

Changes in Health Behaviors and Self-Rated Health of Participants in Meta Salud

A Primary Prevention Intervention of NCD in Mexico

Catalina A. Denman*, Melanie L. Bell[†], Elsa Cornejo*, Jill Guernsey de Zapien[†], Scott Carvajal[†], Cecilia Rosales[†]

Hermosillo, Sonora, México; and Tucson, AZ, USA

ABSTRACT

Background: Meta Salud was a community health worker–facilitated intervention for the prevention of noncommunicable diseases in Northern Mexico.

Objectives: This analysis examined changes in perceived health, eating habits, and physical activity immediately and 3 months after the intervention. The impact on the resulting behavioral and psychological factors are reported.

Methods: This was a nonrandomized intervention study with 1 baseline and 2 post-intervention follow-ups. Outcome evaluation consisted of anthropometric measurements, laboratory tests, and a lifestyle questionnaire.

Results: The most consistent patterns were increases in metabolic equivalent of task values expended per day from baseline to post-intervention (difference = 996; 95% confidence interval [CI]: 81 to 1,912) and to 3-month follow-up (difference = 1,073; 95% CI: 119 to 2,028); greater likelihood of meeting Centers for Disease Control and Prevention daily exercise recommendations, with an increase from 49% to 60% at post-intervention (OR: 1.6, 95% CI: 1.0 to 2.4) and 63% at follow-up (OR: 1.7, 95% CI: 1.7 to 2.7); lesser likelihood for consuming whole milk, from 38% to 59% (OR: 2.9, 95% CI: 1.8 to 4.7); fewer daily servings of packaged foods, from 0.72 to 0.57 (difference = -0.16; 95% CI: -0.28 to -0.03); fewer days of poor mental health, from 9.3 to 5.8 (difference = -3.4; 95% CI: -5.1 to -1.7); and greater likelihood for reporting good self-rated health, from 41% to 54% post-intervention (OR: 2.1, 95% CI: 1.3 to 3.6) and 57% at follow-up (OR: 2.5, 95% CI: 1.5 to 4.4). Changes in other outcomes, although in the expected direction of association, were not statistically significant.

Conclusions: The study identified important strategies for making feasible dietary changes in the consumption of whole milk, sugary drinks, and packaged foods, yet there is still a need to identify strategies for improving consumption of healthy foods. There was stronger evidence for ways of improving physical activity as opposed to other outcome measures. Overall, it highlights the importance of behavioral and psychosocial factors as key intervention targets in preventing noncommunicable diseases in low- and middle-income countries.

Noncommunicable diseases (NCD) such as cardiovascular diseases (CVD) and diabetes are the primary causes of death in Mexico and constitute a burgeoning public health problem, particularly in northern states such as Sonora [1]. According to the Global Burden of Disease Study, the 4 groups of diseases responsible for 80% of the world's NCD deaths—cardiovascular diseases, cancers, respiratory diseases, and diabetes—have 4 risk factors in common: tobacco use; physical inactivity; the harmful use of alcohol; and unhealthy diets [2]. Mexico has recognized the importance of community-based health promotion efforts to address these risk factors [3], including the key role played by community health workers (CHW) in these efforts, but here, as in other low- and middle-income

countries, development of NCD primary prevention programs led by CHW is incipient and has not yet achieved the level of experience or results documented by programs developed for other health priorities such as human immunodeficiency virus prevention, improving maternal-child health, and other reproductive health programs [4–6]. By implementing and evaluating Meta Salud, a community-based, CHW-led NCD prevention and health promotion program, we provide evidence of the changes achieved by a primary prevention program focused on NCD in Mexico, a country that faces major risk factors for CVD and other NCD due in part to obesity and overweight [7], poor physical activity [8], and poor access to healthy foods and beverages.

The authors report no relationships that could be construed as a conflict of interest.

The Center for Health Promotion in Northern Mexico received funding from the UnitedHealth Chronic Disease Initiative to develop and implement Meta Salud. Components of this research were also supported by the Arizona Prevention Research Center (AzPRC). The AzPRC is a member of the Prevention Research Centers Program, supported by the Centers for Disease Control and Prevention (cooperative agreement 5U48DP001925-05).

Other than funding the project, UnitedHealth Chronic Disease Initiative had no involvement in the study.

From the *Centro de Estudios en Salud y Sociedad, El Colegio de Sonora, Hermosillo, Sonora, México; and the †Mel and Enid Zuckerman College of Public Health, University of Arizona, Tucson, AZ, USA.
Correspondence: C. A. Denman (cadenman@colson.edu.mx).

