic Women

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Abstract Nutrition in early childhood can significantly impact physical and mental health outcomes for children. However, research on broadly defined pre/postnatal nutrition interventions is sparse. The present study is a process and outcome evaluation of a primary care-based nutrition intervention targeting low-income Hispanic women. Pregnant women enrolled in the program were in their first trimester and received services through their 6-month well child check. The program provided vouchers for fruits and vegetables from the local farmers' market, nutrition classes, cooking classes, and lactation counseling. We conducted a prospective study of program participants (n=32) and a comparable group of women for whom the program was not available (n=29). Panel survey data measured maternal diet, exercise, stress, depression, social support, infant feeding practices, and demographics. Outcome measures obtained from medical records included pregnancy weight gain, infant weight at 6 and 12 months, and infant development at 9 months. Findings reveal that the program was not associated with infant weights. However, despite similar profiles at baseline, women in the intervention group were more likely than women in the comparison group to have significant improvements in diet, exercise, and depression ($p \leq .05$). In addition, participants were more likely to breastfeed (p=.07) and their infants were more likely to pass the ages and stages developmental screen (p=.06) than women in the comparison group. The study was limited by a lack of random assignment and small samples. However, the breadth and size of the effects suggest pre/postnatal nutrition interventions integrated into primary care warrant additional investigation.

Keywords Early childhood nutrition · Primary care · Hispanics

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Introduction

Low-income minority children exhibit disproportionately high rates of physical and developmental problems [1–3]. Inadequate nutritional intake during pregnancy and infancy is a factor that contributes to these disparities in child health [4]. The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) attempts to address these risk factors by providing nutrition education and supplemental foods for low-income pregnant women and children up to age 5. WIC has been an effective and efficient program that improves physical and cognitive child outcomes [5, 6]. However, it has been noted that WIC focuses on ensuring adequate caloric intake from core food groups, but offers limited support for fresh fruits and vegetables and has not been particularly effective in promoting breastfeeding [7–9]. To supplement, primary care practitioners typically offer nutritional guidance and a few interventions have attempted to improve the dietary practices of high-risk pregnant women (e.g., overweight/diabetic) [10, 11]. However, research on more broadly defined pre/postnatal primary care nutrition interventions is sparse

[12]. The present study is an evaluation of a more inclusive and comprehensive pilot nutrition intervention for pre/postnatal women. The program served low-income Hispanic women attending a primary care clinic in the Southwest. Program services were offered to women from the first prenatal visit through the child's 6-month well check visit. The intervention provided vouchers for fruits and vegetables from the local farmers' market, nutrition classes, cooking classes, and lactation counseling. The primary program goals were to (1) improve maternal diet and health behaviors during pregnancy, (2) increase breastfeeding rates at 6 months, and (3) improve infant weight and developmental outcomes in the first year of life. The quasi-experimental evaluation examined program participation, mediating health behaviors, maternal weight gain, and child outcomes for the intervention group (n=32) relative to a comparison group (n=29). This prospective study provides a unique exploration of the feasibility of offering a broadly defined nutrition intervention in standard obstetrics/pediatric practice and the potential of such a program to improve maternal health behaviors and infant outcomes.

Early Childhood Nutrition

Pregnancy and infancy are critical periods for early child development. Experiences during this time provide the foundation for a child's physical health, social and emotional development, and learning. Factors consistently correlated with child development are maternal mental health, substance use, environmental toxins, parent/child attachment, and nutrition [13–16]. In addition, these factors are intricately intertwined and disproportionately present for women and children living in resource-poor environments. Consequently, low-income minority children experience relatively high rates of physical health and developmental problems [1, 2, 17].

Research provides more detailed delineation of how nutrition influences child health and development. Studies reveal that maternal obesity affects the child's risk of obesity. This higher risk is observed in infancy and persists through childhood and adolescence [18–20]. Maternal obesity also increases the child's risk of developing behavioral health problems such as attention deficit/hyperactivity disorder [21]. In addition, researchers who study prenatal diets have found the intake of energy, protein, essential fatty acids, iron, and folate to be critical to fetal development and birth outcomes [22]. Most of this research comes from studies of supplements, although some examine the benefits of dietary practices (e.g., fish consumption) [23]. Finally, research on the relationship between infant feeding practices and health is extensive and definitive. The incidence and duration of breastfeeding is associated with improved brain development and a reduction in the risk of obesity [24–26].

