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## Pathways curriculum and family interventions to promote healthful eating and physical activity in American Indian schoolchildren

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### Abstract

**Background**—Pathways, a multisite school-based study aimed at promoting healthful eating and increasing physical activity, was a randomized field trial including 1704 American Indian third to fifth grade students from 41 schools (21 intervention, 20 controls) in seven American Indian communities.

**Methods**—The intervention schools received four integrated components: a classroom curriculum, food service, physical activity, and family modules. The curriculum and family components were based on Social Learning Theory, American Indian concepts, and results from formative research. Process evaluation data were collected from teachers ( $n = 235$ ), students ( $n = 585$ ), and families. Knowledge, Attitudes, and Behavior Questionnaire data were collected from 1150 students including both intervention and controls.

**Results**—There were significant increases in knowledge and cultural identity in children in intervention compared to control schools with a significant retention of knowledge over the 3 years, based on the results of repeating the third and fourth grade test items in the fifth grade. Family members participated in Family Events and take-home activities, with fewer participating each year.

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**Conclusion**—A culturally appropriate school intervention can promote positive changes in knowledge, cultural identity, and self-reported healthful eating and physical activity in American Indian children and environmental change in school food service.

### Keywords

Obesity prevention; Health promotion; Family; Curriculum; Diet; Physical activity; American Indian; Elementary schoolchildren

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### Introduction

Pathways, a multisite school-based health promotion and obesity prevention study for American Indian schoolchildren, was initiated by the National Heart, Lung, and Blood Institute (NHLBI) of the National Institutes of Health in 1993 [1]. Interest in obesity and obesity-related diseases such as cardiovascular disease and diabetes has been increasing nationwide [2]. In 1999, 61% of adults were overweight or obese [3]. Even more alarming is the prevalence of overweight or obese adolescents that has nearly tripled in the past 2 decades [4]. As 1 of the 10 Leading Health Indicators, obesity has been identified as a major public health concern and has become a top priority for health promotion and disease prevention efforts [5]. In 2001, the U.S. Surgeon General issued a “Call to Action” in a precedent-setting document addressing overweight and obesity. The report was a joint effort of the Office of Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, National Institutes of Health, and other U.S. Department of Health and Human Services agencies [2] and provides recommendations for prevention in various settings and age groups.

In response to growing concerns over the increase in obesity, a risk factor for diabetes and cardiovascular disease, [6] a unique collaboration among the NHLBI, five universities, and seven American Indian tribes was developed to test theory-based school interventions. Pathways was designed to be culturally appropriate and easily implemented by trained school teachers and other staff [7–12]. Pathways was implemented in two phases. Phase 1 was a 3-year project to determine the feasibility of a multilevel school-based intervention in American Indian schools [1,10]; to conduct formative assessment [8]; to develop and pilot test interventions and measurement protocols [9,11,12]; and to pilot test process evaluation approaches [10]. Following the successful completion of the feasibility phase, the Phase 2 full-scale study was conducted from 1996 to 2000.

Although some cardiovascular health research has documented effective approaches to reducing cardiovascular risk factors in school-age children [13,14] and some specifically for American Indian schoolchildren [15,16], few studies have been designed to address the primary prevention of obesity in schoolchildren. The increasing prevalence of overweight and obesity-related diseases [17], especially diabetes [18], among American Indians and the paucity of prevention studies [15,16] established an important need for Pathways. Pathways researchers, using a modified participatory approach [19], designed, implemented, and evaluated a unique intervention that merged constructs from Social Learning Theory (SLT) [20,21] with American Indian concepts [9] and a set of target behaviors identified through an

extensive formative assessment [8]. This approach provided the foundation for designing the interventions to be culturally appropriate for the participating tribal groups.

This paper includes a description and results from the curricular and family components, an overview of the formative assessment, theoretical constructs, and cultural considerations used in designing the interventions, and results from evaluation of the teacher training. In addition, barriers related to implementation and the implications for practice and further research are addressed. Other articles in this supplement describe in detail the design and results of the two other major components of the Pathways intervention [22–24]. Additional classroom curriculum and family component results can be found in other articles describing the Knowledge, Attitudes, and Behaviors (KAB) Questionnaire [25] and process evaluation [26].

## Background

### Theoretical constructs

Social Learning Theory has been used over the past several decades for school-based interventions that promote healthy eating and physical activity behaviors [20,27–30] and was selected to guide the major theoretical development of Pathways [9]. SLT emphasizes individual, behavioral, and environmental factors that interact. These three areas served as the basis to organize components of the intervention and are shown in Fig. 1, adapted from Perry [30]. Components of the intervention were designed to enhance individual personal attributes such as children's knowledge, values, sense of personal control, and behaviors related to food choices and physical activity [9,20,31]. The interventions promoted changes in behavioral attributes by providing opportunities and experience in goal setting, skills development in food selection and preparation, physical activity, and self-monitoring. Pathways also was designed to create an environment that was supportive of healthful eating and physical activity by changing the school food service and physical education classes, introducing new role models, demonstrating the selection and preparation and taste-tasting of lower fat foods, providing increased opportunities for physical activity; and encouraging families to choose and prepare healthier foods and to exercise with their children.

