Bienestar: A Diabetes Risk-Factor Prevention Program

Robert P. Trevino, Jacqueline A. Pugh, Arthur E. Hernandez, Velma D. Menchaca, Robert R. Ramirez, Monica Mendoza

ABSTRACT: *The Bienester Health Program, a diabetes risk-factor prevention pilot program, targeted fourth grade Mexican American children. The primary goals are to decrease the two established risk factors for diabetes — overweight and dietary fats. Since the health program is based on Social Cognitive Theory, on social systems structure, and on culturally relevant material, it considers the child's social systems on both its health program and process evaluation. Learning activities were developed for four social systems that potentially influence children's health behaviors (parent, classroom, school cafeteria, and after-school care). Preliminary results show that the Bienestar Health Program significantly decreased dietary fat, increased fruit and vegetable servings, and increased diabetes health knowledge.* (J Sch Health. 1998;68(2):62-67.)

Overweight and dietary fat intake are established risk factors for diabetes. In Mexican Americans, the San Antonio Heart Study found a significant relationship between overweight and both the prevalence and 8-year incidence of diabetes.[1,2] Dietary fats, independent of body weight, are also reported to cause insulin resistance and diabetes in experimental and clinical studies.[3-6] Thus, health programs that decrease per cent body fat and/or decrease dietary fat intake may potentially prevent diabetes.

Greater adiposity and higher dietary fat intake are more common in Mexican-American children than in non-Hispanic White children. Mexican-American children have more centralized adiposity, higher body mass index, and larger skinfolds than non-Hispanic White children.[7,8] Mexican-American children also consume higher portions of dietary fats and lower portions of vegetables and fruits than that recommended by national standards.[9] Since diabetes is highly prevalent in Mexican-American adults, and both diabetes risk factors are more common in Mexican-American children, a prudent measure would be to explore health education programs aimed at decreasing overweight and dietary fat intake in Mexican-American children.

Preliminary results from the Bienestar (Well-being) Health Program are described. The Bienestar Health Program is a school-based diabetes risk-factor prevention program, and results from the pilot study contributed to program refinement. The program was designed to be implemented for fourth grade Mexican-American children from poor school districts, since the disparity in body fat between Mexican-American and non-Hispanic White children is evident as early as eight years for boys and 13 years for girls.[8] Diabetes and overweight also are more common in Mexican-American adults from lower than from higher socioeconomic status.[1,10]

The primary goals of the Bienestar Health Program are to decrease body fat and/or to decrease dietary fat intake in children. Body fat is measured by bioelectric impedance analysis (BIA) and body mass index (BMI), and dietary fat intake is measured by three 24- hour dietary recalls. Secondary goals are to increase vegetable and fruit intake, health knowledge, self-efficacy, self-esteem, and level of activity.

PROGRAM DEVELOPMENT

Theoretical Framework

The Bienestar Health Program is based on Social Cognitive Theory.[11] This conceptual model describes behavior as being motivated and regulated by internal standards and self-evaluation. According to this model, social systems in the individual's environment in addition to self-evaluation mediate the relationship between an individual's knowledge and attitudes and his/her consequent behaviors.

Program Description

Using social systems structure, interventions were developed for the four social systems that conceptually should exert the most influence on children's health behaviors. The four social systems are parents, school classroom, school cafeteria, and after-school care. These four separate components were integrated by content, chronology, and culturally relevant themes and operated from September through April.

The parent health education intervention consists of a nutrition education seminar to provide content knowledge, cooking classes to provide an opportunity to practice with feedback (including taste), a theatrical play with health topics presented by the children to provide affective motivation, a series of health newsletters written by the children to inform parents of ongoing activities and reinforce earlier activities, and an individual dietetic consultation to discuss their respective child's nutritional data and therapy recommendations to inform parents about their child's level of risk.

