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Let's Move Together:

A Randomized Trial of the Impact of Family Health History on Encouragement and Co-Engagement in Physical Activity of Mexican-Origin Parents and Their Children

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Abstract

Background—Due to shared health behaviors and disease risk, families may be more effective targets for health promotion. This study assessed whether providing family health history (FHH)-based risk information for heart disease and diabetes affected encouragement to engage in physical activity (PA) and healthy weight (HW) maintenance and co-engagement in physical activity among 320 Mexican-origin parents and their 1,081 children.

Method—At baseline and 10 months, parents indicated who they encouraged and who encouraged them to engage in PA/HW, and with whom they coengaged in PA. Households were randomized to receive FHH-based assessments either by one or all adult household members. Primary analyses consisted of regression analyses using generalized estimating equations.

Results—At baseline, parents reported encouraging their child for both PA and HW in 37.6% of parent-child dyads and reported receiving children's encouragement for both in 12.1% of dyads. These increased to 56.8% and 17.5% at 10 months ($p < .001$). Co-engagement in PA increased from 11.4% to 15.7% ($p < .001$), with younger children (30.4%) and mother-daughter dyads (26.8%) most likely to co-engage at 10 months. Providing FHH-based risk information to all adult household members (vs. one) was associated with increased parent-to-child encouragement of PA/HW ($p = .011$) at 10 months but not child-to-parent encouragement. New encouragement from parent-to-child ($p = .048$) and from child-to-parent ($p = .003$) predicted new 10-month PA co-engagement.

Discussion—Providing FHH information on a household level can promote parental encouragement for PA/HW, which can promote greater parent-child co-engagement in PA. In this

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Declaration of Conflicting Interests

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high-risk population with a cultural emphasis on family ties, using FHH-based risk information for all adult household members may be a promising avenue to promote PA.

Keywords

cardiovascular disease; community health promotion; diabetes; diffusion of innovations; family health; Latino; network analysis; physical activity/exercise; race/ethnicity; social influence

Despite well-documented health benefits of physical activity (Danaei et al., 2009; Hamilton, Hamilton, & Zderic, 2007; van Uffelen et al., 2010), the proportion of Mexican American adults meeting national physical activity recommendations has been less than 10% when objectively measured (Tucker, Welk & Beyler, 2011). Exploring ways to increase physical activity levels among this population is strongly needed, as studies have documented high prevalence of childhood and adult obesity (Belcher et al., 2010), diabetes (Centers for Disease Control and Prevention [CDC], 2014), and metabolic syndrome among Mexican Americans (Beltran-Sanchez, Harhay, Harhay, & McElligott, 2013).

Family-Based Interventions for Physical Activity

Despite evidence showing that physical activity levels and other health behaviors are similar among family or household members (e.g., Cameron et al., 2011; Sallis, Patterson, Buono, Atkins, & Nader, 1988), most interventions aimed at increasing physical activity levels have been individually focused with modest success (Foster, Hillsdon, & Thorogood, 2005; van Sluijs, McMinn, & Griffin, 2007). Interventions that capitalize on social networks have been suggested as a more effective approach to the adoption and diffusion of behaviors (Valente, 1995), given the role of social influence on adolescent and adult health behaviors and associated outcomes (Christakis & Fowler, 2007, 2008; de la Haye, Robins, Mohr & Wilson, 2010; Valente, Fujimoto, Chou, & Spruijt-Metz, 2009; Valente, Hoffman, Ritt-Olson, Lichtman, & Johnson, 2003). Consequently, families or households may be more effective targets for physical activity interventions (Gruber & Haldeman, 2009; Koehly & Loscalzo, 2009).

Research evaluating how interpersonal processes among family members shape physical activity has typically focused on the influence of parents on their children's behavior (Beets, Cardinal, & Alderman, 2010; Edwardson & Gorely, 2010). Parents' participation in physical activity with their children ("co-engagement") is a consistent predictor of child physical activity (Beets et al., 2010; Edwardson & Gorely, 2010), a phenomenon that is likely to be in part driven by behavior modeling and normative influence. Edwardson and Gorely (2010) found that providing tangible support (particularly transportation) and intangible support (particularly encouragement) predicted children's and adolescent's physical activity habits. However, this work considered the unidirectional influence of parents on children's physical activity, whereas support processes are likely to be reciprocal, with parents encouraging children *and* children encouraging parents (de la Haye, de Heer, Wilkinson, & Koehly, 2014). Moreover, much of the prior work focused on dependent children within a narrow developmental stage (children and early adolescents), whereas families are likely to be important social milieus for physical activity behavior change throughout the life span. The current study proposes to extend this prior work by considering optimal approaches to

activate encouragement for physical activity among parents and children and facilitate co-engagement in physical activity. Encouragement in both directions was considered, and children of a broad age range were included.