### Formative assessment and risk behaviors

A second important element of the Pathways intervention approach was a set of target behaviors identified through an extensive formative assessment conducted during the feasibility phase [4]. Formative assessment data were collected from teachers, school administrators, food service staff, physical education (PE) specialists, parents, and students in all four field centers that represented the participating tribes. A combination of qualitative and quantitative methods were used, including in-depth interviews, semi-structured interviews, focus groups, and direct observation [32]. The Pathways intervention focused on those behaviors identified in the formative assessment as the most common across field centers and were also the most associated with obesity, specifically those related to dietary intake and physical activity.

## Cultural concepts and traditions

Formative assessment data provided a framework of social, cultural, and environmental factors that influence the learning and behavior of American Indian students. Using this information, theoretical constructs from SLT were integrated with American Indian concepts and traditions [9]. For example, the curricula were designed to uniquely address nutrition and physical activity through incorporating supportive American Indian concepts and traditions that were culturally appropriate for the participating tribes. The classroom curricula included cultural stories, games, music, artwork, foods, family activities, videos, and events contributed by members of the seven tribes and other sources. This historical and cultural sharing, built on traditions of healthful eating and active lifestyles, was integrated throughout the curricula to reinforce the students' cultural identity and the knowledge and skills they were learning about healthful eating and physical activity. The lesson content and educational methods were reviewed and considered appropriate by participating tribal representatives.

## Intervention feasibility

The curricular and family components were fully implemented in four schools, one from each field center, as a pilot during the feasibility phase. This pilot was essential for designing a final intervention that reflected the reality of schools in American Indian communities. With the critical review and input from teachers, school staff, students, and families during this phase, the interventions were designed to be easy and enjoyable to implement by existing school staff and to reinforce existing goals and objectives of the schools.

## Methods for the Pathways study

### Design

The full scale study took place from 1997 to 2000, during the academic school year [33,34]. Participants in the study included a cohort of 1704 children who were followed from baseline throughout the study. New students who entered the schools after baseline measurements were conducted were not included in the cohort; however, those in intervention schools did receive the intervention. Forty-one elementary schools from across field centers were randomized to intervention or control conditions. Randomization occurred after baseline measurements were taken. Participating schools included public, parochial, tribal contract and grant schools, and government schools under the Bureau of Indian Affairs located in New Mexico, Arizona, Utah, and South Dakota. Six of the intervention schools included residential dormitories where students lived during the week.

Field centers were located at the University of New Mexico, University of Arizona, Johns Hopkins University, and University of Minnesota and the coordinating center was located at the University of North Carolina. The Pathways staff included individuals who were members of participating American Indian communities. The Pathways study was reviewed and approved by all university institutional review boards and comparable tribal entities.

**Classroom curriculum**—During third and fourth grades the Pathways curricula included an average of three to four activities for each lesson, which were implemented in two 45-

minute sessions per week for a total of 12 weeks (6 weeks in the fall and 6 weeks in the spring). During the fifth grade, the curriculum was implemented in two 45-minute lessons per week for a total of 8 weeks (ending in January) so end point measures could be collected.

The curricula were developed by the Curriculum Working Group, a multidisciplinary group of individuals representing the five participating universities, seven American Indian nations, and the NHLBI staff. The editor was an American Indian educator with experience working with tribal schools. Throughout the developmental process, the curricula were reviewed by various working groups and committees to obtain their suggestions and approval (Fig. 2). The Formative Assessment Working Group reviewed the curricula to evaluate how well priority behaviors were being addressed. They also were reviewed for cultural accuracy and appropriateness by the Seven Nations Committee, which was composed of American Indian Pathways staff. The Intervention Committee reviewed the curricula for compatibility with the other three intervention components, which also were reviewed. Finally, the Steering Committee, made up of principal investigators from each participating university and one representative from the Seven Nations group, reviewed the entire intervention including the curricula to give their final acceptance and approval. The classroom curricula incorporated culturally appropriate lessons through the use of tribal knowledge, maps of Pathways Nations, and American Indian stories comprising in-class and take-home activities that promoted healthful eating behaviors and increased physical activity. The use of audio-taped American Indian flute music signaling the start of a classroom Pathways activity established an environment that enhanced student interest. The focus of the lessons was not obesity prevention but the importance of living a healthy and balanced life, a widely held American Indian value. Many of the SLT constructs provided a good basis for integrating the cultural concepts (i.e., working together in groups and creating social support).