GLOBAL HEART
© 2015 World Heart Federation (Geneva).
Published by Elsevier Ltd.
All rights reserved.
VOL. 10, NO. 1, 2015
ISSN 2211-8160/\$36.00.
<http://dx.doi.org/10.1016/j.ghheart.2014.12.007>

In this article we seek to understand the changes in health behavior associated with biomarker improvements and to gain insight on ways to strengthen intervention approaches. The quantitative analysis was complemented by qualitative data collected from 3 sources: feedback from CHW about their experience from facilitating the education sessions; participant evaluation of the program; and research team field notes. All helped to improve our understanding of the relationships among intervention, context, and results.

METHODS

Meta Salud is a 13-week NCD prevention and health promotion program developed by the Center for Health Promotion in Northern Mexico, a collaborative endeavor of El Colegio de Sonora (located in Hermosillo, Sonora, Mexico) and the University of Arizona Zuckerman College of Public Health (located in Tucson, AZ, USA). The center contributes to creating and strengthening healthy environments for the population in Northern Mexico at the individual, family, and socioecological levels, based on a perspective grounded in the social sciences, public health, and sociocultural epidemiology. The center also focuses on building healthy communities in Arizona and other U.S. border regions and in U.S. metropolitan areas with large Latino populations. Center activities include the development and evaluation of models and program curricula for the primary prevention of chronic diseases and for health promotion in general; training of graduate (masters and doctoral) and post-doctoral researchers, as well as development and implementation of health promotion education programs for CHW and other health care providers; and public health policy advocacy aimed at improving public infrastructure to promote healthy lifestyles, institutionalizing and sustaining evidence-based health promotion programs and strategies, facilitating the creation of a transborder network and continuous public health policy forum for CHW, as well as dissemination of research and program results through policy briefs, academic articles and presentations, and participation in the popular press.

The Meta Salud program includes weekly 2-h educational sessions and a physical activity group. The educational sessions provide information on heart health, physical activity, type 2 diabetes, fat and cholesterol, sodium, glucose and sugar, maintaining a healthy weight, building a healthy community, preparing healthy foods on a budget, smoking cessation, and emotional well-being. Session activities are designed to motivate change using a participative methodology that promotes the adoption of healthy lifestyle behaviors. Program implementation materials are available at <http://sitios.colson.edu.mx/metasalud/>.

Meta Salud was adapted for the northern region of Mexico, which borders the United States, from previous evidence-based programs (Su Corazón, Su Vida [9], and Pasos Adelante [10]), and piloted in Hermosillo, Sonora, Mexico, during 2011 and 2012. The intervention was

carried out during 2 intervention cycles in 4 community health centers managed by the Mexican State of Sonora's Health Ministry. Sessions were facilitated by 9 CHW employed by the Health Ministry and trained specifically for the intervention. Each intervention cycle consisted of 4 community intervention groups, thus totaling 8 groups. Each intervention group was facilitated by a team of 2 CHW who recruited 15 to 20 people to participate in the program. At the beginning of the first session, the research team discussed the study aims and protocol, and then obtained informed consent from the group participants, taking care to answer questions and clarify information. Participation in the evaluation study was not required for enrollment in the program.

The pilot intervention was evaluated by research staff using both quantitative and qualitative measures at baseline, program conclusion, and 3-month follow-up. Outcome evaluation consisted of anthropometric measurements (height, weight, and waist and hip circumferences) and laboratory tests, which measured blood glucose, cholesterol, and triglycerides, as well as administering a questionnaire designed to collect information on lifestyle, physical activity, and dietary habits. These anthropometric and laboratory data have been analyzed and published elsewhere [11]. The intervention also included a process evaluation based on data from field notes maintained by the research team members, CHW self-evaluations, and participant satisfaction surveys. This article reports the analyses of data (including changes in perceived health, eating habits, and physical activity) from the outcome evaluation questionnaire.