The school classroom intervention was the Bienestar health curriculum. Developed by staff from the Social & Health Research Center and the departments of education at Southwest Texas State University and University of Texas at San Antonio, the Bienestar health curriculum was

Robert P. Trevino, M.D., Executive Director, Social & Health Research Center, 1302 South St. Mary's, San Antonio, Texas 78210; Jacqueline A. Pugh, M.D., Associate Professor Dept. of Medicine, University of Texas Health Science Center at San Antonio, 7703 Floyd Curl Drive, San Antonio, Texas 78284-7870; Arthur E. Hernandez, Ph.D., Associate Professor, Dept. of Education, University of Texas at San Antonio San Antonio, Texas 78249; Velma D. Menchaca, Ph.D. Associate Professor, Dept.of Curriculum and Instruction Southwest Texas State University, 601 University Drive, San Marcos, Texas 78666-4616; Robert R. Ramirez, M.A., Research Director, Social & Health Research Center, 1302 South St. Mary's, San Antonio, Texas 78210; Monica Mendoza, B.S., Program Director, Social & Health Research Center, 1302 South St. Mary's, San Antonio, Texas 78210. *This study was supported with grants from The Texas Diabetes Council and Southwest General Hospital, San Antonio, Texas.*

designed to supplement the existing health curriculum so as not to eliminate or reduce important content coverage not related to diabetes prevention. Intended to be implemented in the fourth grade, all instructional material were written at the fourth grade reading level.

The curriculum was developed around three sections: nutrition, wellness, and noncommunicable disease. The nutrition section is self-explanatory. The wellness section includes self-esteem, weight management, and exercise. The non-communicable disease section includes diabetes, hypertension, heart disease, and cancer. The lessons were developed with culturally-relevant educational material. Theory suggests that children from ethnic populations may improve their understandings of concepts and skills if curriculum uses examples and content from the learner's respective culture to illustrate key concepts, principles, and generalizations.[12]

The Bienestar health curriculum includes 28 ready-to-use lessons, including review lessons and tests. The curriculum includes a teacher's manual, a children's workbook, test instruments with respective keys, transparencies, extensions for the thematic instruction, and support materials. Essentially the curriculum provides teachers all the content, instructional strategies, and materials. The school cafeteria component addresses cafeteria staff with the objective to teach healthy recipes; purchasing foods with high health value; reading and interpreting food labels; and overall guidelines for preparing healthy meals.

The Bienestar Health Club component involves after-school learning activities aimed at rehearsing and reinforcing classroom learning and promoting leisure time moderate to vigorous physical activity. The health club education incorporates the literary, visual, and performing arts. In essence, the health club involves an arts program with health topics.

PROGRAM EVALUATION

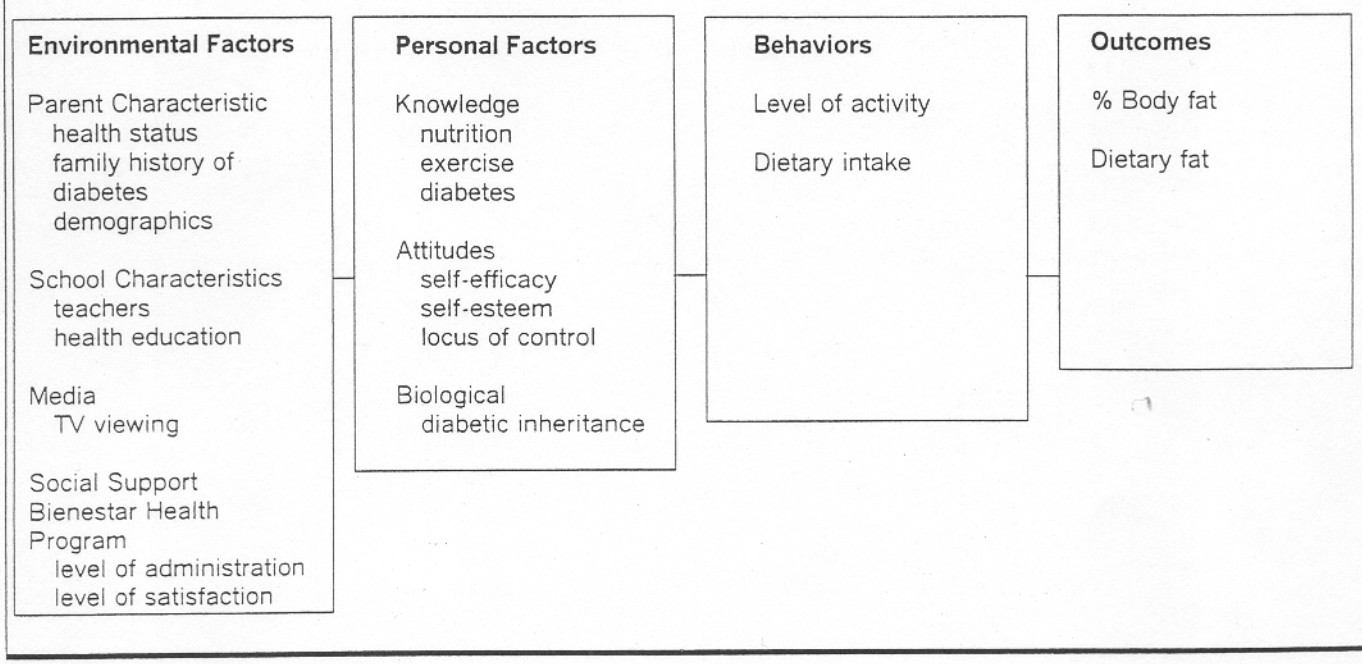
Personal, environmental, and behavioral characteristics of students and parents, examined by process evaluation, are essential in determining and explaining effects of the intervention, monitoring implementation, and detecting and correcting "weaknesses" of the intervention. (See Figure 1.)