In the third and fourth grades, two American Indian elementary age schoolchildren living in an American Indian community were depicted in the curricular lessons and activities to promote healthful eating and physical activity. Their story began with a journey where they were accompanied by their grandparents, who shared their life experiences that reinforced cultural pride and healthy traditions. Other Pathways activities promoted skills in personal goal setting, hands-on activities in snack preparation, taste-testing new foods, making healthy choices, and being physically active as exemplified both in the cultural games and in classroom exercise breaks.

In the fifth grade, the stories featured young American Indian runners from the Seven Nations carrying messages about healthful eating and physical activity. Identification of “everyday foods” (foods that are healthful to eat everyday) and “sometimes foods” (foods that should be eaten sparingly) provided students with information for the selection and planning of healthful meals and snacks. Some students became “Trailblazers” and led their teams to complete a series of physically active par course like trails called the “Mt. Pathways Challenge.” Teaching others, being a role model, and developing self-discipline and motivation were emphasized in the fifth grade. Students kept a log of their daily physical activity and provided activities and demonstrations for other students.

During each of the 3 years, the classroom curricula culminated with a family celebration event. This event provided an opportunity for students to demonstrate to their families and the school community what they had learned from the lessons and activities in Pathways. For example, students took turns teaching exercise breaks to their families and other students at these events. There were student displays and interactive booths along with opportunities to participate in a 2-mile walk/run called the “Great Race.”

Each curriculum training session for teachers was held at the beginning of each semester prior to implementing the curricula for each grade level. The training session included an overview of the major objectives of the curriculum, teacher’s manual, materials, classroom, and family activities. Classroom teachers participated in student activities in the lessons, so they had a better mastery when teaching in their own classroom.

During the feasibility phase, a centralized training was conducted for all field centers by the Pathways Curriculum Working Group. However, during the main trial, a train the trainers model was used that allowed each site to conduct local training. In addition, the smaller number of teachers at each training site allowed for individual questions to be answered and gave each participant ample opportunity to master the rationale for the concepts and to discuss any specific needs in their local community school sites.

The curriculum training for teachers was provided in conjunction with training the food service personnel and PE teachers. This scheduling facilitated ongoing coordination among those involved in the three components. For example, classroom teachers worked with food service personnel on the ordering and scheduling of food for activities related to preparation of snacks and taste-testing of new foods in the classroom. In addition, the PE teacher provided modified American Indian games for students during their regular PE class. In the fourth and fifth grade curriculum, the PE teacher participated with the classroom teacher to plan activities such as the Great Race and Mt. Pathways.

**Family component**—The Pathways family component was designed to increase family involvement in creating home environmental changes related to healthful eating and physical activity. It was designed to reach extended family members, since many American Indian households include uncles, aunts, grandparents, cousins, and/or clan members in addition to the immediate family. Two main family intervention strategies were implemented—Family Packs and Family Events.

**Family Packs:** The classroom curriculum included 10 Family Packs in both the third and the fourth grades. There were four Family Challenge sheets in the fifth grade. These materials were sent home with the students following specific Pathways classroom curriculum lessons. There were two types of Family Packs: Action Packs and Snack Packs. Action Packs focused on information, including cultural stories, that reinforced a health education message taught in the classroom curricular lessons. They also included suggested activities for family members to try such as making a low-fat snack or taking a family walk or a hike together. Snack Packs consisted of healthful nutrition tips and provided low-fat food items or low-sugar beverages for the student to share with his or her family.

At the completion of each Family Pack activity, the student and an adult family or household member signed a return card. Students in residential schools had a dormitory supervisor serve as a guardian and sign the return cards. These students were able to share the (nonperishable) materials with their families when they went home on weekends.

During the fifth grade, the take-home packages were called Family Challenges. Families completed a goal or challenge (i.e., the student and at least one family member were challenged to exercise together by walking, hiking, dancing, playing basketball, etc., at least three times within a week) and returned the signed sheet to the classroom. Students who returned three of five return cards and four of four Challenge Sheets by the end of each semester received a small reward.

**Family Events:** A total of nine Family Events were held throughout the 3 years of the study at intervention schools. They took place during the school day or in the evening after school depending on what time of day would most likely attract the most people. At each event, key Pathways educational and behavioral messages about low-fat foods and physical activity were provided to the students and families through enjoyable activities, in several ways: through interactive booths, printed educational materials, and displays. The interactive or “hands-on” participatory booths included games that involved physical activity such as a modified American Indian game or line dancing. Attractive educational materials were distributed and Pathways staff members or volunteers were available to answer questions. Other booths featured a food label reading contest designed to teach the attendees about important information to look for on food labels. There also were displays demonstrating high-fat versus low-fat food items or high-sugar versus low-sugar beverages. Practical examples of ways to lower dietary fat were provided. A low-fat school meal was served as an example of how the food service personnel were working to support healthful eating in their school. At the end of each Family Event door prizes were awarded such as basketballs, volley balls, or bags of healthful groceries.

Pathways staff coordinated a team of community volunteers, parents, teachers, food service staff, and school administrators to implement the family activities. All events provided an informative atmosphere in which health education concepts that were introduced in the classroom, in food service, and in physical education classes were reinforced.

