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Social support and physical activity change in Latinas: Results from the *Seamos Saludables* trial

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Abstract

Objective—Family responsibilities and poor social support are barriers to physical activity among Latinas. This study evaluated the effects of a home- and print-based intervention on social support, moderating effects of familial ties on support and moderate-to-vigorous physical activity (MVPA), and mediating effects of support on MVPA.

Methods—Participants were randomized to receive through the mail either individually tailored physical activity intervention or general wellness print materials. Familial ties and social support were assessed by marital and child status and the social support for physical activity measure, respectively. MVPA was measured using the 7-day Physical Activity Recall Interview and accelerometer. Assessments were conducted at baseline, 6 months post-treatment, and 12 months follow-up.

Results—Participants (n=266; 40.6 ± 9.9 years old) were mostly immigrant and Spanish-speaking Latinas. The intervention group achieved greater increases in family and friend support compared to the wellness control group from baseline to post-treatment and follow-up (p<0.05). Intervention changes in support did not depend on marital or child status. The intervention also increased minutes per week of MVPA more than the wellness control (p<0.05) and the effect did not depend on marital or child status. There were significant indirect effects of treatment, indicating the intervention achieved greater increases in MVPA by increasing family (ab=5.21, SE=2.94, 95% CI=0.91–14.11) and friend (ab=6.83, SE=5.15, 95% CI=0.16–20.56) support.

Conclusions—The intervention improved and sustained support from family and friends and MVPA irrespective of familial ties. Social support mediated increases in MVPA.

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INTRODUCTION

Physical activity is important for chronic disease prevention (U.S. Department of Health & Human Services, 1996). Latinas have disproportionately high rates of physical inactivity (Pleis, Ward, & Lucas, 2010) and concomitant diseases such as obesity and type 2 diabetes (Flegal, Carroll, Kit, & Ogden, 2012; Harris et al., 1998), which are of public health concern considering that Latinas comprise the largest ethnic minority group in the United States (Ennis, Rios-Vargas, & Albert, 2010). Given the health benefits associated with physical activity, it is critical to identify and address factors that promote and hinder physical activity in Latinas.

Social ties are associated with physical activity in Latinas. Several large observational studies have found that familial ties such as being married or having children at home increase the risk of physical inactivity (Dowda, Ainsworth, Addy, Saunders, & Riner, 2003; Ham, Yore, Kruger, Heath, & Moeti, 2007; Marshall et al., 2007; Neighbors, Marquez, & Marcus, 2008). Compared to non-Hispanic White women, Latinas are less likely to participate in leisure time physical activity but more likely to engage in household or caregiving activities (Sternfeld, Ainsworth, & Quesenberry, 1999; Willey, Paik, Sacco, Elkind, & Boden-Albala, 2010). Family responsibilities, lack of childcare, and poor spousal support are consistently cited as barriers to physical activity among Latinas (D'Alonzo, 2012; Evenson, Sarmiento, Macon, Tawney, & Ammerman, 2002; Martinez, Arredondo, Perez, & Baquero, 2009; Parra-Medina & Hilfinger Messias, 2011; Van Duyn et al., 2007). In contrast, non-familial or friendship ties have been positively associated with physical activity. For example, having fewer friends increases the odds of physical inactivity (Willey et al., 2010). Moreover, Latinas who are physically active report that they know people who exercise or belong to community or faith-based groups, indicating that physical activity is a means of social interaction (Evenson, Sarmiento, Tawney, Macon, & Ammerman, 2003; Pescatello, Alonso, Schaffino, & Leavitt, 2008; Wilbur, Chandler, Dancy, & Lee, 2003).

In addition to being part of a social network, receiving social support from family and friends has also been linked to physical activity in Latinas. As opposed to simply having social ties, social support refers to the provision of informational, instrumental, or emotional resources from one’s social network which benefit health. While a national survey of middle- and older-aged Latinas reported that support from family and friends contribute similarly to physical activity (Eyler et al., 1999), other studies have found only friend support to be related to greater leisure time- and vigorous physical activity (Hovell et al., 1991; Marquez & McAuley, 2006).

Intervention studies have aimed to address social support as a way to promote physical activity. Walking groups, aerobic exercise classes, and exercise partners have been common strategies to increase physical activity (Bopp, Fallon, & Marquez, 2011; Grassi, Gonzalez, Tello, & He, 1999; Harralson et al., 2007; Hovell et al., 2008; Keller & Cantue, 2008; Poston

et al., 2001). Although social support offered through these programs improves physical activity in participants, there is evidence suggesting that physical activity regresses post-treatment when contact wanes (Castro, Sallis, Hickmann, Lee, & Chen, 1999; Keller et al., 2014). In addition, while physical activity programs address barriers such as providing opportunities or access to facilities for physical activity, participation and retention are affected by caregiving responsibilities and spousal support (Avila & Hovell, 1994; Collins, Lee, Albright, & King, 2004; Grassi et al., 1999; Harralson et al., 2007; Hovell et al., 2008; Poston et al., 2001). Given the need for interventions to consider the role of interpersonal support, it is important to examine whether alternative approaches such as home-based interventions with minimal study contact could help Latinas improve social support for physical activity from their existing personal networks and whether this support would influence physical activity engagement.