For several reasons, family-level interventions to promote physical activity may be particularly valuable among Mexican-origin populations. Cultural factors, such as *familism*, may enhance intervention success at a family level. Familism represents a strong identification with, and loyalty to, the family. This includes meeting familial obligations, providing family support, and the belief that behaviors should meet familial expectations (Sabogal, Marin, Otero-Sabogal, Marin, & Perez-Stable, 1987). Also, Mexican American household size tends to be larger (3.8 persons vs. a national average of 2.6), suggesting that family health history (FHH)-based risk information may have relevance for more household members. Finally, prior research has found a stronger clustering of physical activity behaviors in Mexican American families compared to non-Hispanic White families (Sallis et al., 1988), suggesting the family as an ideal context for intervention.

Theoretical Framework

A theoretical framework particularly relevant for the current study is communal coping (Afifi, Hutchinson & Krouse, 2006; Lyons, Mickelson, Sullivan, & Coyne, 1998). Communal coping is a form of cooperative problem solving, representing an important shift from addressing health promotion at an individual level to a group level. The theory posits that intervention approaches that emphasize stressors or health threats that are shared among members of a social group, such as family, can motivate cooperative strategies aimed at reducing the stressor or threat. Such cooperative actions might include family encouragement of healthy behaviors or multiple family members co-engaging in preventive behaviors such as physical activity (Afifi et al., 2006; Lyons et al., 1998). The current study focused on promotion of healthy behaviors within a household whose members may jointly be at risk for common complex disease, such as diabetes and heart disease. As such, the communal coping model was used as the overarching theoretical framework for this study (Koehly & Loscalzo, 2009; Koehly & McBride, 2010).

Family Health History Information for Family-Based Interventions

Family health history of common chronic diseases such as diabetes and heart disease tends to cluster within families (Harrison et al., 2003) and confers increased risk of disease. As such, FHH information is relevant to all family members, making it particularly useful in family-based interventions. Although FHH information has been underutilized in medicine (Berg et al., 2009), research has shown that provision of FHH information is associated with improved health behaviors including physical activity (Ruffin et al., 2011), nutritional intake (Pijl et al., 2009; Ruffin et al., 2011), and cancer screening (Hailey, Carter, & Burnett, 2000). Wang et al. (2015) further provided insight into *how* provision of FHH-based risk information may lead to health behavior change. They found that receipt of tailored FHH-based risk increased communication about and active collection of familial disease risk. Thus, using FHH-based risk information may be appropriate for family-level interventions

aimed at stimulating communal coping processes, such as communication about risk, encouragement of physical activity, and co-engagement in health behaviors.

Study Aims

Building on this prior work, a 10-month randomized family-based intervention using FHH information for diabetes and heart disease was implemented. The aim was to promote encouragement of and co-engagement in physical activity among members of 162 Mexican-origin families. Specifically, the current study evaluated two hypotheses (graphically represented in Figure 1):

Hypothesis 1: Provision of FHH-based risk information to all adult household members simultaneously (“group-level” feedback) would stimulate the development of *new encouragement* among parents and their children to engage in physical activity and maintain a healthy weight over 10 months, compared to provision of risk information to only one adult household member.

Hypothesis 2: New encouragement would predict co-engagement in physical activity among parents and children at 10-month follow-up.

Method

Participants and Recruitment

The current study includes information from participants who were part of Project Risk Assessment for Mexican Americans (RAMA), a randomized family-based intervention using FHH information to promote communication about family risk of common, complex diseases, encouragement of risk-reducing behaviors, and engagement in health-promoting behaviors (Koehly et al., 2011). Participants in Project RAMA were recruited by randomly calling eligible households from the Mano a Mano cohort, a large, population-based, cohort of Mexican-origin households in Harris County, Texas, established to identify risk factors associated with cancer development (Wilkinson et al., 2010). Households were eligible for Project RAMA if they were part of the Mano a Mano cohort, were multigenerational, and included at least three adult members, all of whom consented to participate. For Project RAMA, a total of 497 participants from 162 multigenerational households were recruited. The retention rate was 93% through the 10-month follow-up. The majority (78%) of households included married couples and one or two adult children. The current analysis includes information *only* from participants who were parents ($N = 320$) and who reported information about their children over 5 years old ($N = 1,081$); assessments were based on parent report. All procedures were approved by the Institutional Review Board of the National Human Genome Research Institute and The University of Texas MD Anderson Cancer Center.

