

Multisite formative assessment for the Pathways study to prevent obesity in American Indian schoolchildren¹⁻³

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ABSTRACT We describe the formative assessment process, using an approach based on social learning theory, for the development of a school-based obesity-prevention intervention into which cultural perspectives are integrated. The feasibility phase of the Pathways study was conducted in multiple settings in 6 American Indian nations. The Pathways formative assessment collected both qualitative and quantitative data. The qualitative data identified key social and environmental issues and enabled local people to express their own needs and views. The quantitative, structured data permitted comparison across sites. Both types of data were integrated by using a conceptual and procedural model. The formative assessment results were used to identify and rank the behavioral risk factors that were to become the focus of the Pathways intervention and to provide guidance on developing common intervention strategies that would be culturally appropriate and acceptable to all sites. *Am J Clin Nutr* 1999;69(suppl):767S-72S.

KEY WORDS Formative assessment methods, formative research, obesity prevention, American Indian children, schools, social learning theory, Pathways, eating behaviors, physical activity

INTRODUCTION

This article describes the use of formative assessment methods in Pathways, a multisite obesity-prevention study in American Indian schoolchildren living in reservations. The description includes the rationale for the choice of methods (both qualitative and quantitative) and presents illustrative results in the form of 3 case examples.

The growing literature on obesity and the burden of chronic disease in American Indians is well described in this supplement. However, relatively little work has been done on the problem of obesity in American Indians from a cultural or ethnographic perspective, and only a few studies in American Indian schoolchildren have successfully increased the children's knowledge of health and patterns of exercise through culturally appropriate curricula (1, 2). Much of the ethnographic work conducted to date described health beliefs and behaviors in particular settings (3-7), but most of this research focused on diabetes and other chronic diseases rather than on local concepts and behavior regarding weight and the perception of fatness. One recent study did examine concepts of body image and weight in a community in Canada, but was aimed primarily at adults (8).

Historically, intervention studies have been designed according to an etic (outsider's) viewpoint. The etic approach to such studies is based on a generalized classification determined in advance and is limited to the investigator's frame of reference (9). To be successful, intervention studies must also include an emic (insider's) point of view. By including information from both viewpoints, an intervention can be designed that is both feasible and acceptable to the target population. Research designed to obtain both viewpoints before developing an intervention in a target population is called formative assessment or formative research. Formative assessment methods in health intervention research are discussed more fully in the next section, followed by a presentation of the model of assessment used in the Pathways study.

PRINCIPLES OF FORMATIVE ASSESSMENT

Formative assessment is conducted before a program is developed to obtain detailed information about the people for whom, and the context in which, the intervention will be designed (10). The purposes of formative assessment are to 1) understand the context in which the intervention will take place, 2) identify specific behaviors of concern, 3) learn the determinants of these behaviors, and 4) identify resources that are available to the program. Formative assessment should collect as much information as possible to assist in forming the program goals, objectives, and content. Such research is often called needs assessment, pre-program research, and developmental research. In the Pathways project, we called this the formative assessment component.

Formative assessment has been used as the basis for develop-

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ing many health education and promotion programs, both domestic and international, on public health topics covering a range as broad as prevention of teen pregnancy (11), tuberculosis (12), diabetes (13), and HIV and AIDS (14, 15); control of malaria (16), sexually transmitted diseases (17), and diarrhea (18); and immunization (19). The Pathways formative assessment was conducted as part of the intervention development process (20–23).

The types of information collected by formative assessment activity include determinants of behavior, access to communication channels, antecedents and consequences of behavior, resources available to the program, information about programs and policies that might affect the intervention, and community attitudes that might inhibit or promote both the program and the behavior of interest. The information collected during the formative assessment phase of an intervention study should be targeted at solving intervention design questions. Both published and gray (programmatic) literature provides many examples of how formative assessment has been used both in the United States and in developing nations (14, 24–26).

