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Healthy Immigrant Families: Participatory Development and Baseline Characteristics of a Community-Based Physical Activity and Nutrition Intervention

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Abstract

Background—US immigrants often have escalating cardiovascular risk. Barriers to optimal physical activity and diet have a significant role in this risk accumulation.

Methods—We developed a physical activity and nutrition intervention with immigrant and refugee families through a community-based participatory research approach. Work groups of community members and health scientists developed an intervention manual with 12 content modules that were based on social-learning theory. Family health promoters from the participating communities (Hispanic, Somali, Sudanese) were trained to deliver the intervention through 12

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Competing Interests

J.A. Levine provides advice to Kersh, Inc, inventors of the accelerometer used in this study, without financial gain. The remaining authors declare that they have no competing interests.

Authors' Contributions

M.L.W., J.A.W., M.M.K.H., S.J.M., C.A.P., M.M.C., J.W.N., A.A., J.A.L., M.G., M.G.D.P.C., A.O., A.H., J.A.N., and I.G.S. participated in the study conception, design and implementation. J.A.S. and P.J.N. participated in study design and performed the statistical analysis. All authors read and approved the final manuscript.

home visits during the first 6 months and up to 12 phone calls during the second 6 months. The intervention was tested through a randomized community-based trial with a delayed-intervention control group, with measurements at baseline, 6, 12, and 24 months. Primary measurements included accelerometer-based assessment of physical activity and 24-hour dietary recall. Secondary measures included biometrics and theory-based instruments.

Results—One hundred fifty-one individuals (81 adolescents, 70 adults; 44 families) were randomized. At baseline, mean (SD) time spent in moderate-to-vigorous physical activity was 64.7 (30.2) minutes/day for adolescents and 43.1 (35.4) minutes/day for adults. Moderate dietary quality was observed in both age groups. Biometric measures showed that 45.7% of adolescents and 80.0% of adults were overweight or obese. Moderate levels of self-efficacy and social support were reported for physical activity and nutrition.

Discussion—Processes and products from this program are relevant to other communities aiming to reduce cardiovascular risk and negative health behaviors among immigrants and refugees.

Trial Registration—This trial was registered at Clinicaltrials.gov (NCT01952808).

Keywords

community-based participatory research; dietary quality; immigrant refugee health; physical activity

Introduction

Immigrants and their descendants are expected to account for most of the US population growth in the coming decades (1), and children of foreign-born individuals—20% of US children—represent the nation's most rapidly growing demographic (2). When immigrant and refugee populations arrive in the United States, they are, across many measures, healthier than the general population (3). However, the longer immigrant groups reside in North America, the more they approximate the cardiovascular risk profiles of the general population, including high rates of obesity (4), hyperlipidemia (5), hypertension (6), diabetes mellitus (7), and cardiovascular disease (8). With increasing duration of residence, children of immigrants may have even greater risk of the development of obesity and associated complications than those who arrived as adults (9).

In general population samples, low levels of physical activity and unhealthy dietary behaviors are associated with each of the cardiovascular disease risks stated above (10). In high-income nations, physical activity levels and dietary behaviors of immigrant and refugee populations are less healthy than those of the nonimmigrant majority populations (11-13). Therefore, interventions to increase physical activity and improve nutrition within the first decade after immigration may be especially helpful (4). Health care professionals and community leaders have called for interventions, tailored to immigrant and refugee populations (14), that address physical activity and nutrition; however, few have been reported (1).

One difficulty in designing interventions to promote physical activity and healthful nutrition is that the reasons underlying suboptimal behaviors among immigrant and refugee populations are multiple, complex, and poorly understood (15,16). Heterogenous impacts of acculturation, socioeconomic position, and health literacy (among other factors) on health behaviors within these communities highlight this complexity (17,18). Community-based participatory research (CBPR) is defined as an investigation of health issues within a community, in which community and academic members equitably collaborate through all phases of the research and programming processes (19). As stated by Tiedje et al (20), “This is an approach to research that is particularly well suited to intervention work that addresses the interplay between health behaviors and the social determinants of health because it empowers communities, promotes understanding of culturally pertinent issues, and targets multifaceted barriers to health.” Furthermore, CBPR appears to be an effective means of approaching health topics with immigrant and refugee populations (21,22).

In 2004, a community-academic partnership developed between Mayo Clinic (a large academic medical center) and Hawthorne Education Center (HEC; an adult education center) to address a health priority of HEC learners and staff. HEC serves approximately 2,000 immigrants and refugees per year through coursework, connection to community resources, and a health clinic. As previously described (20), from 2005 to 2007, this partnership formalized operating norms, adapted CBPR principles, and added many dedicated community and academic partners, forming the Rochester Healthy Community Partnership (RHCP).