In the third grade there were four events held during the year including a Family Fun Night, two Family Workshops, and a Celebration Event. The Family Fun Night, as a kickoff event scheduled at the onset of the academic year before the curriculum was introduced, familiarized the students, their families, and school staff with the Pathways program and the key health behaviors to be addressed. One of the Family Workshops focused on integrating physical activity into everyday life and included a basketball shoot-out and aerobic games. The other included hands-on demonstrations of some low-fat cooking techniques, i.e., rinsing and draining ground meat and using the lower fat meat to prepare a taco salad. The Celebration (culminating event), scheduled for the end of the academic year, allowed students to demonstrate a favorite activity they did during Pathways and encouraged families to maintain healthful behaviors during the summer. In addition, the curriculum and PE teachers, food service staff, school administrators, families, and Pathways volunteers were

recognized for their support of the program. The students and school support staff received certificates of completion and a small reward such as a Pathways water bottle. At the end of fifth grade each student's family received a certificate of appreciation.

In fourth grade there were three Family Events which included a Family Fun Night, a kick-off event, a Physical Activity Event, and a Celebration as a culminating event. The Family Fun Night was scheduled at the beginning of the academic year. The Physical Activity Event was held during a regular Pathways PE class and families were invited to participate. The intent of this event was to work with families to reinforce the health behaviors introduced through the physical activity component of the intervention and to encourage families to implement these behaviors at home. The Celebration Event, scheduled for the end of the academic year, allowed students to again demonstrate to their families something special they learned in Pathways.

In the fifth grade there were two Family Events—a Family Fun Night and a Final Celebration. The Final Celebration Event included interactive booths and displays prepared and presented by Pathways fifth grade students to demonstrate to their families the skills and knowledge they had mastered over 3 years of participating in Pathways.

## Measurement

**Classroom curriculum**—Curricular effectiveness was assessed through a subscale of the Knowledge, Attitudes, and Behaviors Questionnaire administered for the students each year. In addition, teachers filled out evaluation instruments each year as part of process evaluation. The KAB Questionnaire was administered in classrooms by trained and certified Pathways measurement staff following standardized instructions and procedures. The classroom teacher was present when the questionnaires were distributed but did not assist with the administration. The KAB Questionnaire provided the baseline data in the fall of the school year prior to the implementation of the first year of the intervention and again at the end of the third grade after completing the third grade curriculum intervention. This instrument was repeated again at the end of fourth and fifth grades. Items for the KAB curricula scale were changed at each grade in order to assess the concepts in the corresponding curricula. All three curricular scales (third, fourth, and fifth grade) were included in the postintervention administration of the KAB questionnaire.

The third, fourth, and fifth grade curricular scales of the KAB questionnaire included seven to eight multiple choice items that were designed to measure the level of knowledge of healthful eating and physical activities. The mean score of the correct responses of each scale ranged from zero to 1, with 1 representing the healthiest (correct) score and zero the least healthful. Items included in the KAB questionnaire included: (a) making healthy food choices—everyday foods instead of sometimes foods for meals, snacks, and beverages, (b) identifying added fat in food, (c) how to prepare food to reduce fat, and (d) reading food labels to obtain nutritional information. Items related to physical activity included: (a) using body cues to monitor exercise, (b) identifying a variety of ways to increase physical activity, and (c) using peer support and goal setting to increase physical activity. A total of 16 items on the three scales were related to healthful eating and 6 items measured knowledge of physical activities.



Throughout the study, 18 process measures were used to assess specific aspects of the intervention, including the implementation of program components, teachers' evaluations of the curriculum, and its implementation. Specific information on the development, administration, and results of these instruments has been described in detail elsewhere [35]. Only the three process measures for classroom teachers are briefly described here.

**Classroom teacher training form:** All third, fourth, and fifth grade classroom teachers who participated in Pathways curriculum training sessions were asked to sign an attendance log and to provide feedback by completing the Classroom Teacher Training Evaluation form. This instrument assessed teachers' perceptions of the need to teach the curriculum, as well as their readiness and motivation to teach it. Teachers rated their understanding of the need to teach the curricula, the purpose of each lesson, the use of materials, and the specialized vocabulary, as well as how to coordinate efforts with the other components such as Physical Education, Food Service, and Family.

**Classroom teacher evaluation forms:** These forms were distributed to teachers at each of their training sessions and they were encouraged to complete a checklist when teaching each curriculum lesson. For example, they recorded the approximate length of time that each lesson took; the number of students in their class during each lesson, which activities they completed entirely, partly, or not at all; and any general comments about each lesson.