Randomization

Households were randomized based on a 2×2 factorial design (Koehly et al., 2011), displayed in Table 1, resulting in four possible feedback conditions. The first factor was defined by whether supplemental personalized FHH-based disease risk assessments were

provided to all (three or four) participating adult household members or to only one of the participating adult household members. This factor defined the primary study question: whether receipt of a FHH-based risk assessment by at least three adult household members (vs. one adult) would be more effective in promoting encouragement among parents and children and co-engagement in preventive health behaviors (e.g., physical activity). The second factor included whether recommendations based on current lifestyle behaviors and body mass index (BMI) were provided in conjunction with the risk assessments. Half the households received the lifestyle recommendations. An example of the feedback is provided in Figure 2.

Measures

Demographic Characteristics—These included age and sex of parents and children, and whether the child lived with the parents. In addition, parents' birthplace (Mexico or United States) and socioeconomic status (SES) were assessed. SES was defined by a proxy measure based on reported house and car ownership. These indicators were selected as they have been found to be a more comprehensive and multigenerational measurement of access to economic resources for a household than income, employment, or educational attainment (Diemer & Ali, 2009; Diemer, Mistry, Wadsworth, López, & Reimers, 2013).

Encouragement and Co-Engagement—Perceived encouragement to (1) increase physical activity and (2) maintain a healthy weight from family and network members was assessed at baseline and 10-month follow-up. Encouragement was assessed by asking parents two separate questions: “Who has encouraged you to engage in physical activity/maintain a healthy weight?” and “Who have you encouraged to be physically active/maintain a healthy weight?” Participants selected those who they encouraged and who encouraged them from the roster of network members. There were no limits on the number of “encouragement ties” a participant could identify. Given that healthy weight recommendations included messaging related to exercise and, conceptually, physical activity is associated with achieving a healthy weight, the current analysis considered “multiplex encouragement ties” or joint encouragement to increase physical activity *and* maintain a healthy weight. Also, these two variables were found to be highly correlated in our data ($r = .72, p < .001$). Co-engagement was similarly assessed by asking parents: “With whom do you exercise?” Only encouragement and co-engagement ties between parents and children were considered in the current analysis.

Procedures and Design

Participants independently completed baseline assessment using a tablet computer during a home visit in English or Spanish by a bilingual interviewer. A total of 81% of participants completed assessments in Spanish. Follow-up interviews took place over the phone with each individual adult participant. The baseline surveys consisted of questions regarding demographic characteristics and current lifestyle behaviors (physical activity, fruit and vegetable intake, smoking, alcohol use, and health screening behaviors); here we report on physical activity. Using established procedures for “egocentric” networks (McCarty, 2002), participants “enumerated” (list names of) their relatives and other important people in their social network. Each participant provided their FHH by indicating diagnoses of diabetes and

heart disease for each first and second-degree relative. In addition, participants indicated relationship quality and resources exchanged for each network member at each assessment point. These methods have been shown to be valid (Freeman, Romney, & Freeman, 1987) and have been used to measure encouragement in studies of personal networks (Ashida, Wilkinson, & Koehly, 2010).

Participants' responses to FHH questions were used to determine FHH-based risk assessments using the CDC's Family Healthware™ program (Yoon, Scheuner, Jorgensen, & Khoury, 2009; O'Neill et al., 2009) and create feedback packets (described below), which were mailed to each participant. Risk assessments were based on the CDC Family Healthware program and reported as "weak" (population average), "moderate," or "strong" (Yoon et al., 2009). Feedback packets were prepared for each participant and mailed within 1 week of the baseline interview to each adult household member. All materials were modified to an eighth-grade reading level, available in both Spanish and English. All participants received a graphical representation of their FHH along with color-coded risk information and a primer on how to interpret their pedigree (Figure 3). The additional content of the packets varied by intervention condition described below. A more detailed description of the methodology has been previously published (Koehly et al., 2011).