Seamos Saludables was a home-based intervention using print materials delivered through regular mailings to Spanish-speaking Latinas (Marcus et al., 2013; Pekmezi et al., 2012). The individually tailored intervention incorporated theoretical constructs from Social Cognitive Theory and the Transtheoretical Model to help address barriers and encourage adoption and maintenance of physical activity. Results from the study demonstrated that the intervention group significantly increased and maintained moderate-to-vigorous physical activity (MVPA) compared to a wellness control group (Marcus et al., 2013). The purpose of the current study is to evaluate the effects of the intervention on social support, whether the intervention was equally effective for those with spouses and children, and whether changes in MVPA were mediated by changes in social support.

METHODS

Study Design

Data for the present study were taken from *Seamos Saludables*, a randomized controlled trial (n=266) of a culturally and linguistically adapted, individually tailored print-based physical activity intervention for Latinas compared to a contact control group receiving wellness materials (Marcus et al., 2013; Pekmezi et al., 2012). Materials were delivered through the mail on the same schedule to both groups. The main trial outcome was change in MVPA from baseline to 6 months (post-treatment). Participants were assessed for maintenance of physical activity at 12 months (follow-up). Semi-structured interviews were conducted at follow-up with a subgroup of participants to elicit feedback on the program and elaboration on the influence of familial ties and social support on physical activity. Childcare or reimbursement for childcare was provided to participants attending each of the three measurement visits.

Sample

Participants were women (age 18–65 years) who resided in the Northeastern United States (U.S.) and self-identified as Hispanic/Latino. All participants were underactive, defined as participating in less than 60 minutes of MVPA per week. Eligibility was determined via a phone screener using criteria from the Physical Activity Readiness Questionnaire, a measure developed by the American College of Sports Medicine to determine safety of adopting

unsupervised activity. The complete inclusion and exclusion criteria were published elsewhere (Pekmezi et al., 2012). The study was approved by the Brown University Institutional Review Board, and all participants gave informed consent.

Intervention

Tailored intervention—Based on Social Cognitive Theory and the Transtheoretical Model, the intervention emphasized behavioral strategies for increasing physical activity. During the baseline visit, participants in the intervention group received physical activity education, learned to set realistic physical activity goals, and problem-solved anticipated barriers to physical activity. Participants also received pedometers and physical activity logs to encourage self-monitoring of physical activity behavior. The intervention included regular mailings (four mailings in month 1, two in months 2–3, and one in months 4–6, along with maintenance doses in months 8 and 10) of motivation-matched manuals and individually tailored feedback reports. Tailored feedback reports were based on three measures, stage of change, self-efficacy for physical activity, and processes of change, that were administered at baseline and on a monthly basis via mail. These reports were generated by a computer expert system and drawn from a library of approximately 296 messages regarding motivation, self-efficacy, social support, and cognitive and behavioral strategies for physical activity adoption based on participants' responses to questionnaires. The expert system provided feedback on individual progress over time and in comparison to others who have successfully adopted and maintained physical activity. Participants also received information on social support through tip sheets, monthly newsletters, and a goal setting session at post-treatment. Topics covered included identifying individuals who support versus sabotage physical activity goals, eliciting and enlisting help from diverse sources, benefits of exercise partners, addressing barriers such as childcare or spousal support, and availability of physical activity related community resources and activities for families.

Wellness control—The wellness control group received Spanish-language tip sheets and pamphlets on heart-healthy behaviors other than physical activity for Latinos (e.g., low sodium diet) developed by the National Heart, Lung, and Blood Institute (Alcalay, Alvarado, Balcazar, Newman, & Huerta, 1999). The number and timing of mailings matched for the wellness control and intervention groups.

Measures

Baseline characteristics—Basic demographic information was collected at baseline. Participants were asked to report their age, ethnicity, nativity, language spoken, education, income, and employment. Anthropometric measurements included blood pressure (systolic and diastolic) and body mass index (BMI).

Familial ties—Familial ties were assessed at baseline. For the purpose of the present study, marital status was classified as being married/partnered or not, and child status was defined as having children under the age of 18 years living at home or not.

Social support for physical activity—At baseline, post-treatment, and follow-up, participants completed the Social Support for Exercise Survey (Sallis, Grossman, Pinski,

Patterson, & Nader, 1987). The Social Support for Exercise Survey is a 13-item measure that comprises three scales: family participation, family rewards & punishments, and friend participation. The family and friend participation subscales measure involvement (e.g., "Exercised with me") and higher scores indicate greater participation. The family rewards & punishments subscale assesses rewards and criticism for exercising from family and higher scores indicate greater frequency of behaviors. The measure has shown good test-retest and internal consistency reliability and good criterion validity (Sallis et al., 1987).

Physical activity—The 7-Day Physical Activity Recall Interview (PAR) and ActiGraph GT3X accelerometers were used to measure minutes per week of MVPA at baseline, post-treatment, and follow-up visits. The PAR is an interviewer-administered self-report measure that inquires about physical activity over the past week in at least ten-minute bouts across various contexts (leisure, occupational, etc.). It has shown good reliability, validity, and sensitivity to change over time (Sloane, Snyder, Demark-Wahnefried, Lobach, & Kraus, 2009), in Latino and non-Hispanic White populations (Rauh, Hovell, Hofstetter, Sallis, & Gleghorn, 1992). Self-reported MVPA was the primary outcome on which the study was powered. As a second primary outcome, accelerometers were worn for 7 days and data was processed using the ActiLife 5 software, with a cut point of 1952 to establish the minimum threshold for moderate intensity activity and minimum activity duration of 10 minutes.