Methods of researching determinants of behavior might include in-depth interviews, focus-group discussions, observation, household surveys, behavior trials, intercept interviews, participatory rural appraisal techniques, and role-playing. Ideally, formative assessment should include a mix of qualitative and quantitative methods (27). Qualitative approaches, emphasizing responses in people's own words, provide an opportunity for new and unexpected information to emerge, such as beliefs and behaviors that may bear directly on the success or failure of an intervention. Multiple qualitative approaches are important. Booth and O'Gara (28) wrote, "formative research should begin with unstructured observation to maximize discovery. Observation should then be expanded into open-ended, in-depth interviews with key informants." Helitzer-Allen et al (29) suggest that focus groups should be combined with in-depth interviews when sensitive issues are being considered. Quantitative approaches that emphasize more structured, closed-ended data gathering permit comparison and confirmation of patterns of beliefs and behaviors of importance among different settings.

THE FORMATIVE ASSESSMENT MODEL OF THE PATHWAYS STUDY

Pathways is a 2-phase, multisite intervention trial to develop and test a school-based obesity-prevention program in American Indian schoolchildren in grades 3–5. The initial feasibility phase (phase 1) conducted in 9 elementary schools included formative assessment, intervention, and survey instrument (questionnaire) development and pilot testing. Phase 2, currently underway, involves 40 schools and includes additional intervention development and a 3-y randomized trial to assess the effectiveness of the school-based intervention.

The Pathways intervention is multifaceted and includes 4 components: physical activity, food service, classroom curriculum, and family involvement. The Pathways formative assessment was conducted as part of the intervention development process.

The process by which formative assessment was used to develop the Pathways intervention is shown in **Figure 1**. Formative assessment at all participating field centers preceded the development of the interventions. Because the Pathways study required that a common intervention strategy be implemented in the study schools of all 4 field centers, a primary objective of the

formative assessment was to determine the most effective means of collecting, managing, and analyzing formative data from multiple sites to develop the strategy.

Most of the literature on qualitative methodology focuses on data collection in single rather than in multiple sites (30). However, Pelto and Pelto (9) argued that multisite research requires a quantitative component, saying, "a basic requirement in multi community research is that comparability among the several sites be established through the use of survey research." They suggest that some type of structured, systematically administered instrument is required to permit linkages and comparisons between sites and qualitative data collected at different sites.

Discussion in the literature of analytic approaches to multisite qualitative analyses is also rare. Noblit and Hare (31) describe a "meta-ethnographic" analytic approach and a system for synthesizing qualitative studies. Miles and Huberman (32) describe cross-case analysis in great detail and argue that looking at many cases (or sites) can destroy the local web of causality but, on the other hand, can enhance generalizability.

Pathways investigators chose a formative assessment approach that was a compromise between in-depth exploration and cross-site comparability; it combined qualitative and quantitative methods with instrument standardization. In Pathways, standardization was achieved in the format of questions addressed,