Analyses

Analyses were conducted with SPSS Version 19.0 (SPSS, Armonk, NY). Multilevel logistic regressions (generalized estimating equations [GEE] with an exchangeable working correlation matrix) were fitted to assess the primary hypotheses. These models take into account the three-level nested data structure of (1) households, (2) parent participants, and (3) enumerated children. Analyses controlled for demographic variables including parent and child sex and age, whether the child lives in the home, parent-child sex homophily (meaning father-son or mother-daughter dyads), parental SES, parental BMI, and family disease risk for heart disease and diabetes. Initial analyses included parent nativity in the model. The child-to-parent encouragement model could not be fitted with nativity included (i.e., only one U.S.-born parent received new encouragement ties from the child). As such, presented results do not control for nativity to allow for direct comparison.

Hypothesis 1 specified whether feedback condition (all adults vs. one adult household member receiving feedback) prompted new encouragement ties to engage in physical activity and maintain a healthy weight from baseline to 10 months. To test Hypothesis 1, two models were fitted. The dependent variables were new encouragement ties from parent-to-child and from child-to-parent. Analyses conditioned on no baseline encouragement akin to an incident analysis of encouragement. Predictor variables for these models characterized feedback condition. The interaction between the two feedback factors was first assessed and removed from the model if not significant based on a Type I error rate of .05.

Hypothesis 2 specified that new encouragement ties from baseline to 10-month follow-up were associated with new (incident) co-engagement in PA at 10-months. To evaluate Hypothesis 2, the dependent variable was parent-child coengagement in physical activity. The main predictor variables were new parent-to-child and child-to-parent encouragement from baseline to 10-months.

Results

Demographics

The mean age of parents was 49.1 years ($SD = 9.9$); the mean age of their children was 23.3 years ($SD = 9.3$ years). Most children (63.3%) lived at home during the study period. The majority of parents were born in Mexico (80.9%). Parents' BMI was high; 51.6% were obese ($BMI \geq 30 \text{ kg/m}^2$) and an additional 34.4% were overweight (BMI between 25 kg/m^2 and 30 kg/m^2). Parent-child relationships were evenly distributed by gender with about half of dyads being "homophilous" (father-son or mother-daughter; see Table 2).

Baseline to 10-Month Follow-Up Change in Encouragement and Co-Engagement

Across all groups, encouragement and co-engagement increased significantly between baseline and the 10-month follow-up (see Table 3). At baseline, 36.7% of parent-child dyads across all groups reported encouraging their child to be physically active *and* maintaining a healthy weight. Parental perceived encouragement from children was much lower (12.1% of dyads). At the 10-month follow-up there was a significant increase in both of these relationships ($p < .001$): Encouragement from parents to children increased to 56.8%, and encouragement from children to parents increased to 17.5%.

Co-engagement in physical activity was 11.4% at baseline and increased to 15.7% at 10-month follow-up ($p < .001$). Mother-daughter dyads were significantly more likely to co-engage in physical activity, both at baseline and at followup (see Table 3). At 10 months, older children (19.7% of children >18 years) were most likely to encourage their parents to be physically active and maintain a healthy weight, whereas co-engagement in physical activity was highest between parents and their younger children (30.4% for children <12 years).

Factors Affecting Changes in Encouragement and Co-Engagement

All participants who reported at baseline that they encouraged their child to do physical activity and maintain a healthy weight, or co-engaged in physical activity with their child, also reported the same relationships at the 10-month follow-up. As a result, analyses looking at change included only parents who did not encourage/coengage at baseline, representing *incident* encouragement/ co-engagement.

Aim 1: Program Impact on New (Incident) Encouragement Relationships—The first hypothesis tested the impact of feedback condition on parent-to-child and child-to-parent encouragement. Parents had twice the odds (odds ratio [OR] = 2.02, 95% confidence interval [CI; 1.17, 3.50], $p = .011$) to develop new encouragement pathways for their child to be physically active and maintain a healthy weight if all participating adult members of the household received the FHH assessment compared to just one adult. Inclusion of additional behavioral recommendations was not a significant predictor of new encouragement ties (OR = 0.83, 95% CI [0.47, 1.46], $p = .520$). Other factors associated with new encouragement included children living at home (vs. not) and similarity in parent and child sex (see Table 4). For the second part of the hypothesis (with child-to-parent encouragement as the outcome), we found no significant effects of FHH-based feedback condition on initiation of

incident encouragement ties from children to their parents. However, female children ($p = .007$) and parent-child sex homophily ($p = .003$) were both significantly associated with new encouragement from child-to-parent (Table 5).