The instrument to evaluate Meta Salud drew from the same questionnaire used to evaluate Pasos Adelante [12], which included questions from similar surveys such as the Centers for Disease Control and Prevention's (CDC) Behavioral Risk Factor Surveillance Survey, the Minnesota Leisure Time Physical Activity Questionnaire, and the Center for Epidemiological Studies Depression Scale. The questionnaire included sections covering participants' demographic information, extent of physical activity carried out, eating habits (consumption of fruits, vegetables, sugar, fat, and salt), perceived physical and mental health status, previously diagnosed illnesses, and access to health care services. For the Meta Salud implementation in Mexico, questions were added from the Encuesta Nacional de Adicciones 2002 (National Substance Use Survey) to assess changes in tobacco and alcohol consumption. Furthermore, during the implementation of the intervention, we became aware, through our qualitative evaluation, that some participants were making changes in habits not captured in the questionnaire: specifically, reducing consumption of high-sodium packaged foods and broth cubes, cooking refried beans with oil instead of lard, and switching from wheat flour tortillas (made with lard) to corn flour tortillas (made with water). Thus, we decided to assess these changes during the final intervention cycle ($n = 65$).

Statistical methods

Primary analysis. This was a nonrandomized intervention study with 1 baseline and 2 post-intervention follow-ups (immediately and at 3 months post-intervention).

Linear mixed models were used to estimate the differences between baseline and both follow-ups for all continuous outcomes, adjusting for age, and using participants as a random effect to account for within-subject correlation due to repeated measurements. Generalized linear logistic mixed models were used for all binary variables, with odds ratios computed to compare post-intervention values to baseline values. Time was used as a categorical variable, which reduces the likelihood of model misspecification [13]. All available outcome data were used within the mixed models, which are robust in the presence of missing data [14].

We graphed odds ratios for binary outcomes and the standardized mean difference of first follow-up and baseline for each continuous outcome. The standardized mean difference was computed as the difference in means divided by the standard deviation of the mean difference.

Sensitivity. We performed several sensitivity analyses to assess the robustness of the results to the following: 1) skewness; 2) missing data; and 3) outliers. Multiple imputation, using all outcomes and key demographics were performed. Because many of the continuous outcomes were skewed, we tested the logarithm of the outcome + 1. Additionally, we excluded 7 observations where the number of weekly metabolic equivalent of task (MET) value was >20,000 (~6 h of vigorous exercise per day) and retested.

All analyses were performed using SAS (version 9.4, SAS Institute, Cary, NC, USA).

RESULTS

For the intervention, 265 participants were recruited from low-income neighborhoods, 184 consented to participate in the evaluation, and 166 successfully completed the program (see Fig. 1). There were few missing outcome data. Of the 184 consented participants, 171 (95%) were assessed at baseline, 176 (98%) were assessed at the intervention conclusion, and 152 (84%) completed the 3-month follow-up.

Demographics

Meta Salud participants tended to be female and married; the average age was 41.5 years; and most were born in the state of Sonora (see Table 1). Most had a middle school-level education (grade 9), were currently unemployed outside the home, and had lived in the community for >10 years. Almost all had health care coverage from 1 of the institutions within the Mexican health care system, particularly through the Instituto Mexicano del Seguro Social (Mexican Social Security System), which covers workers and their families, and the Seguro Popular

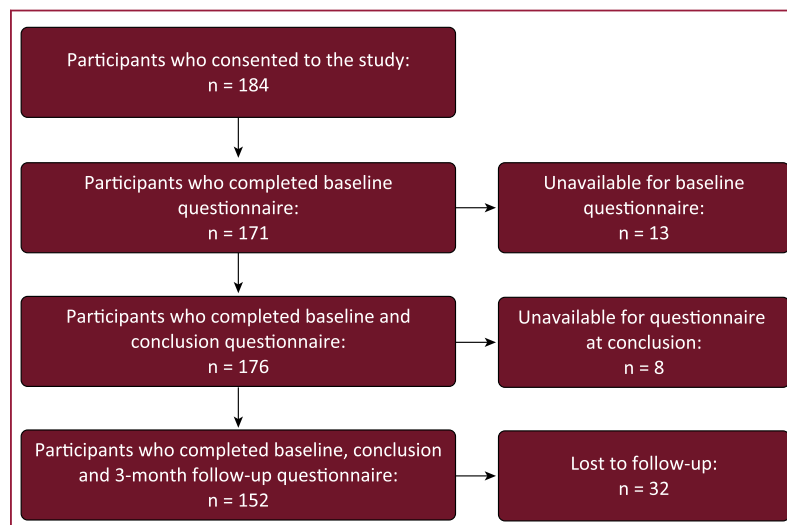


FIGURE 1. Flow diagram of participants in the evaluation study for Meta Salud, a 13-week community-based program for the primary prevention of chronic disease conducted in Hermosillo, Sonora, Mexico, 2011–2012.