Qualitative interview—At the follow-up visit, a randomly selected subsample of intervention participants (N=20) were interviewed to elicit information on their experience with the intervention. Oral interviews were conducted one-on-one either in-person or over the telephone and audio recorded. A semi-structured interview guide focused on understanding the social support context of participants and how it helped or hindered efforts to adopt and maintain physical activity. The sample size of 20 was used as this was the point at which saturation was reached. Specifically, the research team reviewed the transcripts and noted that several themes had emerged from the interview content and new concepts and/or categories were no longer appearing.

Analysis

Summary statistics—Baseline characteristics were assessed using descriptive statistics. Differences between groups were analyzed using t-test for continuous variables and χ^2-test for categorical variables. All analyses were performed with SAS 9.3 statistical software.

Group differences in social support and MVPA—Using a mixed-effects longitudinal regression model, between group differences in mean social support at 6 and 12 months was assessed controlling for baseline values. Models included random intercepts to account for within-subject correlation between repeated outcomes over time, and standard errors were adjusted to account for clustering. All analyses were conducted on the intent-to-treat sample, including all participants randomized at baseline. Mixed effects models use a likelihood based approach to estimation and therefore made use of all available data without directly imputing missing outcome values. Models using MVPA data based on the PAR interview and accelerometer have been presented elsewhere (Marcus et al., 2013).

As a subsequent step to testing intervention effects, the potentially moderating effects of marital and child status on the association between intervention and social support and MVPA were explored. The analytical strategy was similar to that described above, with the addition of main effects of the potential moderators and the interaction between the moderator and intervention.

Mediation analysis—Analyses were conducted to determine whether three social support types (family participation, family rewards and punishments, and friend participation) were the mechanism through which intervention participants significantly increased their MVPA from baseline to 6 months and maintained these changes from 6 to 12 months, compared to wellness control. A multiple mediation model (run separately for self-reported and objectively measured MVPA outcomes) was used based on the product of coefficients approach with bootstrapped standard errors (10,000 bootstrapped samples). Multiple mediation models are designed to simultaneously test the effects of multiple mediators (while controlling for the effects of the others), which allows the effect of each of the hypothesized mediators on the association between intervention and MVPA outcome to be identified.

The effect of the intervention on physical activity outcome can be thought of as a series of paths: the effect of the intervention on change in the mediators (*a* path), the effects of the change in the mediators on the change in MVPA at post-treatment or follow-up (*b* path) and the total effect (*c* path) of the intervention on MVPA at post-treatment or follow-up (Figure 1). The indirect effect (*ab*) of the intervention on outcome is the primary effect of interest. Following the guidelines presented in Preacher and Hayes (Preacher & Hayes, 2008), a construct was considered a mediator of the intervention effect if the *indirect* effect of treatment through that construct was significantly different than zero. Interest was in both the mediators of 6 month outcomes and 12 month outcomes and thus two separate multiple mediator models were run to identify the key mechanisms of the intervention effects. Models adjusted for baseline values of MVPA and potential mediators, as well as covariates not balanced by randomization (generation status and blood pressure).

It should be noted that in a multiple mediation framework, there are indirect effects for each of the potential mediators. In addition, the direct effect is the effect of treatment assigned, i.e., the causal path from treatment to outcome that does not go through the mediators. The indirect effect of treatment can be thought of as the amount of mediation, and under the Preacher and Hayes framework, is the product of path coefficients.

Qualitative analysis—Audio-recorded Spanish-language interviews were transcribed verbatim, translated into English, and back-translated into Spanish by different bilingual research assistants. Thematic analysis was conducted on 20 interview transcripts. Specifically, transcripts were reviewed line by line by two independent researchers to identify themes and patterns across interviews. Potential themes were then discussed and consensus was reached. Descriptive summaries supported by quotes from participants are presented.

RESULTS

Sample characteristics

The baseline characteristics of the study sample are presented in Table 1. Participants had an average age of 40.67 ± 9.97 and BMI of 29.39 ± 4.69 kg/m^2. Most were high school graduates (74.8%) and employed at least part-time (52.5%). More than half of participants lived in households earning less than $20,000 annually (53.5%). The majority of participants were born outside the mainland United States (93.6%), of Dominican or Colombian background (65.0%), and Spanish-language dominant (81.5%). Most participants were married (57.0%) or had children under the age of 18 years living in the home (77.3%).

Familial ties and social support

The effects of family ties on changes in social support for physical activity during the course of the intervention were examined. There was no statistically significant difference between married and unmarried participants in changes in friend or family support over time ($p>0.05$). No difference was detected in friend and family support by child status over time ($p>0.05$), suggesting changes in social support throughout the study were no different for women with and without children or a spouse.