Studies of nutrition in the pre/postnatal period tend to focus on individual nutrients (e.g., folate). Food scholars such as Pollan express concern with nutritional studies that reduce food to a small list of vitamins and minerals, ignoring unmeasured nutrients, nutrient combinations, and the presence/absence of toxicants [27]. Available studies of broader dietary practices tend to focus on pregnant women in developing countries or nutrient-deficient populations [28–31]. The limited amount of research on this topic done in developed countries has produced mixed results. Some have found that the nutritional requirements of pregnancy are typically met in developed countries, while others have noted that this is not necessarily the case for low-income minority populations [32–35].

There is reason to believe that low-income minority women in the USA are unlikely to have nutrient-rich diets during their pregnancies [4, 36, 37]. Low-income minorities often have limited access to healthy food. Families with few financial resources experience periods of food scarcity when they are more likely to purchase inexpensive foods that are dense in calories, overly processed, high in fat, and low in nutritional value [38]. In addition, low-income minorities often reside in neighborhoods described as "food deserts" which have a limited supply of fresh fruits and vegetables, inflated prices, and an overrepresentation of fast food chains [39, 40]. African-Americans and Hispanics have lower average levels of education and less access to quality health care, which serves to reduce their access to information about nutrition, exercise, and the risks of overweight and obesity [41, 42]. There is also evidence that Hispanic populations have cultural beliefs that contribute to their risk of obesity. For example, researchers have found that Hispanics prefer heavier body weights compared to whites, believe that heavy babies are healthy babies, and underestimate their children's weight [43, 44]. Finally, it has been suggested that minorities face stressors associated with discrimination and acculturation that may negatively affect lifestyle choices and overall health [45, 46].

Early Childhood Interventions

The most substantive US investment in early childhood nutrition is the WIC program [47]. While WIC has numerous benefits and adopted an improved program in 2009, it offers minimal support for fruits and vegetables and provides limited lactation support [7, 9, 48]. To supplement, primary care offers an excellent opportunity to provide an early child development intervention as this is already the primary point of contact, in some cases the only point of contact, that agencies have with pregnant women and families with young children

[49]. In addition, nutrition is already a topic within the domain of the patient/obstetrician relationship, providing a logical flow to more extensive discussions and supports.

Prenatal nutrition interventions have been offered in primary care. Thangaratinam and colleagues provided a meta-analysis of randomized controlled trials providing lifestyle interventions designed to reduce maternal weight and obstetric outcomes [50]. They examined interventions that focused on diet, exercise, and a combination of the two. Effects were found for only the dietary interventions, which produced a significant reduction in maternal weight gain, preeclampsia, gestational diabetes, hypertension, and preterm delivery. However, the authors noted that the evidence base was weak. The interventions focused on high-risk women (e.g., overweight/diabetic) and emphasized a narrow set of dietary goals (e.g., reducing foods with a high glycemic index). In addition, there were no significant effects on birth weight, little information available about program processes and maternal behaviors, and no outcome measures for infancy/childhood. Studies conducted since this review exhibit similar results and limitations [51]. Finally, while it is beyond the scope of this study to provide a thorough review, research has also demonstrated the benefits of interventions designed to increase breastfeeding [52].

Evaluation of an Early Childhood Nutrition Pilot Program

We have essentially no information about prenatal nutrition interventions that attempt to broadly change dietary habits and target a general low-income minority obstetrics population [53–55]. In addition, it has been suggested that in order to reduce racial/ethnic health disparities, healthcare interventions must begin to move beyond the medical model to include social and environmental factors, yet few nutrition interventions do [56]. To address these gaps, we used a biopsychosocial framework to design and evaluate a primary care-based early childhood nutrition program that would address a broad array of risk factors.