(Popular Insurance), provided by the Mexican Health Ministry to the uninsured population. More than one-half of the participants reported having a close family member diagnosed with diabetes, and 17% had been diagnosed with diabetes themselves. Based on body mass index, 30% were overweight and 47% were obese. Seven percent had been previously diagnosed with heart disease, 30% with high blood pressure, 22.2% with high cholesterol, 7% with asthma, and 15.8% were current smokers.

Primary results

There were increases from baseline to the conclusion of the intervention in the following: the number of MET expended per day (difference = 996; 95% confidence interval [CI]: 81 to 1,912); the proportion of participants that met CDC daily exercise recommendations, with an increase from 49% at baseline to 60% (odds ratio [OR]: 1.6, 95% CI: 1.0 to 2.4); daily fruit servings from 0.95 to 1.26 (difference = 0.31; 95% CI: 0.12 to 0.50); daily vegetable servings from 0.84 to 1.0 (difference = 0.16; 95% CI: 0.02 to 0.30); the proportion of participants that avoided the consumption of whole milk, from 38% to 59% (OR: 2.9, 95% CI: 1.8 to 4.7); and the proportion of participants that reported good general health, from 41% to 54% (OR: 2.1, 95% CI: 1.3 to 3.6). There were decreases in the daily consumption of sugary drinks, from 2.1 to 1.6 (difference = -0.43; 95% CI: -0.84 to -0.01); servings of packaged foods, from 0.72 to 0.57 (difference = -0.16; 95% CI: -0.28 to -0.03); and report of poor mental health days per month, from 9.3 to 5.8 (difference = -3.4; 95% CI: -5.1 to -1.7).

There were increases from baseline to the 3-month follow-up in the following: the number of MET

TABLE 1. Demographic and health status characteristics of participants

	No. of Baseline Participants (n = 171)*	Percentage
Age, yrs, mean ± SD	41.5 ± 10.6	
Female sex	168	97
Marital status		
Married	147	85
Single/divorced/widowed	24	15
Education		
Some elementary	27	16
Completed elementary	26	15
Some high school	100	59
Completed high school	11	6
Post-high school	7	4
Currently employed	62	36
Health insurance	167	98
Length of residence in community		
<5 yrs	8	5
6–10 yrs	14	8
>10 yrs	149	87
Born in Sonora	126	74
Family members with diabetes	105	61
Diagnosed with diabetes	29	17
Length of time with diabetes		
<1 yr	6	21
1–5 yrs	7	24
6–10 yrs	6	21
>10 yrs	7	24
Not known	3	10
BMI, kg/m ²		
<25	24	14
25–29.9	52	30
30–39.9	81	47
>40	17	10
Heart disease	12	7
High blood pressure	52	30
High cholesterol	38	22.2
Asthma	12	7
Current smoker	27	15.8

BMI, body mass index.
*Although there were 184 patients who initially consented in the study, only 171 participants completed the baseline survey. Percentages may not add to 100 due to rounding.

expended per day (difference = 1,073; 95% CI: 119 to 2,028); the proportion of participants meeting CDC daily exercise recommendations (OR: 1.7, 95% CI: 1.7 to 2.7); the proportion of participants that stopped consumption of whole milk (OR: 2.1, 95% CI: 1.3 to 3.4); and the proportion of participants that reported good general health (OR: 2.5, 95% CI: 1.5 to 4.4). There were decreases from baseline to 3-month follow-up in the following: proportion of participants that consumed whole milk (OR: 0.47, 95% CI: 0.19 to 0.78); daily consumption of sugary drinks (difference = -0.73; 95% CI: -1.19 to -0.30); daily servings of packaged foods (difference = -0.24; 95%

CI: -0.36 to -0.11); and report of poor mental health days per month (difference = -3.4; 95% CI: -5.2 to -1.6).

There was no evidence of changes from baseline to the conclusion of the intervention or 3-month follow-up in daily sitting, daily walking, use of olive or canola oil for cooking, corn tortilla use, oil used to cook beans (instead of solid fats), and poor physical health days. Nor were there evidence of changes in the number of days of inability to perform regular activities due to poor health at immediate post-intervention and daily vegetable servings or fruit servings at follow-up. See [Table 2](#) and [Figures 2](#) and [3](#).