Familial ties and MVPA

As previously reported, participants in the intervention increased MVPA significantly more than the wellness control (Marcus et al., 2013). Interactions between treatment group and marital or child status for MVPA were not significant (for either self-reported or objectively measured MVPA). As shown in Figure 2, married participants reported slightly more self-reported activity than unmarried participants at 6 months in both the intervention and wellness control groups; however, this difference was not significant. A similar pattern was found for objectively measured MVPA (not shown). Those without children at home reported slightly more activity from 6 to 12 months, but again, this was not significantly different. This suggests the intervention was equally effective whether or not women had children, and whether or not they were married.

Intervention and social support

Changes over time in social support for physical activity differed by treatment group. The intervention produced greater increases in friend participation ($t=2.16$, $p=.003$ at 6 months and $t=2.61$, $p=0.01$ at 12 months), family participation ($t=4.07$, $p<0.01$ at 6 months and $t=2.32$, $p=0.02$ at 12 months), and family rewards and punishment ($t=3.92$, $p<0.01$ at 6 months and $t=3.70$, $p<0.01$ at 12 months) compared to the wellness control. No further changes occurred between 6 and 12 months. Intervention-related changes in support did not depend on marital or child status.

Social support mediators of six-month change in MVPA

Effect of treatment on social support mediators (a path)—Results indicate that all *a path* coefficients were statistically significant, suggesting differential effects of treatment assigned on all potential social support mediators (Table 2). Specifically, intervention

participants reported higher mean scores on friend participation (a=2.49, SE=1.09, p=0.02), family participation (a=3.97, SE=1.18, p<0.01), and family rewards and punishments (a=0.51, SE=0.16, p<0.01) at 6 months, compared to wellness control, after controlling for baseline values of the mediators as well as confounders.

Effect of social support mediators on change in MVPA (b path)—The simultaneous effects of the mediators on the outcome (MVPA at 6 months) were tested controlling for its baseline level, as well as potential confounders. Results suggest significant effects of family participation on minutes per week of self-reported MVPA at 6 months. Specifically, mean self-reported MVPA was higher amongst those with higher family participation (b=1.86, SE=0.88, p=0.03). There was no significant effect of friend participation or family rewards and punishments on self-reported MVPA at 6 months. Patterns were similar for objectively measured MVPA, with higher mean values amongst those with higher family participation (b=1.35, SE=0.65, p=0.04).

Direct and indirect effects of treatment (ab path)—After adjusting for baseline values and confounders, there was no significant indirect effect of treatment for family participation when the outcome was self-reported MVPA (ab=7.39, 95% CI: −0.32–21.78) but the effect was significant when the outcome was objectively measured MVPA (ab=5.21, 95% CI: 0.91–14.11) suggesting that at least some of the effect of the intervention on MVPA was attributed to changes in family participation.

Social support mediators of twelve-month change in MVPA

Effect of treatment on social support mediators (a path)—Results indicate that all *a path* coefficients were statistically significant (Table 3). Specifically, intervention participants had higher mean friend participation (a=2.97, SE=1.23, p=0.01), family participation (a=2.39, SE=1.23, p=0.05), and family rewards and punishment (a=0.50, SE=0.16, p<0.01) at 12 months compared to wellness control, controlling for baseline values of the mediators as well as confounders.

Effect of social support mediators on change in MVPA (b path)—The simultaneous effects of the mediators on the outcome (MVPA at 12 months) were tested controlling for baseline MVPA and potential confounders. Results show a significant effect of 12-month social support on minutes per week of self-reported MVPA at 12 months. Specifically, mean self-reported MVPA at 12 months was higher among those with higher friend participation at 12 months (b=2.29, SE=0.99, p=0.02). There was no significant effect of the family participation and family rewards and punishment on self-reported MVPA at 12 months. There were no significant b path coefficients for objectively measured MVPA.

Direct and indirect effects of treatment (ab path)—After adjusting for baseline values and confounders, there was a significant indirect effect of treatment for friends participation (ab=6.83, SE=5.15, 95% CI: 0.16–20.56) such that the intervention group achieved greater increases in self-reported MVPA at 12 months by increasing friend participation at 12 months. The total direct effect of treatment was still significant (c'=50.16, SE=16.13, p<0.01), indicating other potential mediators may account for part of the

association between intervention and self-reported MVPA. There were no significant indirect effects on objectively measured MVPA.

Social support themes from qualitative interviews

Five broad themes on social support and networks related to physical activity were identified from the qualitative interviews with intervention participants at follow-up (Table 4).

Family involvement—Participants with children at home discussed that while childcare presented challenges for physical activity, including them in activities was a strategy utilized for staying active. Husbands were often mentioned as walking partners. Comments from spouses and children were generally encouraging of participants' physical activity but some negative family interactions were noted.

Social roles—Participants discussed that they understood physical activity to be a challenge to traditional cultural and gender norms but participating in the intervention helped them view it as a path to health. Engaging in physical activity was perceived as an opportunity to support oneself or provide self-care among caregivers.

Social integration—Some participants explained that support from family members for physical activity was limited because most family remained in their home countries. One participant related poor mental health among Latinas to the feeling of being "alone in this country." Aside from spouses and children, friends were identified as support sources for physical activity as they provided companionship in exercise.

Social connectivity—Although participants described their personal networks to be helpful and encouraging of their active lifestyles, the desire for additional social connectivity was a prominent theme. The idea of sharing the experience with other women was presented as a recommendation for improving the intervention. Women with children also felt that family-based physical activity programs would be most practical and beneficial.