The mission of RHCP is “to promote health and well-being among the Rochester population through community-based participatory research, education, and civic engagement to achieve good health for all” (23). Since its inception, RHCP has matured, developed a community-based research infrastructure (24), and become productive and experienced at deploying data-driven assessments and interventions with immigrant and refugee populations (25,26). Community and academic partners conduct all phases of research together, including joint dissemination of research results at community forums and academic meetings.

The goal of this project was to build on past experiences of this established CBPR partnership to systematically develop and evaluate a sustainable, socioculturally appropriate physical activity and nutrition intervention with and for immigrant and refugee families in Rochester, Minnesota. The aim of this paper is to report the participatory development of the intervention, study design, and baseline characteristics of the study participants.

Methods

The study was approved by the Mayo Clinic Institutional Review Board and by the Rochester Public School District on behalf of the community. This trial was registered at Clinicaltrials.gov (NCT01952808).

Study Setting and Participants

Rochester, Minnesota, is a small metropolitan area in the southeastern part of the state. According to 2007-2011 American Community Survey estimates, 14,172 foreign-born residents live in the metro area. The Healthy Immigrant Families (HIF) project included partners from the Hispanic, Somali, and Sudanese communities in Rochester.

Intervention Development

Formative Research—The intervention was developed on the basis of formative research conducted by the study team to elucidate barriers and promoters of sustainable, healthful levels of physical activity and nutrition after immigration to the United States, at both the individual and family levels. Sixteen focus groups were conducted in 2012; participants were from local immigrant communities and included 127 adults and adolescents stratified by age, gender, and ethnicity. RHCP community partners participated in focus group moderation and qualitative analysis. Results for physical activity (27) and nutrition (20) are reported elsewhere.

In brief, the focus groups found striking similarities in barriers and promoters of physical activity among the heterogeneous participants, suggesting that the shared experiences of immigration and related socioeconomic and linguistic factors markedly influenced understanding, conceptualization, and practice of physical activity. The biggest barriers to initiating physical activity were low levels of familiarity and comfort with exercise facilities and opportunities, but participants were motivated to engage in physical activity when receiving social support from family, friends, and communities (27). For nutrition, results from the focus groups found that “personal, structural, and societal/cultural factors influence meanings of food and dietary practices across immigrant and refugee populations... [and] that cultural factors are not fixed variables that occur independently from the contexts in which they are embedded” (20). Additionally, family and community-focused approaches to incorporating these factors may be valuable for informing health-promoting practices (20).

Theoretical Framework—Social cognitive (learning) theory (28) (SCT) was the conceptual basis for the intervention. This theory recognizes the interplay of individual factors (eg, self-efficacy to become physically active) and social environmental factors (eg, social support) on health behavior change. Self-efficacy has been postulated to be an influential cognitive mechanism mediating behavioral change (28). Low self-efficacy is an influential determinant of inactivity (29), and it is associated with a lack of success at eating a healthful diet (30,31). Likewise, a socially supportive family environment has an important influence on physical activity in general populations (32) and among families of low socioeconomic position (33). Other key constructs of SCT are outcome expectations or the consequences of enhanced physical activity and nutrition (eg, weight loss) (34). Finally, SCT addresses social reinforcers, which can provide more powerful and immediate motivation for enhanced physical activity and nutrition (35).

Participatory Intervention Work Groups—An RHCP HIF grant proposal-writing group was established to develop an intervention within our theoretical framework that aimed to improve physical activity and healthful eating among immigrant and refugee

families. The 16 members consisted of academic and community partners from each participating immigrant group; members were self-nominated on the basis of participation in project conception and prioritization within their communities. The intervention was developed on the basis of results of our formative research, existing literature, and experiences from an RHCP pilot study of immigrant and refugee women (26). The work group met weekly for 6 months to tailor and refine the intervention framework in preparation for a grant application. After the grant was awarded, 8 separate HIF work groups were then assembled to plan and refine the different components of the intervention. These included work groups dedicated to physical activity material, nutrition material, communication and sustainability strategies, group fitness, asset mapping, qualitative research, survey adaptation and translation, and interventionist training. These groups consisted of at least 2 academic and 3 community partners from the 3 immigrant groups (work group participation range, 8-14 members). In this way, groups reflected work by all the participating immigrant groups. Groups met regularly and reported progress to the overall HIF planning committee on a biweekly basis.