To assist with the design of the program, we conducted a needs assessment for the primary care clinic, which serves a low-income, Hispanic population in the Southwest. We collected baseline data on a sample of pregnant women and infants attending the clinic before the program was offered. The results were published in an earlier manuscript [57]. In this research, we learned that a significant proportion of the pregnant women attending the clinic were not eating the recommended two–three servings of fruit daily (45 %) or the recommended three–five servings of vegetables daily (62 %). Results also revealed that fast food and sugar-sweetened beverage consumption were common. Finally, approximately 55 % of the infants in the study profiled in the 85th percentile on weight in their first year, suggesting a clear need for a nutrition intervention with this particular population.

After the baseline data were collected, the clinic launched the pilot program. Participants were recruited from women age 18 and older coming to the clinic for a first trimester prenatal visit between February and June of 2012. Eligible women completed a survey about their health behaviors (e.g., diet, exercise, stress). At the end of the survey, they were asked, if it were available, would they be interested in participating in a nutrition intervention (a brief description of the intervention was provided). Women answering yes to this question and who also spoke Spanish were enrolled until a cohort of approximately 8–12 women at similar stages of pregnancy could be established for the group classes. The group classes were conducted in Spanish because over 90 % of the women attending the clinic speak Spanish. This criterion resulted in only one non-Spanish-speaking woman being excluded from the pilot. Three program cohorts were created. Services were provided from enrollment through the child's 6-month well check. The program was designed to improve food access by providing vouchers for fruits and vegetables at the local farmers' market. It also offered general nutrition classes at four points in time (e.g., first trimester, third trimester, 1 and 3 months). Six cooking classes were offered during the prenatal period and one baby food cooking class was offered at 4–6 months postpartum. The nutrition and cooking classes were offered in a group setting with the intent not only of providing information but also of developing a cohort of women who could support and encourage one another in adopting healthier eating habits. Each class lasted 1.5 h and all classes were held at the clinic. The clinic health educator conducted the nutrition classes. The cooking classes were offered by a trained facilitator from a non-profit community partner. Since there is no evidence-based national curriculum for an early childhood nutrition intervention in pregnancy and infancy, the classes were created using information from the American Academy of Pediatrics pregnancy weight gain guidelines and their Healthy Active Living for Families (HALF) program materials. In addition, clinic staffs were trained in motivational interviewing techniques and incorporated these techniques into the group nutrition classes. The cooking classes used a curriculum created by the local non-profit community partner. Finally, the clinic's lactation consultant provided individual lactation counseling on four occasions (at the clinic or by phone). The present study provides a process and outcome evaluation of the pilot program. The goals of the evaluation were to determine if (1) women would be willing to participate in program activities, (2) the program could improve maternal health behaviors and infant feeding practices, and (3) the program could improve child outcomes, specifically weight and development in the first year of life.

Methods

Study Sample

The intervention study sample consisted of women enrolled in the program. These women were age 18 and older, received prenatal care at the clinic in their first trimester, spoke Spanish, and expressed interest in the intervention (n=32). A comparison group was developed from a comparable group of women in their first trimester who also expressed interest in participating in the program, but who were not able to participate because the program had reached capacity (n=29). Program staff sought to recruit approximately 30 women for each group based upon power analyses conducted using G*Power 3 software [58]. This analysis revealed an n of approximately 60 to be a sufficient minimum sample size to detect a medium effect (Cohen's d) at 80 % power to assess differences in the intervention and comparison group. We were able to achieve approximately 30 in each group as we tracked women from the first to the third trimester. However, attrition rates reduced our total sample sizes available for the child outcomes at 9–12 months (intervention n=22, comparison, n=21).

Study Design and Data Collection

The evaluation was a quasi-experimental prospective design, following the intervention and comparison groups from their first trimester visit until the child's 12-month well check. The design is described in Fig. 1.