Social transmission—Several participants explained how their newfound knowledge and physically active lifestyles affected their social network. For example, physical activity was adopted by other members in the household. Participants recognized their roles as disseminators of valued information; physical activity information and intervention materials were shared with friends and co-workers interested in learning more about becoming active.

DISCUSSION

The purpose of this study was to evaluate the influence of family and friends on physical activity outcomes in Latinas participating in a home- and print-based intervention. The study examined familial ties and family and friend support as well as the relationship between them to understand how they affect the adoption and maintenance of physical activity in underactive women. The study also sought to better understand the social support system of participants and its effects on efforts to adopt and maintain physical activity.

Participants were predominately immigrant and Spanish-speaking Latinas with a spouse or dependent children at home. Changes in family and friend support for physical activity did not differ by marital or child status. Participants' accounts revealed that support from family came in the form of their adoption of and co-involvement in activities such as walking.

Family and friend support for physical activity increased more for the intervention group than the wellness control. The increase in family support was also maintained from post-treatment to follow-up. Sustaining gains in social support at follow-up has been a challenge for physical activity interventions as scores tend to return to baseline levels (Castro et al., 1999; C. Keller et al., 2014). The positive results in the present study may be attributed to targeting social support using different strategies including individualized assessments and feedback on support, tip sheets and newsletters providing practical ideas on garnering support, and a goal setting session that addressed support status at the post-treatment visit. This approach may also explain why the intervention was able to enhance family support in participants regardless of having children to care for at home.

Similarly, the intervention succeeded at increasing MVPA for participants irrespective of family ties. Hence, participants with a spouse or children at home fared just as well in the intervention as those without a spouse or children. These results indicate that a home-based intervention approach holds promise in reducing family-related constraints on physical activity that are often cited in the literature on women (Bellows-Riecken & Rhodes, 2008).

Mediation analyses using self-reported and objectively measured MVPA showed indirect effects in the same direction but produced different significant outcomes. This was not unexpected given that the 7-Day PAR and accelerometer measure different aspects of physical activity. Unlike the 7-Day PAR, accelerometers do not accurately estimate activities such as stationary bicycling, elliptical training, swimming, and upper extremity movement.

Family participation mediated the effect of the intervention on objectively measured MVPA at post-treatment whereas friend participation mediated the intervention effect on self-reported MVPA at follow-up. This could indicate that different types of support may be most relevant at different stages of behavioral change. Help from family in the form of emotional and instrumental support may be essential during the earlier stages when motivational readiness for physical activity, self-efficacy, and behavioral processes of change are low (Pekmezi et al., 2012). Support from friends in the form of positive social interaction (i.e., having someone to do something enjoyable with) may play a bigger role in maintenance of physical activity (Oliveira et al., 2011). There is a currently a scarcity of literature on support sources and types as they relate to adoption and maintenance of physical activity.

Given that Latino culture is generally characterized by close family relationships and high family support, family participation was expected to improve MVPA. This finding is in line with participant descriptions of inclusion of spouses and children in physical activity. Family involvement may be a particularly effective strategy for the adoption of physical activity.

Increases in friend support proved important for maintenance of physical activity. Specifically, participants who had friends encourage and join them in physical activity were better able to sustain MVPA gains achieved at six months post-treatment. Our findings are

consistent with other studies in Latino adults showing support from friends to be a stronger predictor of self-reported physical activity including minutes of walking than support from family (Castro et al., 1999; M. Hovell et al., 1991). Walking was highly promoted in this study and the most common form of physical activity reported by participants possibly because it lends itself to the inclusion of others. Additionally, narratives of participants revealed a lack of extensive family networks in the U.S. and a reliance on friends for motivation and companionship for physical activity.

Immigrant Latinas in previous studies have similarly described social isolation or low social integration as a barrier to being active (Evenson et al., 2002; Parra-Medina & Hilfinger Messias, 2011). Participants in the present study indicated that physical activity was perceived as a social activity and an opportunity to connect and share with others. This may be an especially unmet need for low acculturated Latinas with small local personal networks. Since larger personal networks in the U.S. have a protective health effect for Latinos (Finch & Vega, 2003), future studies targeting immigrant Latinas would benefit from offering opportunities for interpersonal contact and social integration. By listening to participants' stories, this study found that while women with caregiving roles may be at risk of social isolation and inactivity, they are highly receptive to physical activity and perceive it as a form of empowerment. Participants also voiced the need to include the family network, particularly children, in future physical activity programs. Family-based approaches may potentially amplify intervention efforts because reciprocal influence can facilitate the sharing of lifestyle goals and behaviors in family members (Sorkin et al., 2014). Further, participants explained how they influenced family, friends, and co-workers with regards to physical activity education and engagement. Such a phenomenon could have public health implications and should be further explored.

There are study limitations worth considering. Because social support was measured simultaneously with physical activity, it was assumed for the sake of mediation that changes in social support precede changes in MVPA. It is possible that becoming physically active increases support for physical activity as a result of greater solicitation of support or improved mood and subsequent perception of relationship quality. Moreover, the Social Support for Exercise Survey measured family and friends as broad sources of support and did not specify social ties such as spouses, children, female or male friends, and co-workers.