Personal factors examined in the children participating in Bienestar include knowledge, attitudes, and biological factors. The health knowledge scale measures nutrition, exercise, and diabetes. The attitudes considered include nutrition and exercise self-efficacy and locus of control, and global self-esteem. Biological factors such as potential heritability of diabetes are measured by family history of diabetes of both parents.

Self-efficacy is an individual's judgment of the capability to accomplish specific tasks effectively. Beliefs concerning self-efficacy, however, may be influenced by perception of locus of control.[13] Rotter suggests that, based on experience, individuals decide whether causal control for a given condition is personal (internal) or situational (external). An internal locus of control results in efforts to regulate situations and outcomes, an external locus of control results in limited efforts since situations and outcomes lie outside individual control. While self-efficacy is task specific, self-esteem reflects a more general perspective of self-worth, usually founded on experiences of success in challenging situations.

Items for the attitudinal scales were originally generated from previously validated scales and discussions between research staff and teachers. The self-efficacy scale was modeled after the Child and Adolescent Trial for Cardiovascular Health (CATCH) Intervention Program,[14] the self-esteem scale was modeled after Rosenberg's Self-Esteem Scale,[15] and the locus of control scale was modeled after the Desirable and Undesirable Event Locus of Control

Figure 1
Environmental, Personal, and Behavioral Characteristics Measured in Student and Parent Participants



Scale.[16] Items from the scales were reviewed by two, fourth-grade teachers and modified for fourth grade reading and understanding. Though not yet demonstrated valid or reliable with Mexican-American children, initial reports of effectiveness and utility suggest sufficient validity and reliability for present purposes. An examination of scale functioning was conducted as a part of this pilot.

Biological factors, though not described as Social Cognitive Theory determinants, were examined since susceptibility to diabetes is strongly influenced by degree of relatedness to the diabetic proband. On the parent questionnaire, in four separate items, parents were asked if they themselves, their siblings, their mother, or their father were diagnosed with diabetes by a physician.

Environmental factors examined included measures of intervention implementation and contextual factors. Intervention implementation was considered in terms of program administration (protocol fidelity in specific activity implementation) and participant satisfaction (participants' reaction and level of enthusiasm).

Contextual factors refer to parents' health status and demographics, school staff experience and attitudes toward health education, school commitment to health education, and concurrent school health programs. Other factors include children's hours of television viewing and social support. The social support scale used in this study was modeled after the Hispanic Health Nutrition and Evaluation Survey's Social Support Scale.[17] Implementation and contextual factors are potentially confounding variables that may explain an intervention program's outcomes and thus must be measured and considered.

Behavioral factors examined were level of activity and dietary intake. Level of activity was measured by the "sweat test" which was found reliable and predictive of exercise frequency.[18] Respondents were asked, "Do you do any physical activity such as fast walking, jogging, cycling, basketball, volleyball, etc. long enough to work up a SWEAT at least one day per week?" If respondents answered"yes" then they were asked, "How many times per week and for how long each time do you do those activities?"

Dietary intake was measured by three, 24-hour dietary recalls (2 week days and 1 weekend day). Studies have found dietary recall to be reliable and valid in children of this age group.[19,20] All interviews were conducted in English during school hours by five trained Social & Health Research Center full-time staff members. Staff training outlined two procedures for collecting dietary information. One was an interviewing technique which consisted of a script for dialogue prompting methods and recording methods. The other was a measuring technique which consisted of using food models and measuring utensils. Time of day and type of food/beverage consumed, and amount consumed measured in fluid ounces, cups, and/or portion sizes were collected for the day (24 hours) prior to the interview.