The five data collection points for G1 and G2 are t1=first trimester prenatal visit, t2=third trimester prenatal visit, t3=2 months well child check (WCC), t4=6 months well child check, t5=12 months well child check. Women in G1 and G2 completed self-administered surveys at each interval as they waited for their appointment. The clinic medical assistants distributed the surveys and were blind to the differences in intervention and comparison group women. All surveys included questions on mother's diet, exercise, stress, social support, a depression screener, substance use, health concerns, and demographics. For the postnatal period, the surveys also included questions about breastfeeding/infant feeding practices. The surveys were available in English and Spanish. Clinic staff collected data on program participation for the intervention group (weekly vouchers redeemed, classes attended, and lactation counseling visits). Medical record data for both groups were obtained from the clinic's electronic medical record system. These data provided health-related outcome measures on maternal weight gain, infant weight, and child development. Informed consent was obtained for all study participants and a small gift card was offered to the comparison group as an incentive to participate in the study. IRB approval was obtained for the study.

Measures

Primary Outcome Measures Several outcome measures were included in the present study. These measures, representing health outcomes or behaviors conclusively tied to health, are (1) maternal weight gain in pregnancy measured from the first to the last prenatal appointment using IOM standards, (2) breastfeeding at 6 months, (3) infant weight for height in the 85th and/or 95th percentile or higher at 6 and 12 months, (4) upward crossing of ≥2 major weight-for-height percentiles from birth to 6 months, and (5) infant development measured with the Ages and Stages Developmental Questionnaire at 9 months [59–66].

Secondary/Mediating Outcome Measures Mother's diet was assessed using an 8-item index from Starting the Conversation (STC) a brief index recommended for use in a primary care setting [67]. STC is shown to be robust across participant characteristics and demonstrated validity and treatment sensitivity [68]. It includes questions about the frequency of consumption of fruits, vegetables, sugar-sweetened beverages, high-fat foods, desserts, etc.

Mother's alcohol use (past month), tobacco use (past week), and whether there is a smoker in the household were measured using established survey items [69–71]. Mother's exercise in the past week was measured as days exercised for at least 20 min [69].

The surveys also included validated measures of maternal social support (ESSI) [72], the Cohen 4-item Perceived Stress Scale [73, 74], and a two-item depression screener (PHQ-2) [75, 76].

Control Measures Demographic data obtained from the self-administered surveys included mother's age; race/ethnicity; primary language; marital status/cohabitation; household size; insurance coverage; receipt of WIC; receipt of Supplemental Nutrition Assistance Program (SNAP)/food stamps; and preexisting health conditions of diabetes, overweight/obesity, high cholesterol, and/or high blood pressure.

Group	*Intervention (X) and Observation (O)*	*N*
Intervention (G1)	O_{t1} X O_{t2} X O_{t3} X O_{t4} X O_{t5}	32
Comparison (G2)	O_{t1} O_{t2} O_{t3} O_{t4} O_{t5}	29

Fig. 1 Quasi-experimental design

Analytical Plan

All quantitative analyses were conducted with SPSS (22.0) software. The analysis focuses on three issues, (a) comparability of the intervention and comparison groups, (b) program participation rates and factors associated with participation, and (c) differences in the intervention and comparison groups in mediating variables and outcomes. An intent-to-treat design was used when analyzing outcomes. Bivariate statistical tests for differences between the intervention and comparison groups included chi-square for nominal variables, *t* tests for continuous variables normally distributed, and Mann-Whitney *U* tests for continuous variables not normally distributed. Logistic regressions were also run to identify the effect size for the intervention and to control for any baseline differences in the intervention and comparison groups. We use an alpha level ≤.05 for identifying statistically significant differences. However, because of the small sample sizes, particularly for child outcome measures, we report directional effects as well ($\alpha \leq 10$).

Results

Description of Intervention and Comparison Group

Table 1 provides a description of the participants in the intervention and comparison groups. Bivariate statistical tests reveal few differences between the two groups.