Sensitivity

Results from the sensitivity analysis using multiple imputation for missing data were consistent with the primary analysis, in magnitude of effect as well as statistical significance. Results from the sensitivity analyses (assessing the skewness of the data) were mostly consistent with the primary analyses. The exceptions were that the daily fruit servings' p value changed from 0.2 to 0.04 at follow-up, with an estimated difference of 0.09 log servings (95% CI: -0.15 to 0.002); and MET, where the p value changed from 0.03 at both time points in the original analysis to 0.08 (difference = 0.39; 95% CI: -0.05 to 0.82) for the change in log MET from baseline to post-intervention and p = 0.2 for the change in log MET from baseline to 3-month follow-up (difference = 0.32; 95% CI: -0.14 to 0.77) in the sensitivity analysis where the log-transform was used. When the 7 observations with very high MET (>20,000) were excluded, however, the results remained significant at p = 0.02 (difference = 874; 95% CI: 115 to 1,633) for post-intervention and p = 0.02 for follow-up (difference = 970; 95% CI: 181 to 1,759). All other p values either remained the same or were smaller, indicating robust results.

DISCUSSION

Results published previously in *Preventing Chronic Disease* [11] provide documentation as to the effectiveness of the Meta Salud intervention in terms of targeted clinical changes, such as reduction in body mass index, waist and hip circumferences, and glucose and cholesterol levels, among others.

The current study's findings show there were significant improvements in multiple outcome measures at both immediate and 3-month post-intervention assessments: reported MET; CDC-recommended physical activity guidelines; and good self-rated health. There were also significant decreases in consumption of whole milk, sugary drinks, packaged foods, and days of poor mental health for both time periods. We did not see a significant increase in fruit or vegetable consumption beyond the immediate post-intervention assessment.

In terms of physical activity, we observed an increase in MET and achievement of CDC-recommended guidelines

TABLE 2. Outcomes for Meta Salud, a 13-week program for the primary prevention of chronic disease carried out in Hermosillo, Sonora, Mexico, 2011–2012

	Baseline (n = 171)	Conclusion (n = 176)	3-Month Follow-Up (n = 152)		p Value	Follow-Up – Baseline	p Value	Overall p Value*
				Conclusion – Baseline				
Physical activity								
Sitting, min/day	170.7 ± 112.7	187.7 ± 168.6	167.5 ± 138.2	17.8 (–7.1 to 42.6)	0.2	0.76 (–25.5 to 26.9)	1.0	0.03
Walking, min/day	37.7 ± 80.4	34.6 ± 52.4	30.8 ± 55.5	–3.1 (–15.4 to 9.3)	0.6	–6.9 (–19.8 to 6.0)	0.3	0.6
MET/week	2,961 ± 3,931	3,957 ± 4,832	4,034 ± 5,172	996 (81–1,912)	0.03	1,073 (119–2,028)	0.03	0.04
CDC recommended exercise/day	49	60	63	1.6 (1.0–2.4)	0.04	1.7 (1.1–2.7)	0.02	0.03
Nutrition								
No whole milk	38	59	53	2.9 (1.8–4.7)	<0.0001	2.1 (1.3–3.4)	0.004	<0.0001
Sugary drinks/day	2.1 ± 2.5	1.6 ± 2.5	1.3 ± 2.4	–0.43 (–0.85 to –0.01)	0.04	–0.73 (–1.19 to –0.30)	0.001	0.004
Olive or canola oil for cooking	5	10	9	2.1 (0.9–4.9)	0.1	2.06 (0.86–4.94)	0.2	0.2
Vegetable servings/day	0.84 ± 0.64	1.0 ± 0.87	0.89 ± 0.71	0.16 (0.02–0.30)	0.03	0.05 (–0.10 to 0.20)	0.5	0.09
Fruit servings/day	0.95 ± 0.78	1.26 ± 1.37	0.80 ± 0.77	0.31 (0.12–0.50)	0.002	–0.14 (–0.34 to 0.06)	0.2	<0.0001
Packaged food servings/day [†]	0.72 ± 0.40	0.57 ± 0.50	0.49 ± 0.48	–0.16 (–0.28 to –0.03)	0.01	–0.24 (–0.36 to –0.11)	0.0002	0.001
Corn tortilla use [†]	71	74	67	1.59 (0.66–3.88)	0.3	1.19 (0.49–2.89)	0.7	0.6
Oil used to cook beans (instead of solid fats) [†]	58	65	64	1.33 (0.51–3.47)	0.6	1.62 (0.60–4.38)	0.3	0.6
General health								
Poor physical health days/month	9.1 ± 10.4	7.5 ± 9.8	8.4 ± 9.7	–1.5 (–3.2 to 0.2)	0.09	–0.69 (–2.5 to 1.1)	0.4	0.2
Poor mental health days/month	9.3 ± 10.8	5.8 ± 9.6	5.8 ± 8.1	–3.4 (–5.1 to –1.7)	0.0001	–3.4 (–5.2 to –1.6)	0.0003	<0.0001
Good health	41	54	57	2.1 (1.3–3.6)	0.005	2.5 (1.5–4.4)	0.001	0.002
No. of days unable to perform regular activities due to poor health	2.5 ± 5.5	2.1 ± 4.24	1.5 ± 3.4	–0.40 (–1.3 to 0.51)	0.4	–1.1 (–2.0 to –0.1)	0.03	0.09