Dietary information was analyzed using Nutrition IV software for windows (The Hearst Corporation, San Bruno, CA., 94066). These analysis provide specific macronutrient and micronutrient content of foods. Servings of fat, fruit, and vegetables were quantified manually using the U.S. Department of Agriculture's Food Guide Pyramid method.[21] The Food Guide Pyramid method applies specific conversion factors to convert gram weight quantities into serving quantities.

Outcome factors examined include body fat and dietary intake. Procedures for dietary intake were described above. Body fat was measured indirectly by BIA (Tanita Corporation of America Inc., Skokia, Ill., 60077) and BMI (kg/cm^2). The BIA was used for body fat measurements (percent body fat and fat mass in grams) in body fatness study because, in children, body fatness relates closely to atherogenic and diabetogenic risk factors[22] and because BMI may not represent their true body fatness.[23] Also, BIA provides a quick and efficient method for group studies. Bioelectric impedance analysis has shown close correlations with BMI, dual-energy X-ray absorptiometry, skinfold thickness, and underwater body density measurements in non-Hispanic White children.[24,25] Mexican-American children in this study showed a positive and significant correlation ($r=.92$; $p<0.05$) between percent body fat measured by BIA and BMI measured by a Detecto scale.

The BIA instrument consisted of a computer laptop and a metal electrode box. Children wearing indoor clothing are asked to remove their shoes and socks, and step on a metal electrode box. Within 30 seconds the instrument prints out percent body fat and fat mass in grams. The children, also wearing indoor clothing and barefooted, have their body weight and height measured with Detecto scale.

PROGRAM RESULTS

The Bienestar Health Program has operated for two years in two parochial schools located in the poorest school district of San Antonio, Texas. This report presents student characteristics and preliminary findings from the 1996-97 school year (n = 102). Table 1 shows selected demographic variables from a sample of parents that completed the survey. Most households had two working parents and most mothers had only a high school education. On average, all children participating in the program were at risk for developing diabetes (Table 2). They were overweight, ate a high fat diet, ate a low fiber diet, and had a high family history (1st or 2nd degree relatives) of diabetes.

Evaluation variables were measured in September and May before and after implementation of the program, respectively. Results show that the Bienestar Health

Table 1
Parental Characteristics of the Bienestar Health Program Fourth Grade Students (n=54 households)

	Mean or Percent
Single-parent households (%)	15
Average number of persons per household	2.8
Average household total annual income ($)	38,000
Average total annual income per person ($)	13,500
Two working parents (%)	85
Mothers' education (%)	
high school	42
tech/vocational training	32
college	21

Program significantly decreased dietary fat servings and percent fat total kilocalories and significantly increased dietary fruit and vegetable servings and diabetes health knowledge (Table 3). The nine-month program did not decrease percentage of body fat and did not increase level of activity. As discussed earlier, diabetes potentially can be prevented by decreasing either dietary fat intake or percentage of body fat.

The self-efficacy, self-esteem, and locus of control constructs developed for the program were piloted and tested for psychometric soundness. Subjects for this analysis were a convenient sample of 71 fourth grade Mexican-American students (49 % male, 51 % female). Results for internal (alpha) estimates and test-retest reliabilities are presented in Table 4. The self-esteem subscale had the highest alpha value (0.76). Test-retest reliabilities are important determinants of the stability of each measure. The survey instrument was readministered at two weeks after the initial test to analyze the inter-class reliability. All subscales were at or above the 0.50 level. Since, in addition to program goals, an important aim of the pilot implementation is to improve implementation and assessment, the questionnaires and support materials were reviewed for clarity, validity, and 4th grade readability, and training manuals were developed for the standardization of interviewing and implementation methods.

Self-efficacy differences between baseline and post-intervention were not analyzed because this subscale required revision between measurements. Self-esteem, in turn, was measured and did show a modest insignificant increase from baseline to post-intervention. Self-esteem analyzed by multiple regression showed a significant inverse relationship with percentage of body fat (not shown).

All fourth grade students received the health curriculum. The health club, held every two weeks after school, had 45% attendance at more than 50% of meetings. Students were divided between those who attended more than 50% (n=46) and those who attended less than 50% (n=56) of the health club meetings. The high attendance group had a significantly higher health knowledge score improvement between baseline and post-intervention than the lower attendance group. This finding suggests classroom curricula alone may not produce the favorable results observed with a social systems structure.