Aim 2: Impact of Encouragement on New (Incident) Co-Engagement—The second hypothesis posited that new encouragement led to co-engagement in PA at 10-month follow-up. At 10-month follow-up, new encouragement pathways from parents to children were associated with new co-engagement in physical activity (OR = 3.75, 95% CI [1.01, 13.92], $p = .048$; see Table 6). In addition, new encouragement pathways from children to parents (OR = 7.19, 95% CI [1.95, 26.48], $p = .003$) were also associated with new parent-child co-engagement in physical activity. In other words, development of new encouragement between parents and children, irrespective of who initiated the encouragement, resulted in greater odds of co-engagement at 10-months. Other factors that were positively associated with new co-engagement included the child living with the parents and similarity in child and parent sex (see Table 6). Feedback condition was not associated with co-engagement at 10-month assessment (all vs. one: OR = 1.09, 95% CI [0.45, 2.64]; behavioral recommendations: OR = 0.81, 95% CI [0.35, 1.91]) and thus was not included in the final model.

Discussion

The current study evaluated whether risk information based on FHH provided to a household rather than an individual would activate communal coping processes among Mexican-origin parents and children. Specifically, we found that providing FHH-based risk feedback to multiple family members simultaneously was more effective in motivating encouragement from parents to children than targeting just a single individual. In turn, new encouragement pathways from parents to children *and* from children to parents following receipt of feedback motivated co-engagement in physical activity in parent-child dyads. Additional predictors of new encouragement and co-engagement included the parent and child living in the same household and the sex of the child and the parent being the same.

Our findings suggest that FHH-based risk feedback for common complex conditions can be a useful tool in activating communal coping processes aimed at shifting household behavioral norms related to physical activity among parents and children (Afifi et al., 2006; Lyons et al., 1998). Family history of diabetes, heart disease, and cancer confers increased disease risk, reflecting the genetic, behavioral, and environmental risk factors that cluster within families. As such, engaging multiple family members with risk assessments, rather than one, may have led to an improved understanding of familial risk of disease for both parents and children. In turn, this gained understanding may lead to developing strategies aimed at reducing risk for themselves and their children through encouragement and co-engagement (Afifi et al., 2006). These results suggest that engaging both parents with FHH-based risk information, rather than one, may be an approach for activating communal coping processes aimed at shifting household behavioral norms.

Furthermore, new encouragement from parents to children, *and from children to parents*, predicted increased co-engagement in physical activity at follow-up. Understandably,

feedback did not explain shifts in child-to-parent encouragement given that parents, rather than children, were largely the recipients of family risk information. However, there is evidence that encouragement of physical activity among parents and their children tends to be reciprocated (de la Haye et al., 2014). Thus, one plausible explanation of new child-to-parent encouragement ties is that children respond in kind to their parent's encouragement efforts, leading to parents and children engaging in healthy behaviors together. These findings are consistent with longitudinal research (Epstein, Valoski, Wing, & McCurley, 1990, 1994; Ornelas, Perreira & Ayala, 2007), which has reported that family cohesion, parental engagement, and parent-child communication are essential in maintaining moderate to vigorous physical activity over time (Ornelas et al., 2007) and that changing habits for both parent and child requires cooperative and joint changes (Epstein et al., 1990, 1994).

Implications and Future Research

Building on existing social networks, culturally strong family ties (Sabogal et al., 1987) and clustered health behaviors (Sallis et al., 1988) of Mexican-origin families appears a potentially valuable way to promote encouragement and engagement in physical activity for the entire household. FHH-based risk information, which has relevance to all family members, can be used to stimulate communication among household members (facilitate encouragement) and emphasize promoting cooperative action (such as co-engagement in physical activity).

Future research should assess which types and which delivery method of FHH information has the most impact on health promotion activities within a household or family. For example, parents may be motivated by health information about their children (McBride, Persky, Wagner, Faith, & Ward, 2013); such motivations to model healthy behaviors to lower the disease risk for their children could be leveraged when designing intervention strategies. Furthermore, given the gender homophily effects suggested in the current study, interventions facilitating mother-daughter and father-son encouragement or co-engagement may be optimal for this population. Finally, future research that identifies optimal messaging or varying support contexts, such as coaching or community-based train-the-trainer approaches, to stimulate communication and maximize behavior change while minimizing potential negative interactions is warranted.

Children's motivations for encouraging their parents and co-engagement in physical activity may vary across children's age-groups. For example, older children may encourage their parents or co-engage with them for health reasons, whereas younger children simply may wish to play. Given that child-to-parent encouragement also predicted co-engagement in physical activity, it would be worthwhile to evaluate whether children are responding to their parents' encouragement as well as explore other approaches to activating child-to-parent encouragement.