Due to small cell sizes, the three-item ordinal scale dietary measures were collapsed into dichotomous measures of consumption (frequent/infrequent) for the comparison between the two groups. The intervention group reported more fat consumption ($p \leq 05$) than the comparison group, but all other dietary measures were similar. There were no differences on exercise, substance use, or living with a smoker. None of the women reported smoking in the past 30 days, so this variable was excluded from the analysis. Regarding demographic characteristics, there was a directional difference ($p \leq .10$) in the two groups on WIC, with the intervention group having lower rates of WIC receipt than the comparison group (measured at baseline). The majority of the intervention and comparison group women were primarily Spanish-speaking (100 %/93 %), married (87 %/70 %), and uninsured (79 %/78 %). Over 80 % of the women in both groups reported no preexisting physical health issues. However, 23 % of the intervention and 18 % of the comparison group women screened positive for depression in their first trimester.

Program Participation

Table 2 provides detailed information on participants' compliance with the program activities.

Table 1 Descriptive profile of intervention and comparison groups

	Intervention (n=32)	Comparison (n=29)	p value
Mean age	28.69	26.70	.126
Married	86.7 %	70.4 %	.132
Mean HH size	3.22	2.93	.353
Spanish-speaking	100.0 %	92.9 %	.307
Uninsured	79.3 %	77.8 %	.574
WIC	38.7 %	60.7 %	.091[d]
SNAP	43.8 %	46.4 %	.835
Diet			
Fast food 1+/week	65.6 %	75.0 %	.429
Fruit 3+/day	56.3 %	65.5 %	.459
Vegetables 3+/day	31.3 %	17.2 %	.204
SSB 1+/day	41.9 %	48.3 %	.622
Protein 3+/day	29.0 %	42.9 %	.268
Chips 2+/week	43.8 %	44.8 %	.933
Sweets 2+/week	25.0 %	41.4 %	.174
Fat some/a lot	67.7 %	41.4 %	.040*
Exercise days past week	1.37	1.67	.596
Live with smoker	6.30 %	7.70 %	.829
Alcohol days/month	.03	.15	.436
Health condition			
Diabetes	0.0 %	0.0 %	–
Overweight/obesity	18.1 %	7.1 %	.187
High cholesterol	3.10 %	7.1 %	.476
High blood pressure	0.00 %	0.00 %	–
Screen positive for depression	22.6 %	17.9 %	.653
Mean stress score	8.07	8.54	.567
Mean social support score	24.45	23.85	.668

*$p \leq .05$; [d] $p \leq .10$

Results reveal wide variation in redemption of the food vouchers. While a sizable percentage of the women redeemed most of the vouchers, a fairly large proportion did not. However, participation in the prenatal classes was high. Approximately 93 % attended the first prenatal class and 91 % attended the second prenatal class. Attendance dropped considerably after birth. Approximately 22 % attended the 1-month, 13 % the 3-month, and 30 % the 4–6-month cooking class after the child's birth. Attendance at the six prenatal cooking classes was high. The average number of cooking classes attended was 4 with a range of 0–6. A plurality of participants (11 or 34 %) attended all six cooking classes. The vast majority of participants received all scheduled lactation consultations.

We also sought to explore characteristics related to program compliance. The only factor associated with program

Table 2 Program compliance among participants

	Percentage	*f* value
Voucher redemption (weeks)		
0–4	12.5	4
5–8	15.6	5
9–12	15.6	5
13–16	9.3	3
17–20	25.0	8
21–24	21.8	7
General classes attended		
Prenatal 1	93.1	27
Prenatal 2	90.6	29
Postnatal 1 month	21.9	7
Postnatal 3 months	12.9	4
Postnatal 4–6 months	29.6	8
Cooking classes attended		
0	6.3	2
1	6.3	2
2	15.6	5
3	12.5	4
4	9.4	3
5	15.6	5
6	34.4	11
Lactation counseling (all four sessions)	87.5	28

participation was age, with older women more likely than younger women to attend the cooking classes. Interestingly, a positive depression screen, stress, and lack of social support were not associated with lower rates of participation in any program activities.

Mediating Factors and Health Outcomes

Table 3 provides the results of the bivariate tests revealing the changes occurring from the first to the third trimester in the mediating variables.