Nonetheless, there are several strengths to this study. Both self-reported and objectively measured MVPA were assessed. The findings provide a better understanding of the psychosocial mechanisms of action through which physical activity in Latinas can be influenced. The study distinguished support sources which have differential effects on physical activity. The role of social support from family and friends on long-term physical activity was evaluated, which is likely to have greater impact on chronic disease and health disparities than shorter term changes. Finally, the narratives of participants gave greater insight into the social support context which was not revealed from the Social Support for Exercise Survey and offer directions for future intervention consideration.

CONCLUSION

A home- and print-based physical activity intervention improved and sustained support from family and friends in participants irrespective of familial ties. Given that low spousal support and caregiving responsibilities are often cited as barriers for physical activity, this intervention holds promise for Latinas with families. Increases in social support partly mediated increases in MVPA. Such findings help pinpoint potential theoretical mechanisms of action related to physical activity change in Latinas and better inform our efforts to address the disproportionate chronic disease burden in this community.

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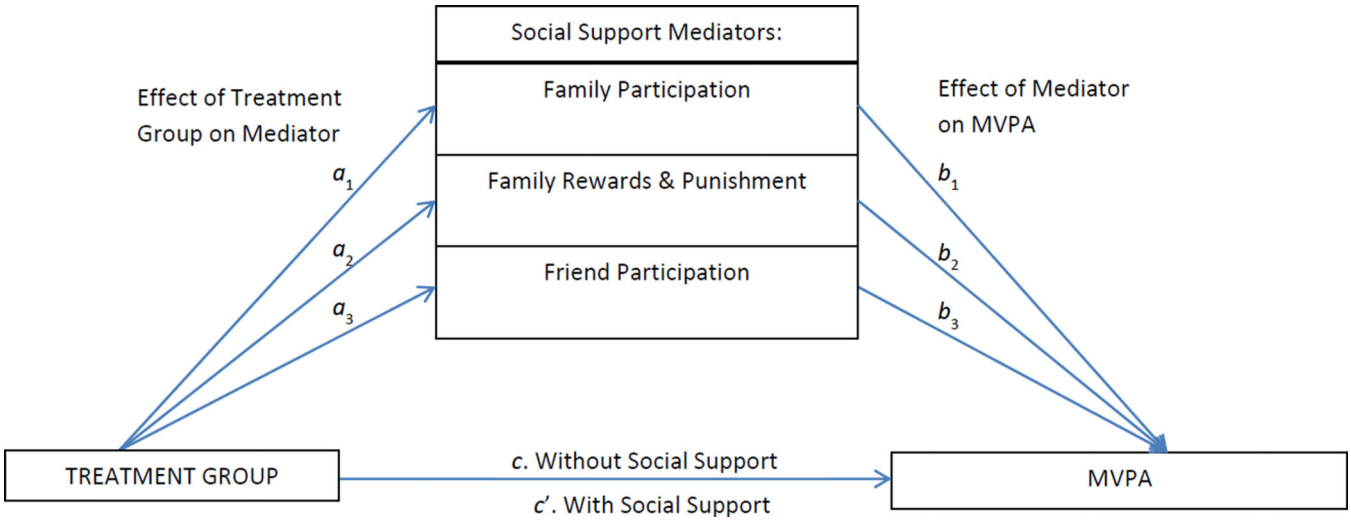
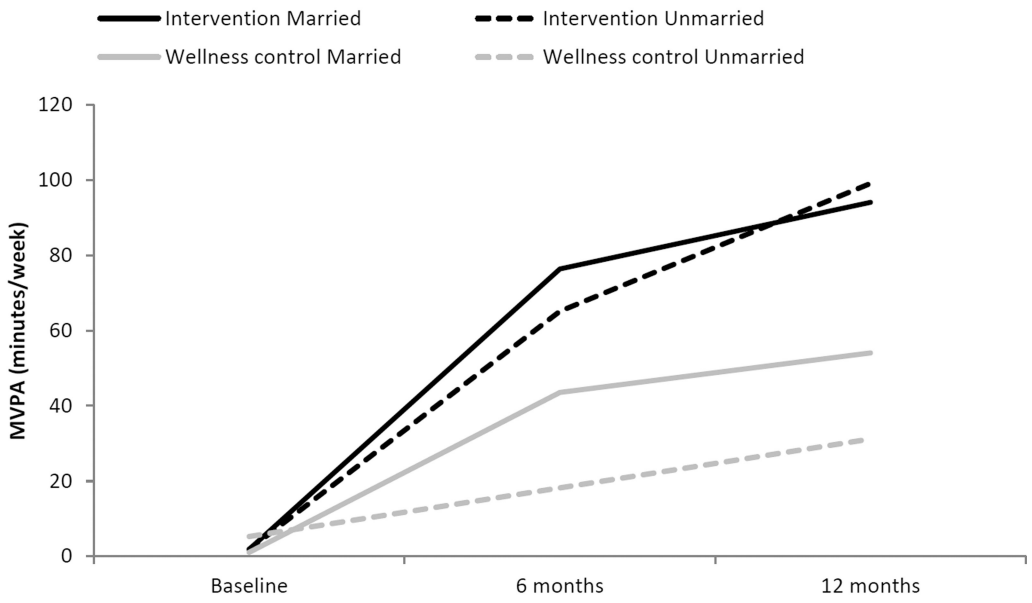
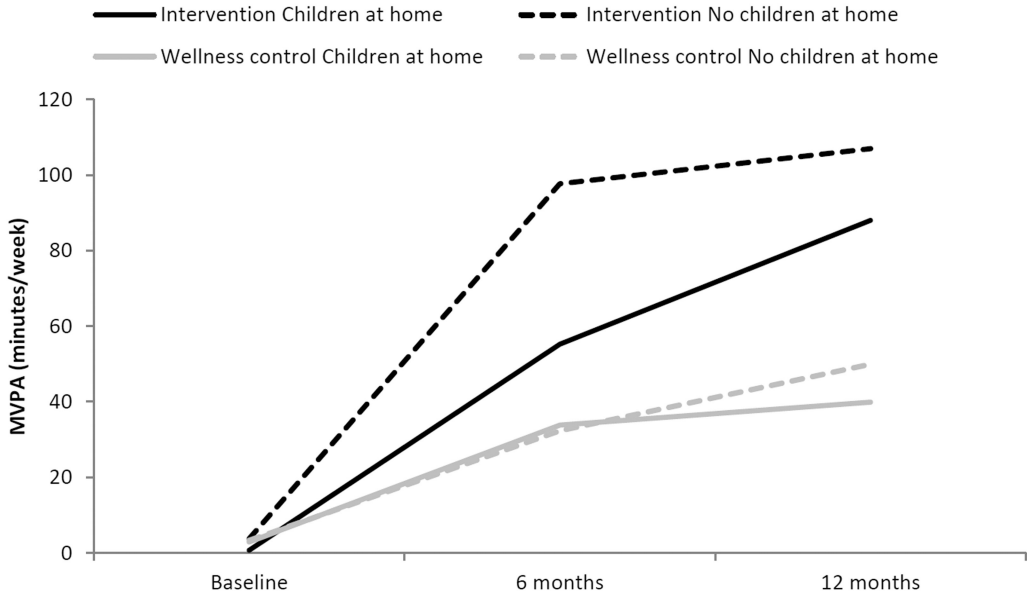