Finally, we did not find that level of FHH-based disease risk affected families' responses to the health information, although the majority of participants had some risk of disease (data not shown). It may be that just providing FHH information (even for those at the population baseline level risk) is enough to elicit a response, regardless of disease risk. Prior research (Williams et al., 2001) has suggested that a small proportion of high risk families carry a

large proportion of cardiovascular disease burden. Thus, directing resources toward families at the highest risk may be an effective approach for prevention, even if interventions aren't necessarily *more* effective among this group.

Limitations

While our findings have implications for family-based interventions aimed at increasing physical activity levels in at risk families, there are several limitations to this work. For example, the study had limited data available on factors potentially associated with participants' ability to interpret FHH-based risk information such as health literacy and parent-child language preferences. However, our results are encouraging given that we effectively reached a largely Spanish-speaking population low in SES. Also, rather than a more comprehensive assessment of SES, a proxy based on home and car ownership was used for household SES. Furthermore, process data were not collected, which limits our insight into why or how new encouragement and co-engagement pathways occurred among parents and children. Encouragement questions were not tailored to parents' or children's baseline behavior; as such, indicators of no encouragement may reflect participants' perceptions that the question is not relevant for them or their child (i.e., "maintaining a healthy weight" could potentially be perceived as not applicable among participants or their children if they are not currently at a healthy weight). Social desirability bias could have influenced the increases in reporting of encouragement and co-engagement, although the lack of association between feedback condition and parents' perceptions that their children encourage them suggests otherwise. Finally, the current study findings are based on parents' perceptions. Future research should take into account children's perspectives, which would allow for a more complete picture of the social network dynamic between parents and multiple children (e.g., Agree, Biddlecom, & Valente, 2005).

Conclusions

Family-based interventions using FHH-based disease risk information may activate communal coping processes, including behavioral encouragement of and co-engagement in physical activity among high-risk Mexican American households. Building on strong family ties and using risk information that is relevant to all family members may increase program impact and appears to be a valuable avenue for future public health programs.

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Figure 1.
Graphical representation of study hypotheses.

The impact of your family history on DIABETES risk is:	MODERATE
Why your family history is a risk factor: <ul style="list-style-type: none"> • There are two or more closely related family members with diabetes. 	
<p>The following can help reduce your overall risk:</p> <p><u>SCREENING TESTS</u></p> <p>Keep testing your cholesterol. A cholesterol test measures your bad cholesterol (LDL), your good cholesterol (HDL), and stored fat in your body and blood (triglycerides). If your cholesterol is too high, you are at risk of heart disease and stroke. There are a number of ways that you can lower your cholesterol. One way is to change your diet. Try to eat less eggs, beef, and poultry. Exercising is another great way to lower your cholesterol. Talk to your doctor about having your cholesterol tested. Your doctor can tell you how often you should have this test done.</p> <p>Get your blood pressure checked. High blood pressure can lead to heart disease. It is important to have your blood pressure checked often. You can make changes in the way you live and also take medicine to lower your blood pressure. Ask your doctor or health provider how often you should check your blood pressure. They will suggest a schedule that is right for you.</p> <p>Get your blood sugar tested. High blood sugar is a symptom of diabetes. Having high blood sugar can lead to heart disease and stroke. One way in which you can lower your risk of disease is to have a blood sugar test. A blood sugar test is used to find out blood glucose levels. It may be used to diagnose or screen for diabetes. It is also used to monitor patients who have diabetes. Talk to your doctor about blood sugar testing.</p> <p><u>LIFESTYLE CHANGES</u></p> <p>Your weight exceeds the range recommended for your height. Losing weight may reduce your risk of heart disease, diabetes and cancer. Losing weight will improve your overall health. Based on your height, your ideal weight ranges from 114 to 154 pounds. Even a weight loss of a few pounds can make a difference. Talk to your doctor about a diet and exercise program that is right for you.</p> <p>Add exercise to your life. Exercise can help you lose weight. It can also lower your risk of diabetes, some cancers, and heart problems. Most adults need at least 30 minutes of exercise on most days of the week. Examples include walking, mowing the lawn, dancing, swimming, and bicycling. The key is to find the right exercise for you. If it is fun, you are more likely to keep doing it. You may want to walk with a friend, join a class, or plan a group bike ride. Talk to your doctor about getting started on an exercise plan that is right for you.</p>	

Figure 2.
 An example of family health history risk feedback.

Figure 3.
A family health history pedigree.