Descriptive statistics at baseline, program conclusion and 3-month follow-up, with changes from baseline or odds ratios. Values are mean ± SD or percentage and difference or odds ratio (95% confidence interval).
 CDC, Centers for Disease Control and Prevention; CI, confidence interval; MET, metabolic equivalent of task.
 *Overall F-test for time variable.
 †n = 65.

for physical activity, though no changes in some other outcomes related to sedentary behavior. This was probably because the intervention has a specific physical activity component required as part of program participation. The weekly education sessions include 10 to 20 min of physical activity, and participants were encouraged to form a walking group that meets several times a week. During the time of the intervention, Zumba and other dance-based fitness programs were popular in the city of Hermosillo. These classes were provided free by the municipal government in many parks around the city. This activity became an attractive option to the walking group suggested as part of the Meta Salud program. However, perhaps the lack of changes in daily sitting and daily walking (beyond the post-test) may speak directly to the issue of accessibility to green spaces in the community, a lack of infrastructure

that promotes walking [15], including sidewalks and lighting, and a general climate of insecurity in many low-income neighborhoods. Climatic issues are also a challenge in Sonora; in Hermosillo, the average daily high temperature during spring and summer is 37°C and has reached as high as 49.5°C during the summer [16].

In terms of changes in dietary habits, it appears feasible to reduce consumption of whole milk, sugary drinks, and packaged foods—all of which are available in both the large supermarkets as well as the small convenience stores throughout Mexico. The intervention clearly outlines strategies for making changes that were relatively easy to implement. Much more challenging are the areas of cooking oils and consumption of fruits and vegetables, which does not come close to the 5-serving threshold recommended for preventing CVD [17]. This may be

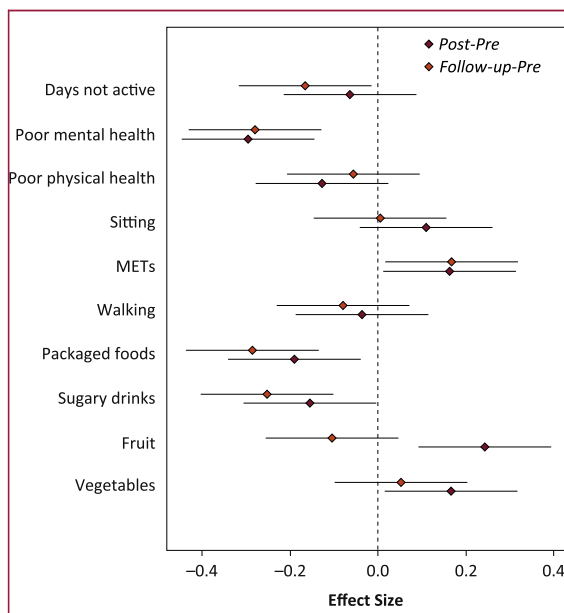


FIGURE 2. Standardized effect sizes for each outcome comparing pre- and post-intervention, and 95% confidence intervals. MET, metabolic equivalent of task.

attributed to the lack of comparative cost of healthy food options in Mexico [18]. More innovative and meaningful strategies in these arenas need to be developed, including addressing the aggressive marketing and lobbying tactics of the food industry [19].

The increase in days of good health and decrease in days of poor mental health may speak to the overall impact of the integrated social support model within the intervention, a component that may work beyond initiating individual changes in health behaviors. There are health benefits associated with the feeling of belonging to a group that provides support and opportunities to socialize, although we had difficulty maintaining participation. Among program participants, 61% had a family member with diabetes and 17% had diabetes themselves, which may have been a motivation to join and stay in the program. However, the question remains of how to recruit and maintain participants who do not perceive themselves to be at risk for NCD, even though they may be overweight. Furthermore, our qualitative evaluation and questionnaire results point to the need to examine whether the habits acquired during the program were maintained beyond the 3-month follow-up.

Study limitations

Study limitations included the lack of a control group, as well as difficulties recruiting men and maintaining program participation—which affected missing data—due to issues such as lack of child care, conflicting work schedules, lack of transportation, family emergencies, or an inability to commit to a 13-week program.