**Classroom teacher interview form:** This documentation of the fidelity and dose of each of the Pathways curricula was also assessed by a one-on-one interview with teachers conducted by a trained Pathways measurement staff member. These interviews were completed at the conclusion of weeks 6 and 12 for third and fourth grade teachers and week 8 for fifth grade teachers. As a part of the interview, teachers were asked their opinion on the curriculum for that semester. Pathways measurement staff members collected the completed Classroom Teacher Interview Forms and asked the teacher's opinion on the curriculum.

**Family component**—Family interventions were assessed using seven different process evaluation measures.

(1) The Family Registration Roster documented the number of Pathways cohort students who attended each family event, along with the number of family members. Attendance by other students was recorded separately. The attendance at the Family Events provided documentation by event of participation by Pathways students and families. (2 and 3) Evaluation forms were administered to participants attending the Family Events to gather feedback from students and families about the events. The Evaluation Form for Child Participants was designated for children who were under 16 years of age, and the Evaluation Form for Adult Participants was for those over 16 years of age. Questions on each form measured the overall interest and enthusiasm of the participants. For example, two questions on the child evaluation form were: (a) "Did you like this family event?" and (b) "Would you attend another family event?" Examples of two questions on the adult evaluation form were: (a) "Was the event worthwhile?" and (b) "Would you attend another family event?" Additionally, the adult form included a comment section after each question.

(4) The Family Pack Return Card Log documented participation by students and their families in the Family Component of both the third and the fourth grade, and (5) the Family Challenge Sheet Log documented their participation in the fifth grade. (6) Classroom teachers were asked to record the number of students who returned 5 of the return cards included in the 10 take home Family Packs during the third and fourth grade curricula and each of the four Family Challenge Sheet Packs during the fifth grade curriculum. (7) They were then asked to record on the family log the number of students who returned their family cards or sheets to the classroom after their families participated in the activities suggested in the Family Packs.

**Analysis:** Quantitative data were analyzed using the Statistical Analysis System [36]. Descriptive statistics were used to characterize the study population.  $\chi^2$  tests were used to examine tables on attendance of family events over the 3 years. The data had several potential sources of variation: school, schools, tribes, and field centers. The effects of the intervention on the curriculum and ethnicity scales were examined using mixed model regression methods appropriate to the design of the study [1,7] accounting for the study variability. The baseline scale (third grade) and treatment condition were included in the models as fixed effects, while field center and school nested within field center were included as random effects. We then examined the effects of the intervention on the ethnicity and curriculum scales at the end of the third, fourth, and fifth grade. In addition, at the end of the fifth grade measurement, we repeated the items comprising the third and fourth grade scales, thus obtaining the results of all three scales at the end of the study. Qualitative data were analyzed using NUD\*IST [37].

## Results

### Classroom curriculum

**Teacher feedback**—Over the 3 years of intervention, the majority of the classroom teachers completed approximately 93% of Pathways lessons. Overall, most teachers were excited about the curricula even though Pathways was a new area to incorporate into their coursework. During the postcurriculum interviews conducted each year, most of the teachers expressed positive comments. Examples of their comments were as follows: “I think it (Pathways curriculum) was excellent. . .learned a lot from this project.” “Wish it could continue.” “The students like it.” “When we have parties kids bring healthy snacks. . .a real surprise to see the fifth grade kids choose good things to eat.” Constructive comments were mainly related to specific activities that often took longer to teach than the suggested 45 minutes.

Teachers expressed positive comments about the training that preceded implementing the curriculum each year. Results from the Evaluation of Classroom Teacher Training indicate that the fourth grade teachers ( $n = 107$ ) felt the most confident (95.3%) that they had the skills to teach the curriculum. This result was followed by third grade teachers ( $n = 97$ ), 90.7% of whom indicated they were confident and fifth grade teachers ( $n = 46$ ) and 87.0% of whom stated they felt confident. The range of percentages was higher for third, fourth, and fifth grade teachers who reported that they understood the need to teach Pathways (96.9

to 99.1%) and those who reported understanding the purpose of each lesson (97.8 to 100.0%). Teachers were less sure about how to coordinate the necessary arrangements for lessons that involved the help of those working in other Pathways components such as Food Service and Physical Activity (84.8 to 97.2%), as well as familiarity with the specialized vocabulary of the Pathways curriculum (87.6 to 96.3%). Overall, the majority of teachers replied that they looked forward to teaching Pathways (91.7 to 95.3%) in their classrooms.

**Effects on student knowledge**—Comparison of mean scores on the KAB curricular scales revealed statistically significantly higher scores for the intervention group compared to the control group at the end of the third, fourth, and fifth grades as shown in Table 1. In addition, the third and fourth grade scales were remeasured in the spring of 2000 following completion of the 3-year Pathways trial when the cohort was in the fifth grade. Again the mean scores for the intervention group on all three scales were significantly higher than the scores for the control group. These results suggest that the Pathways curriculum was effective in promoting positive changes in knowledge related to healthful eating and physical activity. There was also significant retention of knowledge over the 3-year period for the intervention group, as depicted by the higher scores in the intervention compared to the control group when children were retested on the third and fourth grade materials when they were in the fifth grade.