Table 1

Design of Project Risk Assessment for Mexican Americans, a Family Health History-Based Risk Intervention Among Multigenerational Mexican American Households.

Factors	<i>ALL adults</i> in household received FHH-based risk information	<i>Only ONE adult</i> in household received FHH-based risk information
Personalized behavioral recommendations added	Group 1	Group 2
No personalized behavioral recommendations added	Group 3	Group 4

Note. FHH = family health history.

Table 2Demographic Baseline Characteristics of Participating Parents ($N = 320$) and Their Children ($N = 1,081$).

Variable	Value, %
Parents	
Mothers	55.0
Fathers	45.0
Parent age, $M(SD)$, years	49.1 (9.9)
Parent birthplace	
Mexico	80.9
United States	17.5
Parent SES	
Own both home and car	67.8
Own neither home nor car	5.9
Parent BMI	
Healthy weight ($BMI < 25 \text{ kg/m}^2$)	14.1
Overweight ($BMI = 25 \text{ kg/m}^2\text{--}30 \text{ kg/m}^2$)	34.4
Obese ($BMI > 30 \text{ kg/m}^2$)	51.6
Children	
Daughters	50.0
Sons	50.0
Child age, $M(SD)$, years	23.3 (9.3)
Child living with parent	63.3
Number of children enumerated (M, SD)	3.4 (1.5)
Parent child dyads with homophily (father-son/mother-daughter)	50.0
Family health risk assessment	
Weak risk for heart disease	52.7
Moderate risk for heart disease	18.5
High risk for heart disease	28.8
Weak risk for diabetes	33.8
Moderate risk for diabetes	29.1
High risk for diabetes	37.1

Note. SES = socioeconomic status; BMI = body mass index.

Table 3

Encouragement and Co-Engagement Among Participating Parents ($N = 320$) and Their Children ($N = 1,081$) at Baseline and Follow-Up.

Variable	Baseline (%)	10-month (%)	p^a
Parents to children			
Parent encourages child to be physically active	46.1	63.9	<.001
Parent encourages child to maintain a healthy weight	43.1	60.7	<.001
Parent encourages child to be both physically active and maintain a healthy weight	36.7	56.8	<.001
Parent gender			.627
Mothers	41.8	58.4	
Fathers	32.7	56.5	
Child age			.346
Young children (<12 years)	38.7	58.3	
Adolescents (12–18 years)	38.9	58.5	
Adult children (>18 years)	37.0	57.4	
Dyad type			.033
Mother-daughter	49.0	66.8	
Mother-son	33.7	48.9	
Father-son	33.3	60.0	
Father-daughter	31.5	52.5	
Children to parents			
Child encourages parent to be physically active	20.7	30.1	<.001
Child encourages parent to maintain a healthy weight	18.2	23.4	<.001
Child encourages parent to be physically active and maintain a healthy weight	12.1	17.5	<.001
Child gender			.002
Daughters	15.7	23.4	
Sons	8.2	11.9	
Child age			.909
Young children (< 12 years)	6.8	11.0	
Adolescents (12–18 years)	10.3	14.4	
Adult children (>18 years)	13.3	19.7	
Dyad type			.009
Mother-daughter	17.1	27.4	
Mother-son	9.8	12.9	
Father-son	5.8	10.0	
Father-daughter	13.4	16.8	
Co-engagement			
Parent and child co-engage in physical activity	11.4	15.7	<.001
Child age (years)			.016
Young children (<12 years)	19.1	30.4	
Adolescents (12–18 years)	15.4	21.3	
Adult children (>18 years)	9.2	12.0	

Variable	Baseline (%)	10-month (%)	p^a
Dyad type			.011
Mother-daughter	19.9	26.8	
Mother-son	8.8	11.5	
Father-son	8.8	14.2	
Father-daughter	5.9	7.6	

^a p value based on generalized estimating equations with shifts from baseline to 10 months as outcome variable in intercept-only model.

Table 4

Impact of the Family Health History Intervention on Encouragement to Engage in Physical Activity and to Maintain a Healthy Weight (Parents Encourage Children).