The study team, which consisted of academic and community partners, developed an intervention manual with 12 content modules: 4 for physical activity (increasing physical activity, muscle strength and flexibility, reducing screen time, and overcoming barriers to physical activity), 6 for nutrition (increasing fruits and vegetables, healthful beverages, reducing dietary fats, healthful snacks, portion control, and smart shopper strategies), and 2 for synthesizing and reinforcing information (exercise/food/work-life balance and celebrating accomplishments). Physical activity content was partially adapted from Active Living Every Day, an evidence-based guide to incorporating more physical activity into busy lifestyles (36) and from the LEARN Program for Weight Management (37). Nutrition content was partially adapted from the Simply Good Eating for English Language Learners curriculum, designed for immigrant and refugee families with low English-language literacy (38). The manual included scripts for the interventionists to use, as well as lists of recommended activities and materials for each module. To promote behavior change outside of sessions, the intervention manual also included a focal asset map of physical activity and nutrition resources within Rochester, Minnesota. Newsletters were created that highlighted key messages from each module and incorporated success stories from community members from each group; these were included in the manual.

From the focus groups, we learned that the primary barrier to behavior change in our community was taking the first step toward being physically active. Because RHCP members believed that opportunities for exercise classes in a “safe” environment were important, an optional component of the intervention was to facilitate opportunities for physical activity. For example, RHCP facilitated the development of a women-only fitness program at the local fitness center (Rochester Area Family YMCA).

Family Health Promoters

Bilingual family health promoters (FHP) from each of the 3 participating communities completed RHCP-facilitated human subjects protection training and were trained to deliver the intervention to participants within his or her respective community. The training

curriculum for FHPs was developed by an RHCP work group that consisted of professionals from dietary services, wellness coaching, nursing, medicine, clinical health psychology, physical medicine, and sports medicine and a conditioning specialist. The final training program included the following domains: CBPR/RHCP orientation, HIF project orientation, protecting human research participant training, principles of CBPR, SCT theory-based behavior change principles, motivational interviewing principles, family-focused communication, physical activity principles, nutrition principles, mastery of intervention guide content, and training on the intervention delivery. FHPs spent an average of 250 hours on overall training, which included practicing each module with families and role-playing under direct observation. Before intervention delivery, FHPs visited each family in their home to make introductions and provide orientation to the intervention. FHPs were employed in supplemental positions by the primary academic partner institution and were paid through grant funding.

Intervention Delivery

FHPs delivered the intervention to participating families through 12 home visits in a 6-month period, followed by phone calls every 2 weeks (up to 12 calls total) during the next 6-month period. Home visits were used to sequentially deliver each of the 12 content modules. At each visit, FHPs also monitored progress on family goals and provided social support and mentoring to problem-solve barriers and to set realistic future goals. Each home visit lasted 30 to 90 minutes. These processes were electronically documented by FHPs for each encounter as a reminder of individualized family goals and progress. In addition to the intervention sessions, FHPs facilitated the family's participation in existing community-based physical activity or group fitness programs. FHPs incorporated counseling strategies consistent with our theoretical framework, including role-modeling, feedback and reinforcement, shaping, and social support to enhance self-efficacy and behavior change. SCT highlights the importance of modeling healthful and successful behaviors and proposes that people are more likely to follow behaviors of someone with whom they can identify. Thus, the FHPs, who were recruited from each of the 3 immigrant populations, modeled healthful behaviors during family sessions (eg, they measured foods, demonstrated movements, and provided specific examples of healthful food choices). Each visit for the delivery of a content module included the following components: 1) assessment of existing subject knowledge and current behaviors related to each module topic, 2) delivery of information and "key" concepts, 3) engagement in an interactive activity (eg, working with food models), 4) discussion of perceived barriers and potential solutions with household members, and 5) individual and family goal setting. A key feature of this intervention involved FHPs working with participants to tailor solutions to each family's unique situation.

After completion of home visits, FHPs initiated follow-up 15-minute phone calls to each participating family every 2 weeks, making up to 12 phone calls over the next 6 months. FHPs spoke with an adult participant representing the family and began by obtaining a progress report about the family's physical activity and diet. Conversations ended with a brief content summary reinforcing points pertaining to 1 of the 12 modules.

The intervention and measurements were pretested and refined with 4 pilot families (14 individuals) in late 2013.

Treatment Adherence

A home visit was considered to be successfully completed when the intervention was delivered to at least 1 participating adult and 1 adolescent family member. A telephone call was counted as completed when the call was made with 1 adult participating family member. Participants were classified as having received an adequate dose of the intervention if they received at least 9 of the 12 home visits and phone calls (75%).

Study Design

Our approach followed established methods for behavioral therapies development research (39,40). Our overall aims were 1) to develop a physical activity and nutrition intervention with and for immigrant families and 2) to evaluate the efficacy of the intervention. We hypothesized that a community-derived, family-focused, and culturally appropriate intervention delivered to immigrants and refugees would improve their physical activity and dietary behaviors compared with a delayed-treatment control group.

The study design was a randomized community-based trial, with a delayed-intervention control group. Measurements were taken at baseline and at 6, 12, and 24 months after initiating the intervention (Figure 1). During the 12-month control period, the delayed-intervention group was contacted up to 4 times by an FHP, who expressed appreciation for their ongoing participation. However, control participants did not receive any physical activity or nutrition intervention during the interactions.