**Effects on ethnic identity**—The KAB questionnaire also included a section on ethnic identity. The results on these subscale questions showed greater ethnic identity in students participating in the Pathways intervention compared to students in the control schools (Table 1).

### Family component

Descriptive information that was collected indicated that the take-home Family Packs and Family Events were generally well received. Table 2 shows that the overall return rate of family pack cards was low, with significant decreases in responses, from 63% in the fall of the third grade to 40.3% by the fall of the fifth grade. Since no forms were collected in the spring of the fifth grade, return rates are given for the spring of the third grade (52.2%) and the spring of the fourth grade (39.8%) and both also had significant decreases.

Comments received at all of the Family Events were very positive and emphasized the extent to which participants enjoyed them. Typical examples of comments received from families: “These (Family Events) are very energizing,” “A good night to spend with children and school,” and “I really enjoy Pathways.” Other comments that indicated that parents valued the educational aspects of the family events include the following: “It helped to refresh my memory on how to cook, what to look for in foods or drinks,” “I want Pathways to come back again. . .to learn more about eating and exercise,” and “There should be more nights like these so children will learn more.”

Each year of the intervention, 97% of the children (under 16 years old) attending the Family Fun Night (kick-off event) reported that they liked the event. Throughout the different events, 95% of the children reported that they learned about healthy foods and the

importance of physical activity. In addition, 96% reported that they would return to another Family Event.

Of the adult family members who attended, 97% stated that it was a worthwhile event. A total of 96% stated that they learned about healthful foods and physical activity, with 96% reporting that they would attend another Family Event.

The total number of Pathways students who registered for all nine Pathways events, cumulative third through fifth grades, was 5405 (Table 3). Of all these students, a total of 58% ( $n = 3134$ ) attended Pathways family events showing a significant increase in attendance over three years ( $\chi^2 = 51.8$ ,  $df = 2$ ,  $P < 0.005$ ). A total of 2544 Pathways adults, including parents, grandparents, and other extended family members, attended the events. The ratio of adults to children went from 0.45 (third grade) to 0.41 (fourth grade) to 0.63 (fifth grade). There was not a statistically significant increase of adults attending during the 3 years. Although the class attendance roster showed that there were more boys than girls registered at the beginning of the year in the Pathways cohort, the number of boys and girls in attendance at the Family Events was about the same.

## Discussion

An overall goal of the Pathways study was to design, implement, and test a multicomponent school-based intervention with the primary purpose being the prevention of obesity by using strategies that would be feasible and appropriate for American Indian schoolchildren. Although schools are a logical location for reaching children, school-based interventions are considered challenging [38]. Acceptance and support are necessary for the successful implementation of an intervention [19]. From the beginning of Pathways, the participating schools and American Indian communities they represented were committed to Pathways. At the onset of the project, tribal leaders, community members, and school staff participated in focus groups and interviews in an assessment that generated more than 25 targeted behaviors that became the cornerstone of the Pathways intervention strategy to help prevent obesity among American Indian children [8]. During implementation of Pathways in both the pilot and the full-scale phases, the support of tribal officials, school board members, and school administrators and staff was highly commendable. Both their active involvement and their commitment throughout the project were evidence of their acceptance of the intervention and provides an example for the development of future interventions in American Indian communities. Pathways demonstrated that a modified participatory approach can be used to conduct a standardized multisite school-based trial, designed to test interventions that focus on the prevention of obesity.

Recognition of the cultural distinctiveness among the tribal groups at Pathways project sites and the employment of American Indians from these communities contributed to the development of an intervention that was culturally competent and rich in Native traditions that promote healthful living. American Indians also contributed essential skills and valuable information that was necessary to communicate with tribal officials, the school community, parents, and students. The American Indians on the Pathways Steering Committee and other

study committees and working groups provided essential guidance and input throughout the study.

Prevention researchers working with underrepresented populations have long valued the importance of culturally competent interventions and the evaluation of these interventions [39,40]. The process that was used to develop and implement Pathways is an excellent model for other researchers who seek to develop culturally competent interventions. One of the important outcomes of Pathways is a culturally appropriate health promotion and disease prevention curricula designed specifically for American Indians that is effective. The results of Pathways provide scientific data with findings that have implications for policy makers and programs for schools that serve American Indian students and school health in general. Interest in Pathways has been expressed by non-Pathways tribal groups and the curricula is disseminated at no charge by downloading it from the internet website (<http://hsc.unm.edu/pathways>).