Variable	10-month follow-up odds ratio [95% confidence interval]	<i>p</i> ^a
Parent characteristics		
Socioeconomic status: Owns both house and car	0.78 [0.49, 1.23]	.284
Parent age	1.02 [0.99, 1.04]	.263
Parent sex female	0.91 [0.51, 1.63]	.754
Parent body mass index healthy weight ^b	1.00	
Overweight	0.83 [0.35, 1.96]	.670
Obese	0.98 [0.44, 2.20]	.971
Child characteristics		
Child age	1.00 [0.98, 1.02]	.909
Child sex female	1.13 [0.89, 1.42]	.310
Child living with parents	1.56 [1.19, 2.04]	.001
Homophily of parent and child sex ^c	1.43 [1.13, 1.82]	.003
Family health history		
Elevated risk for heart disease ^d	0.93 [0.51, 1.69]	.813
Elevated risk for diabetes	1.06 [0.58, 1.94]	.842
Intervention assignment		
Risk assessment received by all adult family members	2.02 [1.17, 3.50]	.011
Additional lifestyle recommendations received	0.83 [0.47, 1.46]	.520

^aResults based on multilevel analyses conducted with SPSS generalized estimating equations. Analyses among those who did not encourage at baseline.

^bHealthy weight is reference category.

^cHomophilous dyads are father-son or mother-daughter.

^dElevated disease risk is indicated by high or moderate risk based on the Centers for Disease Control and Prevention Family HealthwareTM.

Table 5

Impact of the Family Health History Intervention on Encouragement to Engage in Physical Activity and to Maintain a Healthy Weight (Child Encourages Parent).

Variable	10-month follow-up odds ratio [95% confidence interval]	<i>p</i> ^a
Parent characteristics		
Socioeconomic status: Owns both house and car	1.04 [0.45, 2.40]	.928
Parent age	1.01 [0.96, 1.06]	.595
Parent sex female	1.45 [0.49, 4.28]	.503
Parent body mass index healthy weight ^b	1.00	
Overweight	0.83 [0.12, 6.00]	.856
Obese	4.76 [0.83, 27.28]	.080
Child characteristics		
Child age	0.99 [0.96, 1.02]	.536
Child sex female	1.95 [1.19, 3.17]	.007
Child living with parents	1.17 [0.77, 1.78]	.457
Homophily of parent and child sex ^c	1.74 [1.08, 2.79]	.022
Family health history		
Elevated risk for heart disease ^d	0.51 [0.20, 1.32]	.166
Elevated risk for diabetes	1.80 [0.63, 5.16]	.273
Intervention assignment		
Risk assessment received by all adult family members	0.97 [0.40, 2.36]	.952
Additional lifestyle recommendations received	0.86 [0.34, 2.17]	.751

^aResults based on multilevel analyses conducted with SPSS generalized estimating equations. Analyses among those who did not encourage at baseline.

^bHealthy weight is reference category.

^cHomophilous dyads are father-son or mother-daughter.

^dElevated disease risk is indicated by high or moderate risk based on the Centers for Disease Control and Prevention Family Healthware™.

Table 6

Impact of Encouragement on Co-Engagement in Physical Activity Among Parents and Children in the Intervention.

Variable	10-month follow-up odds ratio [95% confidence interval)	<i>p</i> ^a
Parent characteristics		
Socioeconomic status: Owns both house and car	1.00 [.51, 1.96]	.995
Parent age	0.99 [0.93, 1.06]	.833
Parent sex female	1.51 [0.52, 4.40]	.447
Parent body mass index healthy weight ^b	1.00	
Overweight	0.86 [0.21, 3.42]	.827
Obese	1.03 [0.26, 4.04]	.969
Child characteristics		
Child age	0.93 [0.87, 1.00]	.051
Child sex female	0.81 [0.37, 1.76]	.598
Child living with parents	2.27 [1.10, 4.71]	.027
Homophily of parent and child sex ^c	3.30 [1.47, 7.41]	.004
Family health history		
Elevated risk for heart disease ^d	0.69 [0.26, 1.83]	.458
Elevated risk for diabetes	0.94 [0.31, 2.86]	.914
Baseline encouragement		
Parent encourages child	2.26 [0.68, 7.55]	.185
Child encourages parent	4.20 [0.96, 18.44]	.057
New encouragement at 10-month		
Parent encourages child	3.75 [1.01, 13.92]	.048
Child encourages parent	7.19 [1.95, 26.48]	.003

^aResults based on multilevel analyses conducted with SPSS generalized estimating equations. Analyses restricted to those who did not co-engage in physical activity at baseline. Intervention assignment was not a significant predictor and was excluded from the model.

^bHealthy weight is reference category.

^cHomophilous dyads are father-son or mother-daughter.

^dElevated disease risk is indicated by high or moderate risk based on the Centers for Disease Control and Prevention Family HealthwareTM.