Sample Size Calculation

Our preliminary data indicated that a moderate to large effect size could be detected in the outcome variables of interest, including the direct measurement of physical activity for participants (26). The study was powered to detect at least a moderate effect size for the primary outcomes of physical activity and dietary quality between the 2 groups (intervention and control). We calculated that a sample of 64 individuals per group (128 in total) would provide 80% power for a 2-sample *t* test to detect differences in the mean changes from baseline of 50% times the standard deviation of physical activity (accelerometer), dietary improvement, or quality of life, with a 2-sided alternative and a 5% type I error rate. Twenty-three additional individuals were recruited to account for the possibility of cancellation, protocol violations, and incomplete cases.

For secondary outcomes that were categorical, the Fisher exact test would have 80% power to detect differences in the various rates of activity and dietary variables of 25% between the 2 groups. All hypothesis testing was done with 2-tailed alternatives and a 5% type I error rate.

Recruitment and Eligibility

Participants were recruited via face-to-face contact and word-of-mouth initiated and conducted entirely by RHCP community partners from each of the participating immigrant

communities: Hispanic, Somali, and Sudanese. Recruitment partners first completed RHCP-facilitated human subjects protection training (41). They identified potentially eligible families through meetings and word-of-mouth advertising. After hearing about the project or after attending community meetings convened by recruitment partners, interested families were then screened by recruitment partners for potential eligibility via a face-to-face meeting or telephone call. They then obtained permission from an interested adult family member to forward their contact information to a study staff member. A language-congruent study staff member then called the family and conducted a full screen for eligibility. Eligible families were invited to participate and enroll in the study. Participants were offered the opportunity to receive family portraits from a professional photographer as an incentive for taking part in these activities.

Eligibility criteria at the family level included households with at least 1 adult and at least 1 child aged 10 to 18 years. Inclusion criteria for individual participants included 1) not planning to move from the area within the next 2 years, 2) willing and able to participate in all aspects of the study, and 3) ability to provide oral informed consent or assent. Individual exclusion criteria were 1) self-reported pregnancy, 2) self-reported insulin-dependent diabetes mellitus, 3) self-reported diagnosis of cancer within the past 3 years, and 4) answered “yes” to the question: “Do you know of any reason why you should not do physical activity?” Verification of immigrant or refugee status was not an exclusion criterion.

Randomization

Consent, enrollment, randomization, and baseline measurements occurred during a single visit for each participant in February or March 2014 at a community venue. Randomization software allocated the family cluster to receive either an early or delayed intervention after stratifying by community (Hispanic, Somali, or Sudanese). Randomization status was not revealed to participating families or research staff until after baseline measurements were complete. Blinding the study coordinator or interventionists to the intervention group assignments was not feasible because of the logistical needs for coordination between families in this community-based study. However, data managers were blinded to group assignments throughout the study.

Baseline Measures

Primary Outcome Measures—The Kinetic Activity Monitor accelerometer (Kersh Health), validated in previous studies (42), was used for objective physical activity assessment. Participants were asked to wear the accelerometer at their waist during waking hours for 14 consecutive days. The accelerometer was activated and data collected without providing feedback to participants. A valid assessment requires 5 days of wear for at least 12 hours a day. FHPs telephoned participants during the assessment period to maximize adherence (43). Data output included sedentary time and time spent performing mild, moderate, and vigorous physical activities. We defined adequate physical activity following the 2008 Physical Activity Guidelines for Americans (44). The goal for adults (age 18 years and older) was 150 minutes per week of moderate to vigorous physical activity or 75

minutes per week of vigorous physical activity; the goal for children was 60 minutes per day of moderate or vigorous physical activity.

A single 24-hour dietary recall was collected from each study participant using the Automated Self-Administered 24-hour Recall system, a National Cancer Institute web-based tool that enables multiple automated self-administered 24-hour recalls (45). The “ASA-Kids” system was used for adolescents. Recalls were performed under supervision of study staff, including a registered dietitian. The tool is available in English and Spanish. Study staff and interpreters completed the recall with participants who spoke other languages. Data on diet quality included the Healthy Eating Index; intake of fruits, vegetables, sugar, and fat; and total calorie consumption. We defined adequate consumption of fruits and vegetables by cups consumed per day, as defined by the 2010 Dietary Guidelines for Americans (46). Recommended cups of fruits and vegetables per day were calculated for each individual on the basis of daily calorie consumption. Goal for daily consumption of sugar-sweetened beverages (sugared soda, sports drinks, and non-100% fruit juice) was zero.