CONCLUSION

The Bienestar Health Program, in a pre-post design, resulted in a significant decrease in dietary fat intake, an increase in fruit and vegetable intake, and an increase in diabetes health knowledge. Decreased dietary fiber in a more recent study has also been shown to increase the risk of diabetes.[26] These findings suggest that the current model has potential for resulting in the desired outcomes

Table 2
Risk Factors for Diabetes in the Bienestar Health Program Fourth Grade Students (n=102)

	Mean or Percent	Recommended
Age	9.2	
% female	54	
BMI percentile	60th	50th
% body fat	27.8	20
Fat servings	7.40	sparingly
Fruit & vegetables servings	2.5	5
Family history of diabetes*	50*	

* based on 54 household surveys

Table 3
Dietary and Nutrition Mean Values of Children Participating in the Bienestar Health Program (baseline and post intervention; n=102)

	Baseline Mean (sd)		Post mean (sd)		t value
Dietary					
Fat servings	7.40	±3.9	5.53	±2.9	4.49*
Fruit and vegetable servings	2.5	±1.7	3.1	±1.9	-2.82*
Fat (Gm)	68.7	±31	68.3	±44	.08
Dietary fiber (Gm)	8.9	±4.4	9.5	±4.3	-1.13
Cholesterol (mg)	233	±144	202	±81	1.91
% fat total KC	.30	±.06	.28	±.05	2.57*
Psychometric					
Knowledge health score (0-100)	44.6	±11	62.5	±17	8.98*
Self-esteem (0-40)	26.9	±6	27.1	±6	-.37

Note: Two-tailed paired t-tests were utilized to detect mean differences between baseline and posttime.
* $p < 0.01$

Table 4
Internal Consistency and Two-week Test Retest Reliability of the Survey Instruments (n=71)

	Number of Items	Alpha Coefficient	Two-week Test Retest Reliability
Self-efficacy	10	.55	.54
Self-esteem	8	.76	.70
Locus of control	9	.55	.65
Social support	7	.59	.69

which can reduce diabetes risk-factors for the most at risk population.

Since the purpose of the pilot study was program refinement, limitations and challenges were identified. Limitations include lack of body fat reference values for Mexican-American children and the dietary recall methodology. Normal reference values for percent body fat and BMI in these tables are from non-Hispanic White children.[27,28] Since overweight has a causal relationship with diabetes, and both are more common in Mexican-American adults, an effort should be made nonetheless to decrease the higher body fat and BMI values found in Mexican-American children toward the lower normal referenced values developed for non-Hispanic White children.

Another limitation involved the intra-individual variation inherent in dietary recall measurements.[29] To circumvent that flaw, staff collected three days instead of one day dietary recalls, and the dietary results were used for making group means rather than individual estimations.

Based on current experience, three challenges to efficacy must be addressed. First, the health program did not decrease percent of body fat. This finding may be explained, in part, by two studies showing that in children this age a normal physiological increase occurs in percentage of body fat and body mass index.[30,31] The reason for this physiological change is the preparation for puberty that occurs between nine and 13 years of age.[32] Thus, for the 1997-98 school year the program is being evaluated in a quasi-experimental design with two groups, an intervention group (n = 102) and a comparison group (n = 82).The intervention group should have a smaller increase in percentage of body fat than the comparison group.

The second challenge involves increasing level of activity. The pilot Bienestar Health Program included a few learning activities directed at increasing level of activity. The revised program includes an exercise lesson plan in the health curriculum and increased exercise and related activities in the health club meetings. In addition, to improve sensitivity of level of activity measurement, physical fitness instead of level of activity will be measured by recording the children's heart rate before and after undergoing a standardized exercise protocol.[33]

The third challenge involves reducing the cost per student. The Bienestar Health Program costs more than traditional educational interventions. However, since classroom instruction alone likely will not result in targeted behavioral changes, parents and external social systems of the children must be involved.[34,35] For the Bienestar Health Program to be cost effective, the program must be designed for maximum efficiency and must target children at the highest risk for diabetes. For the 1997-98 school year, both intervention and comparison schools are public schools whose children live in surrounding federal housing projects to conduct cost-benefit analyses as well as examine intervention outcomes. Implementing the program in both parochial and public school settings will provide the broad experience and understanding needed to best tailor the Bienestar Health Program for cultural, economic, and educational variability. ■

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