The Pathways curricula were the central integrating factor that guided the multicomponent intervention, reinforced by the family, food service, and physical activity components. Pathways was deemed successful in introducing children and their families to new concepts regarding healthful living and in increasing their cultural identity. The statistically significant positive change in the KAB scores of the children enrolled in the intervention, compared to the children in the control schools, indicate that they learned the basic concepts of healthful eating and physical activity. Significant changes in ethnic identity, compared to the children in the control schools, indicate that the Pathways intervention increased their sense of belonging to their tribal group. Family members frequently stated that they would adopt the practices that they were learning at the family events. The inclusion of the family was important in the effort to extend the Pathways messages beyond the classroom and into the home environment. However, in the future, researchers may find it helpful to monitor Family Events to determine which events were enjoyed the most and which activities are practical to implement. By conducting interviews at the end of the Family Events, additional information about what works best with families could be gathered and evaluated and then applied to future prevention research and practice. Better methods to measure the effectiveness of family interventions must be developed for this population. Future research should explore the feasibility of reaching families in settings other than in the schools. For example, educational booths at local fairs, pow wows, and activities sponsored by local trading posts and grocery stores may offer opportunities to reenforce the messages taught in health promotion projects.

### Implications

Although the intervention significantly affected health knowledge, ethnic identity, and school food service [23,35], the Pathways intervention—like other school-based interventions aimed at changing health behaviors [30]—had no significant effects at its culmination on percentage body fat [33]. This demonstrates a need for additional research to test approaches that promise to be effective in preventing obesity in youth.

The fact that obesity is caused by a combination of many factors, such as genetic, metabolic, behavioral, environmental, and socioeconomic factors, makes it a complex challenge for

prevention. For most individuals, excess calorie consumption and/or inadequate physical activity provide the logical focus for prevention and intervention efforts. Sustained interventions may need to start earlier and last longer and may need to address a broader range of factors that influence caloric intake and physical activity such as environmental and socioeconomic factors beyond the school setting. Integrating interventions such as Pathways into a comprehensive school health education program [37], and including more community-wide activities, may strengthen the efforts of the intervention overall.

The recognition of obesity as being of epidemic proportions is relatively recent. Unlike tobacco use and youth violence, where according to Surgeon General David Satcher, “we know enough to address the challenges,” there is no substantial knowledge base for preventing obesity [5]. Researchers must continue to contribute to the knowledge base about obesity prevention with studies such as Pathways and closely examine the results, both negative and positive, for promising approaches to preventing the growing epidemic of obesity.

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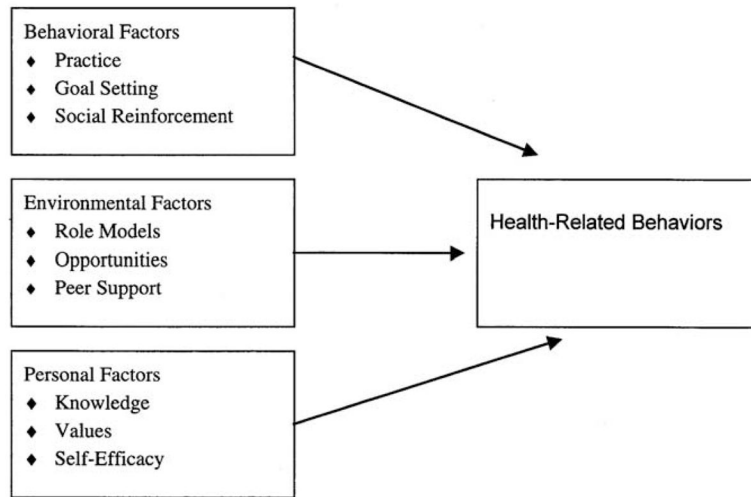
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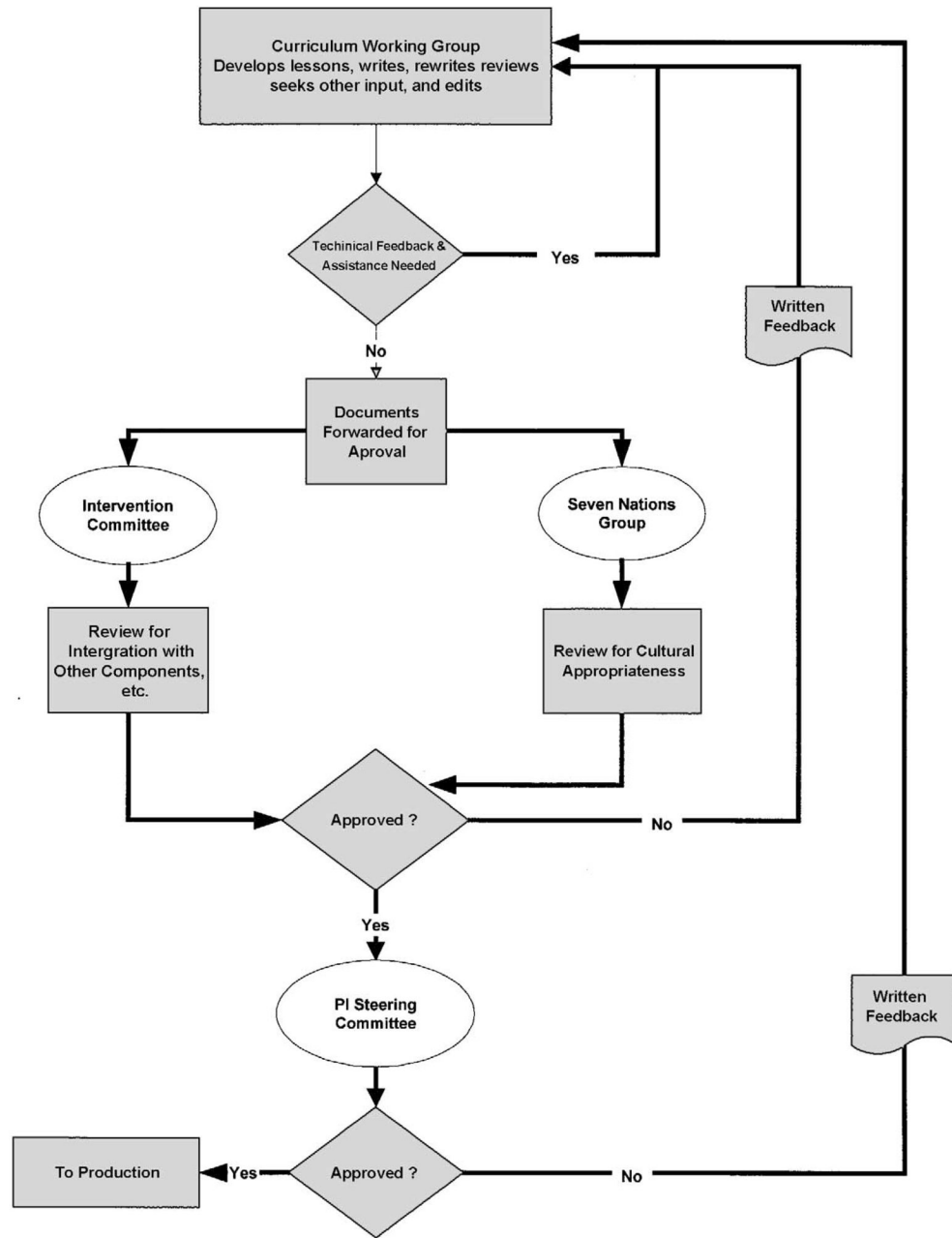
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**Fig. 1.** Selected constructs from Social Learning Theory (adapted from Ref. [30] with permission).