Secondary Outcome Measures—Biometric measures include body mass index (BMI), systolic and diastolic blood pressure, waist circumference, and waist:hip ratio. Weight was measured to the nearest 0.1 kg using a single digital floor scale (Model 876; Seca). Height was measured to the nearest 0.1 cm using a single stadiometer (Model 213; Seca). Overweight was defined as BMI of 25 to 29.9 kg/m² for adults and BMI in the 85th to 94.9th percentile for adolescents; obesity was defined as BMI ≥ 30 kg/m² for adults and BMI ≥ 95th percentile for adolescents (47,48).

Waist circumference was measured to the nearest 0.1 cm by locating the narrowest part of the torso between the ribs and the iliac crest. Participants removed all excess clothing before measurement and smoothed the remaining clothing against the skin. Two manual measurements were taken on each participant with a tape measure. If the difference between the 2 measures exceeded 2.0 cm, a third measurement was taken; the average of the 2 closest measures was used in the analysis. Hip circumference, measured to the nearest 0.1 cm, was taken at the widest part of the buttocks or hip. Obesity was defined by waist circumference and by waist:hip ratio. For circumference, obesity in adults was defined as >88 cm for women and >102 cm for men (49). For waist:hip ratio, obesity in adults was defined as >0.85 for women and >0.9 for men (50).

Seated mechanical blood pressure measurements (systolic and diastolic) were made on the right arm after the participant sat quietly for 5 minutes (51). Blood pressure was measured twice, with 1 minute between readings, and averaged readings were used in the analysis. Health-related quality of life was measured by single-item linear analog scale assessments of physical, emotional, and overall health (52,53).

Theory-Based Measures—For adolescent participants, survey items were adapted from instruments developed for the Patient-centered Assessment and Counseling for Exercise plus Nutrition (PACE+) program for low-income, ethnically diverse adolescents (54). These included scales for physical activity self-efficacy and family support (55); fruit and vegetable self-efficacy and family support (56); and dietary fat self-efficacy and social support (56).

Among adults, analogous survey items from the PACE+ program for adults (57) were used to assess physical activity self-efficacy (58) and family support (56); fruit and vegetable intake self-efficacy (58) and family support (59); and dietary fat intake self-efficacy (58) and social support (59). Additionally, the Nutrition Self-Efficacy Scale was adapted to assess overall nutrition self-efficacy (60).

The English-language versions of both surveys were reviewed and revised for cultural adaptation and meaning by an HIF work group. For the adult survey, we used separate work groups for translation to Somali and Spanish through further editing of each item by forward translation, panel discussion, backward translation, a pretest, a cognitive briefing, and a consensus on the final version by a core group of community leaders from each participating community (61). We have previously described the successful implementation of this survey adaptation and translation process by our CBPR partnership (62). These translated surveys and interviews were pilot-tested and refined with 4 families before baseline measurements.

Data Analysis Plan

Future primary analysis of the accelerometer and dietary data will be compared between groups in terms of average change from baseline by a single 2-sample *t* test. Supplementary analysis of the primary outcomes will include repeated measures analysis of variance modeling to assess the impact of baseline activity and other covariates on the subsequent activity levels. Although we considered using the family as the unit of analysis rather than the individual, it was impractical to collect measurements on an estimated sample size of approximately 550 individuals (3-4 adults and adolescents per family). We will adjust for the clustering nature of our sample within the statistical model by including the family as an effect. Analysis of the secondary outcomes will be conducted either with 1) 2-sample *t* tests supplemented by analysis of variance modeling, as described for the primary outcome, when the variable under study was continuous in nature or 2) the Fisher exact test comparing the relative incidence rates of the outcome under consideration, supplemented by logistic regression to assess the impact of covariates on the univariate results, including the family as an effect on the model. We will perform an additional subgroup analysis to explore outcomes separately for adults and adolescents.

Analysis of the family data will use the same approaches as described for that of the individual data, with additional modifications to account for multiple family members. First, we will randomly sample 1 person from each family to serve as the family representative in the analysis. We will then bootstrap this process 10,000 times to assess the impact of the individual on the family analysis. Second, we will compile the individual results for each family into summary statistics representing the minimum, average, and maximum results observed for each variable per family. The family summary statistics then will be analyzed as was described for the primary and secondary outcomes. Finally, we will compare individual and family outcomes directly by calculating intrafamilial differences between the individuals and families to estimate the difference in effect size between the family and individual outcomes. These family level analyses will allow estimation of the family size effect, which will then be used as a conditioning factor to refine our primary analysis. Missing data will be handled in several ways. Simple imputation methods such as minimum,

average, or maximum values carried forward will be followed by multiple imputation methods to assess the robustness of the study results when data are missing. All analyses will be performed using SAS statistical software (version 9.3; SAS Institute Inc).

Process Evaluation Plan

Process evaluation will be prospectively completed throughout the study interval. These will include semistructured interviews with community partners, academic partners, FHPs, and study participants. Interviews will address issues of process integrity as it relates to the following domains: recruitment, training, implementation, context, and partnership.