Figure 1.
Multiple Mediation Model

a. MVPA changes in groups by marital status





b. MVPA changes in groups by child status

Figure 2.
Treatment group changes in MVPA by familial tie

Table 1

Participant baseline characteristics

	Intervention	Wellness control
	N=132	N=134
Age (years)	41.61 ± 10.07	39.75 ± 9.83
BMI (kg/m^2)	29.59 ± 4.34	29.20 ± 5.03
Education		
High school graduate	76.5%	73.1%
Employment		
Employed at least part-time	54.2%	50.8%
Income		
<$20,000	52.8%	54.3%
$20,000–39,999	26.0%	22.0%
≥$40,000	21.3%	23.6%
Nativity		
Foreign-born	90.9%	96.3%
Language speak at home		
Only Spanish or more Spanish than English	79.5%	83.5%
Marital Status		
Married or living with partner	62.1%	51.9%
Children at home		
Under 18 years old	77.9%	76.7%
MVPA (minutes/week)	1.87 ± 6.85	3.02 ± 10.29

Data are mean ± SD or %

Table 2

Indirect effects of social support on self-reported and objectively measured MVPA at 6 months

6 months (Self-reported)	a path		b path		c total effect		c' direct effect		ab indirect effect	95% CI
	B (SE) β	*p*	B (SE) β	*p*	B (SE) β	*p*	B (SE) β	*p*	B (SE) β	
Family participation	3.97(1.18) 0.22	<**0.01**	1.86(0.88) 0.19	**0.03**					7.39(5.55) 0.04	−0.35–21.78
Family rewards & punishments	0.51(0.16) 0.21	<**0.01**	−8.74(5.94) −0.12	0.14	46.58(13.14) 0.27	<**0.01**	41.68(13.59) 0.24	<**0.01**	−4.51(3.12) −0.03	−13.75–0.58
Friend participation	2.49(1.09) 0.16	**0.02**	0.81(0.92) 0.07	0.38					2.02(3.34) 0.01	−3.46–10.99
6 months (Objectively measured)	**a path**		**b path**		**c total effect**		**c' direct effect**		**ab indirect effect**	**95% CI**
	B (SE) β	***p***	**B (SE) β**	***p***	**B (SE) β**	***p***	**B (SE) β**	***p***	**B (SE) β**	
Family participation	3.87(1.21) 0.22	<**0.01**	1.35(0.65) 0.16	**0.04**					5.21(2.94) 0.03	**0.91–14.11**
Family rewards & punishments	0.53(0.17) 0.21	<**0.01**	−1.01(4.34) −0.02	0.82	36.48(9.66) 0.24	<**0.01**	29.98(9.98) 0.20	<**0.01**	−.53(2.26) −0.01	−5.44–3.92
Friend participation	2.50(1.10) 0.16	**0.02**	0.73(0.68) 0.08	0.29					1.82(2.16) 0.01	−1.52–7.64

Table 3

Indirect effects of social support on self-reported and objectively measured MVPA at 12 months