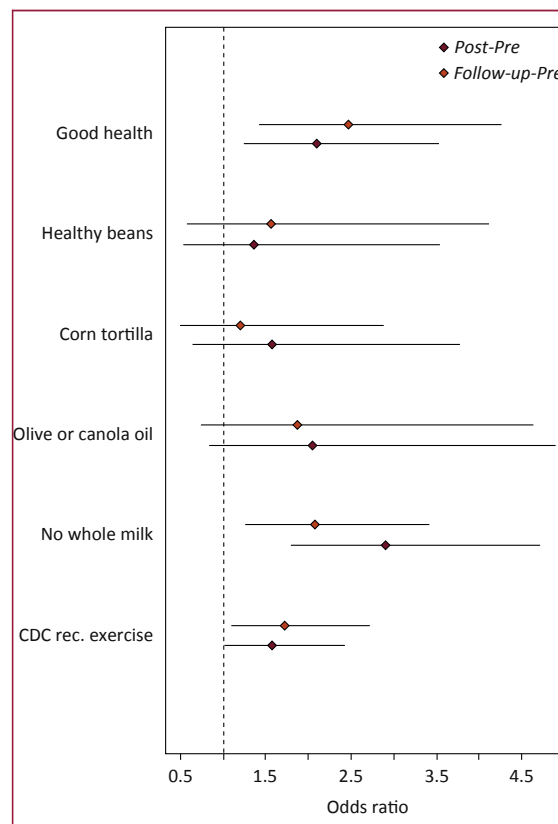


FIGURE 3. Odds ratios for each binary outcome comparing pre- and post-intervention, and 95% confidence intervals. CDC, Centers for Disease Control and Prevention; rec, recommended.

CONCLUSIONS

The Meta Salud intervention provides an opportunity to look closely at those reported health behaviors that may explain positive biological changes. The intervention positively affected many targeted behaviors and positive psychosocial outcomes and may be improved by incorporating other strategies for increased fruit and vegetable consumption, changes in cooking oils, and changes in daily sitting and daily walking. However, to do this, we need to further expand our focus beyond individual- and family-level prevention. Although downstream determinants are important (these include changes in behaviors and are most frequently what interventions target), more upstream social determinants might be the focus and priority of research agendas in an effort to extend the currently observed health gains. Therefore, a wider public health policy approach, promoting structural changes and addressing multiple and interrelated individual and environmental conditions that promote health [20], including an analysis of food industry lobbying and unfair trade policies [21], should be considered imperative adjuncts to individually focused preventive intervention strategies. Only then will we be able to optimally design programs to

improve health promotion and NCD prevention in low- and middle-income countries.

ACKNOWLEDGMENTS

The authors would like to also acknowledge the Secretaría de Salud del Estado de Sonora [Sonora State Health Ministry] for supporting community health worker recruitment and overall intervention logistics, as well as the research staff who participated in the study: Diana Munguía and Karla Robles (El Colegio de Sonora), and Tanyha Zepeda (University of Arizona).