Results

A total of 151 individuals (81 adolescents, 70 adults) from 44 families were enrolled and randomized. The intervention group had 25 families (76 individuals), and the delayed-intervention (control) group had 19 families (75 individuals). We observed no significant sociodemographic differences between the 2 groups, with the exception of more Hispanic adolescents in the early intervention group. Characteristics of the study population are shown in Table 1.

Accelerometry data were collected from 148 participants (98%). Accelerometers were worn for a mean (SD) of 11.4 (6.4) days (adolescents, 10.4 [6.5] days; adults, 12.5 [6] days). The mean (SD) number of hours worn per day was 11.9 (4.8) hours (adolescents, 11.4 [5.3] hours; adults, 12.6 [4.1] hours). The threshold for valid accelerometer baseline data was achieved by 117 participants (77%). The mean (SD) time spent in moderate to vigorous physical activity was 64.7 (30.2) minutes per day for adolescents and 43.1 (35.4) minutes per day for adults. Mean (SD) sedentary time was 795.3 (163.2) minutes per day for adolescents and 714.2 (181.4) minutes per day for adults.

For the 24-hour dietary recall measure, the mean baseline estimates of energy, fruit, vegetable, fat, and sugar are shown in Table 2. Moderate dietary quality was estimated by using the Healthy Eating Index (63), which reported outcomes on a scale of 0-100; mean (SD) scores were 51.9 (11.4) for adolescents and 57.1 (13.5) for adults. Table 2 also presents baseline biometric measurements; 37 adolescents (45.7%) and 52 adults (80.0%) were overweight or obese.

Table 3 presents baseline data from the theory-based measures. Moderate levels of self-efficacy and social support were reported for physical activity and nutrition. Physical activity and healthful eating access were relatively low. Quality-of-life measures were moderately high at baseline.

Discussion

HIF is a community-based randomized trial derived through a CBPR approach to test the efficacy of a physical activity and nutrition intervention among immigrant families in Minnesota. This program represents 5 years of group work between community and academic partners, with detailed formative research to guide the activities. The foundation of

this work is community activism around the problem of accumulating cardiovascular risk and poor health among US immigrants and refugees, particularly those with the shared experiences of poverty and limited English proficiency. It is among the first community-based interventions to use a CBPR approach to address waning physical activity and dietary quality in these populations.

Because of the complexity of factors contributing to health behaviors among immigrant families, genuine participatory intervention development between community and academic partners was essential to derive the products described in this study. The cornerstone of this process was the HIF infrastructure, which had community and academic representation in each work group that addressed different parts of the multicomponent intervention. The task specificity and equal participation between community and academic partners contributed to efficient and effective work toward a common goal. Work group progress was monitored and augmented by biweekly HIF leadership meetings and through 3 full-day workshops with all RHCP community and academic partners to brainstorm key decisions. Program development was further overseen through monthly RHCP leadership meetings that included community and academic partners who were not actively involved in this project.

Across the country, recruitment to research studies is relatively low among racial and ethnic minorities (64) and is particularly difficult among vulnerable immigrant and refugee populations (65). CBPR can significantly improve recruitment efforts (66), and this study provides an example of community participation in research recruitment. Participant recruitment for this study was planned and executed by community partners with research experience after completing training in human subjects protection through an RHCP-facilitated class (41). This strategy resulted in a more relevant community-based sample of participants than traditional recruitment methods.

The baseline data from this study contribute to the literature for physical activity and dietary quality among US immigrants and refugees. Data from accelerometers showed that participants were sedentary for the majority of their waking hours (adolescents, 75.4%; adults, 69.0%). Data on moderate to vigorous physical activity were within the range of national averages for adolescents (67), and 45% met physical activity guideline goals. Moderate to vigorous physical activity for adults was higher than national norms (66), with 71.9% meeting physical activity guideline goals. This finding mirrors data among racial and ethnic minority groups in the United States, in which self-reported physical activity levels generally are lower than those of the overall population, but objectively measured physical activity via accelerometry is higher (68,69). Data in the current study extend these findings to include subset immigrant and refugee populations. Fruit and vegetable intakes among participants in this study were higher than national data for both adults and adolescents (70), but only 6.2% of adolescents and 4.4% of adults were meeting nutritional guideline goals for daily fruit and vegetable consumption. Nearly half of the adolescents (45.7%) and a majority of adults (80.0%) were overweight or obese, consistent with national disparities whereby obesity disproportionately affects racial/ethnic minorities and families living in poverty (71). Likewise, acculturation constructs among immigrant groups have been linked to rising rates of obesity after immigration (72).

Few studies have tested mediators of behavior change for physical activity and dietary quality among immigrants and refugees (73). Previous studies have shown an association between the social cognitive constructs of self-efficacy and social support with physical activity and healthful eating among low-income, ethnically diverse adults (57) and adolescents (54). This study will be the first to explore these mediators among immigrants in an intergenerational fashion, using prospective, objective data for the primary outcomes.