Results reveal that women's diets in both the intervention and comparison groups changed from the first trimester to the third trimester of pregnancy; however, there were improvements in more areas for women in the intervention group. Women in the comparison group increased their vegetable and protein consumption ($p \leq .05$) and evidenced a directional decrease ($p \leq .10$) in their consumption of sugar-sweetened beverages. Women in the intervention group significantly increased their fruit, vegetable, and protein consumption and decreased their reported intake of chips/crackers and fat ($p \leq .05$). Women in the intervention group also had a significant increase in the number of days they exercised in the past week whereas there was no change in this measure for the comparison group.

Women in both groups reported a significant decrease in their stress levels from the first to the third trimester. In addition, women in the intervention group experienced significant reductions in their depression screening scores whereas women in the comparison group did not. In the intervention group, 23 % screened positive for depression in the first trimester but only 7 % screened positive for depression in the third trimester. In the comparison group, 19 % screened positive for depression in the first trimester compared to 15 % in the third trimester.

Table 4 examines key outcome measures for the intervention and comparison groups. Results reveal that women in the intervention group were not less likely than women in the comparison group to have excessive weight gain in their

Table 3 Change in mediating factors during pregnancy (first–third trimester)

	Intervention mean change	*t* value	Comparison mean change	*t* value
Maternal diet				
Fast food	.09	.902	.00	.000
Chips/crackers	−.25	2.273*	.00	.000
Fruit	.22	−2.239*	.00	.000
Vegetables	.28	−2.509*	.36	−2.785**
SSB	-.03	.372	-.18	1.724[d]
Protein	.32	−2.997**	.30	−2.530*
Sweets	−.03	.373	−.07	.701
Fat	−.23	2.041*	−.07	.570
Exercise days/week	2.22	−3.911***	.61	−1.294
Alcohol use	−.03	1.00	−.15	1.443
Positive depression screen	−.16	2.402*	−.04	.440
Stress	−1.64	2.539*	−1.59	2.585*
Social support	.93	−.946	1.46	−1.151

***$p \leq .001$;**$p \leq .01$;*$p \leq .05$; [d] $p \leq .10$

Table 4 Outcomes for intervention and comparison groups

	Intervention	Comparison	X^2	p value
Maternal weight gain			3.358	.187
Over recommended	24.2 % (8)	31.3 (10)		
At recommended	36.4 % (12)	50.0 % (16)		
Under recommended	39.4 % (13)	18.8 % (6)		
Breastfeeding at 6 months			3.375	.066[d]
Yes	79.2 % (19)	54.2 % (13)		
No	20.8 % (5)	45.8 % (11)		
85th % or higher at 6 months			.364	.546
Yes	54.5 % (12)	45.5 % (10)		
No	45.5 % (10)	54.5 % (12)		
95th % or higher at 6 months			.243	.622
Yes	30.4 % (7)	76.2 % (16)		
No	69.6 % (16)	23.8 % (5)		
Crossing 2+ percentiles at 6 months			.001	.915
Yes	4.5 % (1)	5.6 % (1)		
No	95.5 % (21)	94.7 % (18)		
85th % or higher at 12 months			.003	.625
Yes	45.5 % (10)	38.1 % (8)		
No	54.5 % (12)	61.9 %(13)		
95th % or higher at 12 months			.314	.523
Yes	27.3 % (6)	19.0 % (4)		
No	72.7 % (16)	81.0 % (17)		
Ages & stages developmental screen			3.475	.062[d]
Pass	80.0 % (16)	52.4 % (11)		
Borderline/fail	20.0 % (4)	47.6 % (10)		