REFERENCES

- Gutierrez JP, Rivera-Dommarco J, Shamah-Levy T, et al. Encuesta Nacional de Salud y Nutrición 2012: Resultados nacionales. 2nd ed. Cuernavaca, Mexico: Instituto Nacional de Salud Pública. Available at: <http://ensanut.insp.mx/informes/ENSANUT2012ResultadosNacionales.pdf>; 2013. Accessed September 15, 2014.
- Lim SS, Vos T, Flaxman AD, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012;380:2224–60.
- Santos-Burgoa C, Rodríguez-Cabrera L, Macedo de la Concha E, Álvarez-García E, Cebrián Gómez A. Healthy Communities Program. *Prev Chronic Dis* 2009;6:A31. Available at: http://www.cdc.gov/pcd/issues/2009/jan/08_0081.htm. Accessed September 15, 2014.
- Lewin S, Munabi-Babigumira S, Glenton C, et al. Lay health workers in primary and community health care for maternal and child health and the management of infectious diseases. *Cochrane Database Syst Rev* 2010;3:CD004015.
- Singh P. One Million Community Health Workers. Technical Task Force Report. New York: Earth Institute, Columbia University. Available at: http://1millionhealthworkers.org/files/2013/01/1mCHW_TechnicalTaskForceReport.pdf; 2011. Accessed September 15, 2014.
- Bhutta ZA, Lassi ZS, Pariyo G, Huicho L. Global Experience of Community Health Workers for Delivery of Health Related Millennium Development Goals: A Systematic Review, Country Case Studies, and Recommendations for Integration Into National Health Systems. Geneva: Global Health Workforce Alliance, World Health Organization. Available at: <http://www.who.int/workforcealliance/knowledge/resources/chwreport/en/>; 2010. Accessed September 15, 2014.
- Barquera S, Campos-Nonato I, Hernández-Barrera L, Pedroza A, Rivera-Dommarco JA. Prevalencia de obesidad en adultos mexicanos, 2000–2012. *Salud Publica Mex* 2013;55:S151–60. Available at: <http://www.scielo.org.mx/pdf/spm/v55s2/v55s2a12.pdf>. Accessed September 15, 2014.
- Medina C, Barquera S, Janssen I. Encuesta Nacional de Salud y Nutrición 2012: Resultados de Actividad Física y Sedentarismo en Personas de 10 a 69 Años. Mexico: Instituto Nacional de Salud Pública. Available from: <http://ensanut.insp.mx/doctos/analiticos/ActividadFisica.pdf>; 2012. Accessed September 15, 2014.
- Balcázar HG, de Heer H, Rosenthal L, et al. A promotores de salud intervention to reduce cardiovascular disease risk in a high-risk Hispanic border population. *Prev Chronic Dis* 2010;7:A28. Available at: http://www.cdc.gov/pcd/issues/2010/mar/09_0106.htm. Accessed September 15, 2014.
- Staten LK, Cutshaw CA, Davidson C, Reinschmidt K, Stewart R, Roe DJ. Effectiveness of the Pasos Adelante chronic disease prevention and control program in a US-Mexico border community, 2005–2008. *Prev Chronic Dis* 2012;9:E08. Available at: <http://dx.doi.org/10.5888/pcd9.100301>. Accessed September 15, 2014.
- Denman CA, Rosales C, Cornejo E, et al. Evaluation of the community-based chronic disease prevention program Meta Salud in Northern Mexico, 2011–2012. *Prev Chronic Dis* 2014;11:E154. Available at: <http://dx.doi.org/10.5888/pcd11.140218>. Accessed September 15, 2014.
- Staten LK, Scheu LL, Bronson D, Peña V, Elenes J. Pasos Adelante: the effectiveness of a community-based chronic disease prevention program. *Prev Chronic Dis* 2005;2:A18. Available from: http://www.cdc.gov/pcd/issues/2005/jan/04_0075.htm. Accessed September 15, 2014.
- Mallinckrodt CH, Lane PW, Schnell D, Peng Y, Mancuso JP. Recommendations for the primary analysis of continuous endpoints in longitudinal clinical trials. *Therapeutic Innovation & Regulatory Science* 2008;42:303–19.
- Bell ML, Fairclough DL. Practical and statistical issues in missing data for longitudinal patient-reported outcomes. *Stat Methods Med Res* 2014;23:440–59.
- Lara-Valencia F, García-Pérez H. Space for equity: socioeconomic variations in the provision of public parks in Hermosillo, Mexico. *Local Environment: The International Journal of Justice and Sustainability* 2015;20:350–68.
- Servicio Meteorológico Nacional. Normales Climatológicas 1981–2010. Available from: <http://smn.cna.gob.mx>. Accessed September 15, 2014.
- Wang X, Ouyang Y, Liu J, et al. Fruit and vegetable consumption and mortality from all causes, cardiovascular disease, and cancer: systematic review and dose-response meta-analysis of prospective cohort studies. *BMJ* 2014;349:g4490.
- León M. Ven acceso limitado a alimentos saludables. El Universal website. November 2, 2013. Available at: <http://www.eluniversal.com.mx/nacion-mexico/2013/impreso/ven-acceso-limitado-a-alimentos-saludables-210456.html>. Accessed September 15, 2014.
- Calvillo A. ¿Bebidas adulteradas con sello nutrimental? El poder del consumir. August 18, 2014. Available at: <http://elpoderdelconsumidor.org/saludnutricional/bebidas-adulteradas-con-sello-nutrimental/>. Accessed September 15, 2014.
- Cohen DA, Scribner RA, Farley TA. A structural model of health behavior: a pragmatic approach to explain and influence health behaviors at the population level. *Prev Med* 2000;30:146–54.
- Kishore S. NCDs: can we and should we not do better? *Lancet Global Health Blog*. August 26, 2014. Available at: <http://globalhealth.thelancet.com/2014/08/26/ncds-can-we-and-should-we-not-do-better>. Accessed September 15, 2014.