The study design has limitations. The complexity of the health problems addressed in this study called for a multicomponent intervention. Evidence suggests that the level of intervention implementation directly affects study outcomes, yet full implementation of interventions in community-based studies is frequently not achieved (74). The importance of process evaluation has been underscored in these settings (75,76), particularly for randomized trials with multimodal interventions (77). Process evaluation facilitates a richer interpretation of outcomes by elucidating factors that contributed to the success of an intervention (78). Therefore, we plan to prospectively evaluate our research processes at every phase. Furthermore, although the randomized study design is optimal, it carries a risk of indirect intervention dissemination to the control group through social networks among these cohesive communities in a single small city, a phenomena common to behavior-change interventions (79). Finally, although data analysts were blinded to treatment conditions, it was not practical to maintain blinding for the study team members with direct participant contact.

Conclusions

HIF is a multicomponent intervention, cocreated by community and academic partners, to improve physical activity and dietary quality among immigrant and refugee families in Rochester, Minnesota. Processes and products from this program are relevant to other communities aiming to reduce the accumulation of cardiovascular risk and poor health among these populations.

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Abbreviations

BMI	body mass index
CBPR	community-based participatory research
FHP	family health promoters
HEC	Hawthorne Education Center
HIF	Healthy Immigrant Families

RHCP Rochester Healthy Community Partnership
SCT social cognitive (learning) theory

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Figure 1.
Study Overview. Flowchart shows patient enrollment and timeline of interventions.

Table 1Demographic Characteristics of Adult and Adolescent Study Participants^a

Characteristic	Intervention	Control	P Value ^b
Adults (n=70)^c			
Age, mean (SD), y	39.2 (10.9)	38.9 (11.7)	.82
Female, No. (%)	27 (75.0)	23 (67.6)	.50
Ethnicity, No. (%)			.78
Hispanic/Latino	23 (63.9)	20 (58.8)	
Somali	12 (33.3)	12 (35.3)	
Sudanese	1 (2.8)	2 (5.9)	
Born in United States, No. (%)	5/36 (14.7)	2/33 (6.1)	.25
Lived in United States, mean (SD), y	11.5 (7.6)	15.7 (8.7)	.06
English language spoken at home, No. (%)	7/35 (20.0)	10/33 (30.3)	.33
Limited English proficiency, No. (%)	17/35 (48.6)	15/29 (51.7)	.99
Married, No. (%)	24/33 (72.7)	26/33 (78.8)	.57
Education status, No. (%) (n=65)			.88
8th grade or less	18 (51.4)	13 (43.3)	
Some high school	2 (5.7)	3 (10.0)	
High school graduate	13 (37.1)	13 (43.3)	
College or graduate degree	2 (5.7)	1 (3.3)	
Work status, No. (%) (n=68)			.33
Full time	12 (34.3)	11 (33.3)	
Part time	6 (17.1)	2 (6.1)	
Unemployed	17 (48.6)	20 (60.6)	
Mean annual family income, No. (%) (n=59)			.11
\$0-\$9,999	13 (44.8)	8 (26.7)	
\$10,000-\$19,999	2 (6.9)	2 (6.7)	
\$20,000-\$29,999	7 (24.1)	3 (10.0)	
\$30,000-\$39,999	5 (17.2)	9 (30.0)	
\$40,000 and higher	2 (6.9)	8 (26.7)	
Health insurance, No. (%) (n=64)			.25
No insurance	11 (32.4)	11 (37.9)	
Medicaid or Medicare	13 (38.2)	14 (48.3)	
Private insurance	10 (29.4)	4 (13.8)	
Household size, mean (SD)	5.7 (2.2)	5.5 (2.4)	.57
Adolescents (n=81)^d			
Age, mean (SD), y	13.4 (2.5)	13.5 (2.4)	.89

Characteristic	Intervention	Control	<i>P</i> Value ^{<i>b</i>}
Adults (n=70)^{<i>c</i>}			
Female, No. (%)	19 (47.5)	22 (53.7)	.58
Ethnicity, No. (%)			.03
Hispanic/Latino	23 (57.5)	14 (34.1)	
Somali	15 (37.5)	25 (61.0)	
Sudanese	2 (5.0)	2 (4.9)	
Born in United States, No. (%)	18/39 (46.2)	18/38 (47.4)	.92
Lived in United States, mean (SD), y	6.6 (5.0)	6.9 (4.1)	.68
English language spoken at home, No. (%)	21/39 (53.8)	18/39 (46.2)	.50
Limited English proficiency, No. (%)	4/39 (10.5)	6/39 (15.4)	.51

^{*a*}Percentages were calculated using the number of responses received as the denominator.