[d] $p \leq .10$

pregnancies. However, additional chi-square analyses (not shown) revealed that they were more likely than those in the comparison group to gain less than the recommended amount of weight. However, there were no differences (significant or directional) in any of the program's infant weight-related goals (e.g., to reduce obesity risk). Program goals were met of increasing breastfeeding at 6 months and in improving developmental outcomes at 9 months. These differences were directional ($p \leq .10$). However, the effect size for both outcomes is large. For example, bivariate logistic regressions revealed that women in the intervention group were 3.2 times more likely to breastfeed than women in the comparison group and 3.6 times more likely to have infants pass the Ages and Stages Developmental screen than women in the comparison group. We examined these outcomes in logistic regressions, controlling for the two identified differences in the intervention and comparison groups (e.g., fat consumption and WIC receipt). The directional relationship between the intervention and breastfeeding at 6 months was not retained. However, the odds ratio remained high (2.8). Thus, it is difficult to determine whether the initial effect was spurious or if the sample size may be too small to tease out the effects of the three variables reliably. The directional relationship between the intervention and the developmental screen was retained with inclusion of controls, and the odds ratio increased to 5.8. Results are to be interpreted with caution as attrition rates were rather high for child outcomes. Depending upon the infant outcome variable, attrition rates ranged from 24 to 37 %. As discussed previously, women were often very likely to attend their prenatal sessions but less likely to come in for classes and well checks after the child was born. However, the attrition rates did not differ significantly for the intervention and comparison groups.

We also explored factors associated with outcomes. The number of food vouchers redeemed was negatively associated with infant weight measures, and the number of cooking classes attended was associated with an increase in the odds of passing the developmental screen. Further, total class attendance (regular and cooking classes) was directionally related to declines in depression for program participants. No other demographic, behavioral, or psychosocial factors were associated with outcomes.

Discussion

The present study provides the results of a process and outcome evaluation of an early childhood nutrition intervention. This exploratory analysis reveals the feasibility of

implementing a nutrition intervention in a primary care environment serving a low-income Hispanic obstetrics population. The program sought to reduce existing structural and psychosocial barriers to good nutrition faced by women living in resource-poor environments [44]. The intervention attempted to increase access to healthy foods through vouchers and provided instruction in and social support for healthy eating/feeding practices. Program recruiting goals were met and participation in program activities was high. Process measures reveal that women were particularly likely to attend prenatal nutrition classes, cooking classes, and lactation counseling sessions. A sizable percentage of the women redeemed the food vouchers from the local farmers' market; however, there was considerable variation in the levels of compliance with this particular aspect of the program. Participation in classes held in the postnatal period was dramatically lower than that in the prenatal period. In general, results suggest that clinic-based activities provided in the prenatal period (particularly those offered in groups) may be an effective and efficient way to bring more detailed messaging about nutrition to an obstetrics population. Results further reveal that depression, stress, and social support did not correlate with participation in program activities, suggesting that behavioral health programs offered in primary care might benefit women broadly, including some of the most vulnerable subgroups. These findings add to the very sparse literature on program processes for primary care-based early childhood nutrition interventions.

This study also finds that a broad-based nutrition intervention may be able to affect important mediating factors and health outcomes. While women in both the intervention and comparison groups reported improvements in their diets during pregnancy, the intervention group evidenced improvements in more areas. These findings are consistent with, but expand upon, previous research finding that nutrition interventions can contribute to dietary changes among a high-risk sample of pregnant women [50, 51]. We also found that women in the intervention had significant increases in their weekly exercise levels relative to no change in exercise reported by women in the comparison group.

Our study also revealed that approximately one in five women receiving prenatal services at the clinic screened positive for depression in their first trimester. These figures are consistent with other research finding relatively high rates of depression among low-income minority pregnant women [77, 78]. More importantly, we found that the percent of women screening positive for depression declined significantly from the first trimester to the third trimester in the intervention group but not the comparison group. A recent study by Kieffer, Welmarink, and Sinco produced similar outcomes. This study assessed the effects of an educational lifestyle intervention promoting a healthy diet, exercise, and stress management on depression among low-income Hispanic pregnant women [78]. However, no studies have explored the effect of a comprehensive nutrition intervention on the mental health of pregnant women. Research has linked food insecurity and diet with mental health, so it is conceivable that a nutrition intervention that increases access to healthy food could have an effect in this area [79–81]. The effects could also be due to the increases in exercise [82]. Finally, it is possible that the social support provided by the women in the cohort contributed to improvements in mental health and/or behavior changes that led to improved mental health. Ickovics and colleagues conducted a randomized trial of group prenatal visits and hypothesized that the supportive relationships and interactions offered by the group could improve maternal mental health and birth outcomes [83]. They found that group prenatal visits were associated with higher satisfaction with care, increased rates of breastfeeding, and improved perinatal outcomes. They did not find support for their hypothesis that the groups improved mental health. However, their measure of mental health consisted only of prenatal distress, and the groups may not have been as engaging as those formed around an enjoyable activity (e.g., cooking classes). In general, the literature is exceptionally sparse on depression in the prenatal period and targeted interventions. Primary care has traditionally not screened for depression in pregnancy. When depression is detected, medication and therapy are the standard treatment. Given the recent and expanding body of research on the risks to infant development of psychotropic medication use in pregnancy [84–86], research should explore the potential of low-risk alternative interventions such as nutrition, exercise, and/or social support for treating depression in pregnancy.