12 months (Self-reported)	**a path**		**b path**		**c total effect**		**c' direct effect**		**ab indirect effect**	**95% CI**
	B (SE) β	***p***	**B (SE) β**	***p***	**B (SE) β**	***p***	**B (SE) β**	***p***	**B (SE) β**	
Family participation	2.39(1.23) 0.13	**0.05**	1.35(1.02) 0.12	0.18					3.25(3.66) 0.02	−1.04–15.21
Family rewards & punishments	0.50(0.16) 0.22	<**0.01**	−7.28(7.35) −0.08	0.32	56.53(15.86) 0.27	<**0.01**	50.16(16.13) 0.24	<**0.01**	−5.99(3.97) −0.02	−13.21– 2.02
Friend participation	2.97(1.23) 0.17	**0.01**	2.29(0.99) 0.19	**0.02**					6.8(5.15) 0.03	**0.16–20.56**
12 months (Objectively measured)	**a path**		**b path**		**c total effect**		**c' direct effect**		**ab indirect effect**	**95% CI**
	B (SE) β	***p***	**B (SE) β**	***p***	**B (SE) β**	***p***	**B (SE) β**	***p***	**B (SE) β**	
Family participation	2.60(1.25) 0.14	**0.04**	0.66(0.53) 0.10	0.21					1.73(1.74) 0.01	−0.57–6.89
Family rewards & punishments	0.51(0.17) 0.22	<**0.01**	3.50(3.76) 0.07	0.35	31.15(8.03) 0.27	<**0.01**	26.40(8.26) 0.23	<**0.01**	1.79(2.63) 0.02	−3.19–7.91
Friend participation	2.92(1.22) 0.17	**0.02**	0.42(0.53) 0.06	0.43					1.23(1.82) 0.01	−1.79–6.11

Table 4

Themes and selected quotes on social support and networks related to physical activity

Themes	Selected quotes
Family involvement	The truth is I never went to the gym. I rather go to a park with the children. I have a two year old and I took him and he rode his tricycle and I would push him…The girl would do it on her bike and he on his tricycle and we would run faster. Then [daughter] was like, "Mama, today we walk or ride a bike?" I went out every day with them, it was easier." (*Colombian, 33 years old*)
	I am no longer able to walk slowly and I walk in a hurried, fast way. I almost make [husband] fall down. He says I help him maintain his weight and he feels very healthy, too. (*Colombian, 55 years old*)
	He really liked that I got into this study, that I learned. So he was always supportive but at the same time was pressing. He said, "Do this, look at that." When I was with him, I felt pressured because he does so much. I would say, "I'm not used to it. It's hard for me." He would say, "Try, try!" And here we are in a fight. (*Guatemalan, 47 years old*)
Social roles	Look Latino culture neglects exercise a little bit. I realize that more. The neighborhood I live in is home to many Americans and they exercise. Even older people exercise. Our grandparents stay in the house. The lady who has many children and does not exercise. So we neglect it. We are dedicated to cooking, chores, cleaning. We forget ourselves as women. And that's bad because exercise gives one motivation to do new things. And not just household things. A little time for oneself. (*Guatemalan, 47 years old*)
	I stopped exercising and this program reminded me that just because I have two children, I am the head of household, that I don't have to stop taking care of health. Because for many people, many Latinas, we know that not exercising affects us, because one is healthier when one is active. I always like to keep myself fit but when I had my children, I was like I am not going to exercise. (*Mexican, 23 years old*)
	Yes because as Latinas we are stuck in the home. We do not give importance with respect to physical appearance. On the other hand, there are other races who care more about how they look, how they are physically. If they are active or not. The fact for us is that we are living in a country that never feels like our own. We limit ourselves to a certain space. I do feel that the program creates awareness that we need to be in motion. More than anything we need to be healthy. (*Salvadorian, 32 years old*)
Social integration	Well, it is only my children and I so I did not have someone to share any of this with. I alone motivated myself. (*Mexican, 23 years old*)
	My friend because she motivated me because I would go out with her to walk…My family is not here. I have my husband. No, my family is in Colombia. (*Colombian, 53 years old*)
	I don't have a lot of family, but my physical activity with my friends, yes. (*Dominican, 30 years old*)
Social connectivity	It seems very important to us to meet with the people in the [study] in order to see what their personal experiences were. There was a bulletin that told us some things in writing, but if they had a meeting they would not be so alone, a meeting with other colleagues to share more activities. (*Colombian, 55 years old*)
	I think to have it done like in groups for one to be able to share the experiences… For example, here there was no communication with other people, I didn't meet anyone. (*Venezuelan, 26 years old*)
	Involve the children. Like so that I can come with my children. They can be doing their activity so that they know for the future that exercise is good. Very important in our lives. (*Dominican, 41 years old*)
Social transmission	I bought a machine for walking. Then my mom would use it. My son placed it in front of the television, then when he goes to see television, I tell him, "You watch television if you walk for an hour." Then that also involved them, my husband walks, do you understand? All of them like to use the machine. (*Venezuelan, 26 years old*)
	When I went with my pedometer I showed [friends] how many steps I had taken, the calories that I burned. I taught them what a moderate intensity pace was. They loved it. (*Dominican, 22 years old*)
	And with my co-workers…I take my books and they see me reading and [they] tell me "But, lend me your book." They have already lost them all, "lend me your book," because they say they want to do exercise. (*Dominican, 41 years old*)