**Fig. 2.** The review and approval process used during the development of the Pathways curricula.

**Table 1**

Pathways curriculum results: Knowledge, Attitude and Behavior measurements

	Intervention, LS mean $\pm$ SE (N = 584)	Control, LS mean $\pm$ SE (N = 565)	P value
Curriculum, third grade	0.71 $\pm$ 0.02	0.55 $\pm$ 0.02	0.0001
Curriculum, fourth grade	0.68 $\pm$ 0.01	0.61 $\pm$ 0.01	0.0001
Curriculum, fifth grade	0.55 $\pm$ 0.03	0.48 $\pm$ 0.03	0.0003
Scales remeasured during fifth grade			
Curriculum, third grade	0.77 $\pm$ 0.01	0.65 $\pm$ 0.01	0.0001
Curriculum, fourth grade	0.70 $\pm$ 0.01	0.67 $\pm$ 0.01	0.0132
Ethnic identity, fifth grade	0.66 $\pm$ 0.04	0.60 $\pm$ 0.04	0.0002

*Note.* All scales range from 0 to 1, where 0 = least healthy score and 1 = most healthy score. Model:  $Y\{ijk\} = \text{trt} + \text{baseline}\{ijk\} + b\{i\} + c\{\lambda i\} + e\{ijk\}$ . Intervention is statistically different from control ( $P < 0.05$ ).

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**Table 2**

## Family Pack return card rates

<b>Grade</b>	<b>Semester</b>	<b>Average return rate (%)</b>
Third	Fall 1997	63.2
	Spring 1998	52.2
Fourth	Fall 1998	47.3
	Spring 1999	39.8
Fifth	Fall 1999	40.3

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**Table 3**Pathways student attendance at Family Events by grade<sup>a</sup>

	Attendance (N)	Enrollment (N)	Percentage attendance (%)
Third grade			
Family Fun Night	295	642	45.95
Physical Activity Workshop	237	628	37.74
Low-Fat Cooking Workshop	202	642	31.46
Ending Celebration	290	342	84.80
Total attendance	1024	2254	45.43
Fourth grade			
Family Fun Night	333	678	49.12
Physical Education Event	422	647	65.22
Ending Celebration	594	678	87.61
Total attendance	1349	2003	67.34
Fifth grade			
Family Fun Night	351	574	61.15
Family Celebration	410	574	71.43
Total attendance	761	1148	66.28
Total	3134	5405	57.98

<sup>a</sup>Only those students (Intervention Cohort) enrolled in the Pathways study from baseline are included.