^{*b*} χ^2 test was used for categorical variables, and Wilcoxon test was used for continuous variables.

^{*c*}Intervention group, n=36; control group, n=34.

^{*d*}Intervention group, n=40; control group, n=41.

Table 2Baseline Physical Activity, Dietary Quality, and Biometrics Among the Study Population (N=151)^a

Characteristic	Adolescents	Adults
Physical activity		
Moderate to vigorous physical activity, mean (SD), minutes/d	64.7 (30.2)	43.1 (35.4)
Sedentary activity, mean (SD), minutes/d	795.3 (163.2)	714.2 (181.4)
Physical activity goal met, No. (%) ^b	27 (45)	41 (71.9)
Dietary quality		
Energy, mean (SD), kcal	2,095.6 (1,160.4)	1,783.0 (819.7)
Vegetables, mean (SD), cup equivalent	1.3 (0.9)	1.7 (1.5)
Fruit, mean (SD), cup equivalent	1.8 (1.5)	1.4 (1.2)
Fat, mean (SD), g	73.9 (48.8)	59.9 (35.3)
Sugar, mean (SD), g	139.8 (114.4)	97.6 (55.0)
Healthy Eating Index Score, mean (SD) ^c	51.9 (11.4)	57.1 (13.5)
Met consumption goal for fruits and vegetables, No. (%) ^d	4 (6.2)	3 (4.4)
Met consumption goal for sugar-sweetened beverages, No. (%) ^e	2 (2.6)	14 (21.5)
Biometric data		
BMI, mean (SD), kg/m ²	23.8 (5.4)	30.2 (6.8)
Normal weight, No. (%) ^f	44 (54.3)	13 (20.0)
Overweight, No. (%) ^g	14 (17.3)	21 (32.3)
Obese, No. (%) ^h	23 (28.4)	31 (47.7)
Systolic blood pressure, mean (SD), mm Hg	111.1 (10.0)	122.1 (14.7)
Diastolic blood pressure, mean (SD), mm Hg	65.4 (7.7)	76.3 (9.0)
Waist circumference, mean (SD), cm	80.9 (12.6)	98 (13.3)
Waist:hip ratio, mean (SD)	0.8 (0.1)	0.9 (0.1)
Abdominal obesity, No. (%)		
By waist circumference ⁱ	...	42 (60.0)
By waist:hip ratio ^j	...	41 (58.6)

Abbreviation: BMI, body mass index.

^aData were missing for 25 participants (17 adolescents and 8 adults). Percentages were calculated using the number of responses received as the denominator.

^b Goal for adolescents: 60 minutes/day of moderate or vigorous physical activity. Goal for adults (age 18 years and older): 150 minutes/week of moderate to vigorous physical activity or 75 minutes/week of vigorous physical activity.

^c Possible scores ranged from 0-100.

^d Cups consumed per day according to daily calorie consumption, as defined by the 2010 Dietary Guidelines for Americans (44).

^e Zero sugar-sweetened beverages (eg, sugared soda, sports drinks, and non-100% fruit juice) per day.

^f Defined as BMI <85th percentile for adolescents or <25 kg/m² for adults.

^g Defined as BMI 85th-94.9th percentile for adolescents or 25-29.9 kg/m² for adults.

^h Defined as BMI ≥95th percentile for adolescents or ≥30 kg/m² for adults.

ⁱ Waist circumference >88 cm for women, >102 cm for men.

^j Waist:hip ratio >0.85 for women, >0.9 for men.

Table 3

Baseline Theoretical Mechanisms for Physical Activity and Dietary Behaviors

Variables ^{a,b}	Adolescents (n=81)	Adults (n=68) ^c
Physical activity		
Self-efficacy	3.4 (0.9)	2.9 (0.8)
Social support	2.5 (1)	3.0 (1)
Fruit and vegetable consumption		
Self-efficacy	3.9 (0.8)	3.3 (0.9)
Social support	3.2 (1)	
Healthful eating social support	...	2.9 (0.8)
Resource access		
Physical activity	...	2.5 (1.1)
Healthful eating	...	2.4 (1.1)
Quality of life		
Physical well-being	3.5 (1.2)	3 (1)
Mood	3.5 (1.2)	3.3 (1.2)

^a All domains are reported as a mean (SD) on a 5-point Likert scale, with 1 being the lowest response option and 5 being the highest.

^b The number of items that informed each mean differed by domain: physical activity self-efficacy, 6 items; physical activity social support, 4 items (adolescents) or 5 items (adults); fruit and vegetable consumption self-efficacy, 7 items (adolescents) or 6 items (adults); fruit and vegetable consumption social support, 4 items; healthful eating social support, 7 items; physical activity access, 1 item; healthful eating access, 1 item; physical well-being, 1 item; and mood, 1 item.

^c Data were missing for 2 adult participants.