Regarding key outcome measures, we found a directional (but large) difference in breastfeeding at 6 months (odds ratio (OR)=3.2). This difference became non-significant when we controlled for the two differences in the comparison and the intervention groups (fat consumption and WIC receipt). However, the odds ratio remained high (2.8), suggesting our small sample may have limited our ability to conduct multivariate analyses with this variable. We also found a directional and large effect for the intervention on infant development. Of the infants in the intervention group, 80 % passed the Ages and Stages Developmental Screen compared to 52 % of the infants in the comparison group. Logistic regression analysis further revealed that this effect was retained, and strengthened, (OR= 5.8) with the inclusion of the two controls. The effect on infant development represents a new avenue of investigation on the potential benefits of primary care-based nutrition interventions, which have shown some benefits [50] but not for a broad obstetrics population and not for infant development. While we were impressed with the size of the effect on development, with our sample size we can only speculate as to the underlying cause. We expected the dietary/infant feeding changes but were not necessarily anticipating the declines in depression and increases in exercise. Previous literature suggests that all are plausible

explanations for the improved infant development outcomes observed [22, 87, 88].

The present study has a number of limitations, most notably the lack of randomized assignment to groups. However, we found few differences in the intervention and comparison groups, examining a sizable number of psychosocial, behavioral, and demographic variables. In addition, the program effects on infant development held when controlling for the two differences found (fat consumption and WIC receipt) and attrition rates were comparable for the two groups. Of course this does not preclude other differences between the groups that may have gone unmeasured. The study is also hindered by the small sample size. Thus, the findings are provided as hypotheses for further testing. While few definitive conclusions can be drawn with the current evaluation design and sample size, the magnitude of the effects seen warrants additional investigation. Research on nutrition interventions in health care settings is extremely limited and calls have been made for broadly defined nutrition interventions and more observational data [12, 55]. This study is an initial step in that direction. If primary care nutrition interventions actually have the potential to influence diet, exercise, depression, breastfeeding, and child development, this is a new territory that is imperative to explore.

There is a growing movement to integrate behavioral health into primary care. This is an evidence-based practice with demonstrated effectiveness in treating depression among English- and Spanish-speaking patients [89, 90]. However, practitioners have noted that integrated behavioral health care models are somewhat narrowly defined [91]. Consequently, integrated care is evolving rapidly to accommodate new populations and a broader array of behavioral health issues. This seems inevitable as the model brings a much needed biopsychosocial perspective to healthcare settings [92]. This framework provides a more holistic approach, one designed to address root causes rather than symptoms. In the future, the collaborative partners teaming with physicians will likely not be limited to therapists and psychiatrists, but may include nutritionists, yoga teachers, peer supports, and spiritual advisors. Additional research is needed to guide the evolution of integrated care. Primary care-based nutrition interventions, which view nutrition more broadly than nutrient supplements, address social and psychological barriers to healthy behavior, and which promote prevention rather than treatment, provide a glimpse of the model at its full potential.

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Conflict of Interest The authors Watt, Appel, Lopez, Flores, and Lawhon declare that there are no conflicts of interest.

Compliance with Ethical Standards All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

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