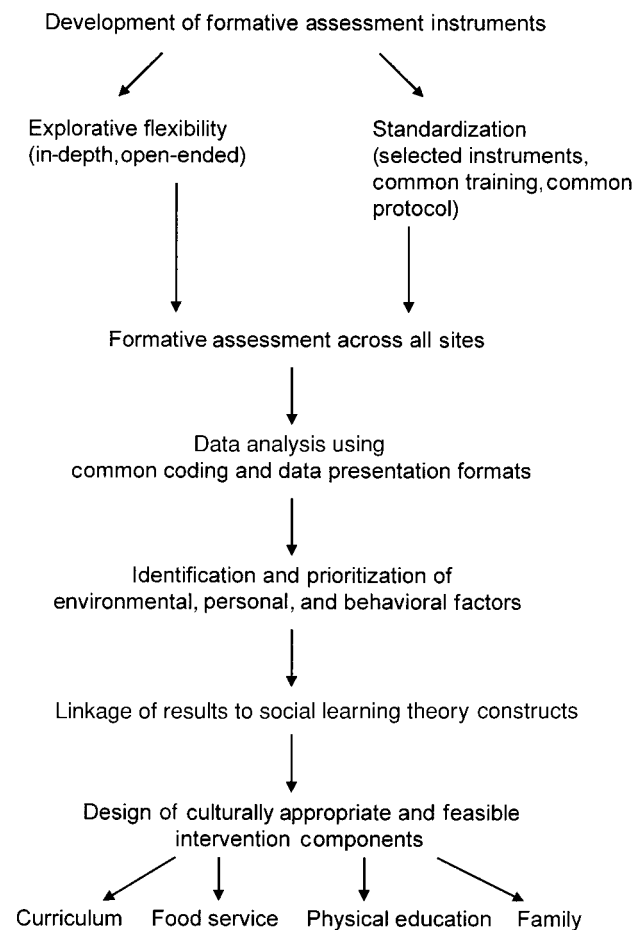


FIGURE 1. Using formative assessment information to develop the Pathways intervention: a multisite approach.

TABLE 1
Methods used in the Pathways formative assessment

Respondents	Qualitative (textual)	Quantitative (numeric)	Qualitative and quantitative
School officials			In-depth interviews
Teachers and aides	Direct observation of classroom activities, recess, and physical education	Semistructured interviews about food and activity behaviors	
Food service staff	Focus groups on curriculum Direct observation of food preparation and service		In-depth interviews
Children	Paired child interviews on food, activity, and health	Semistructured interviews about food grouping and frequency of consumption	Observation of food purchasing and consumption
Parents and other caregivers	Focus groups to identify cultural norms	Semistructured interviews about specific behaviors	In-depth interviews about household beliefs and behaviors
Community	Direct observation of school events		Observation of community resources

centralized training in data collection techniques, determination of types of data to be collected, the use of a common protocol, and analysis using standardized coding and data summary formats.

The results of the formative assessment were then reviewed in the context of the overall theoretical framework selected for Pathways, which is based on constructs from social learning theory. According to this framework, the objectives of Pathways—increased physical activity and healthful eating patterns—will be promoted by positive influence on 3 levels of factors: environmental, personal, and behavioral (33). Formative assessment results were examined according to these 3 levels of factors and then incorporated into the intervention development process.

For example, the environmental information needed and obtained for the development of the intervention included the kinds of foods available to the students at school, at home, and in the community, and the weather conditions, facilities, and resources for physical activities. This information helped us to identify both barriers and opportunities that the intervention could build on, modify, or otherwise address. To influence personal and behavioral factors, the intervention required information on children’s knowledge and values about health, physical activity, and food, and on their sense of personal control over choice of activities, food selection, and food preparation. The formative assessment provided the basis on which the intervention could seek behavioral change by adding to the student’s base of activity alternatives and healthful foods items, providing students with experience in setting goals and monitoring themselves, reinforcing their intention to change, and supporting healthful habits. In addition, data from the formative assessment helped us to identify and prioritize a set of obesity risk behaviors specific to the Pathways sites (34). The case examples discussed later in this article provide detailed illustrations of the link between the formative assessment and the intervention strategies.

METHODS

The development of the Pathways formative assessment has been described previously (34). Various methods were used to gather information, including in-depth interviews, semi-structured

interviews, focus groups, and direct observation. The many respondents included school personnel (ie, teachers, food service workers, and administrators), students in grades 3–5 and their caregivers, and other community members.

The formative assessment protocol was divided into a series of units. Each unit contained information on the purpose of the assessment, guidelines for data collection (eg, preparing data collection materials and locating and selecting respondents, data collection forms, and guides for conducting interviews, focus groups, and direct observations), and guidelines for data analysis (eg, transcription of field notes, detection of trends, perceptions of patterns, and sample methods of presenting data). The methods of data collection and the respondents for each method are summarized in **Table 1**. Several of the units were divided into subunits as the protocol evolved. For instance, initial focus groups with teachers were later followed up with individual, semistructured interviews with teachers.

Training sessions were held on 3 occasions and included data collectors from each field center. Most of the data collectors were Americans Indians who spoke their respective tribal language. In these training sessions, the data collection protocol was refined and made more culturally relevant.

The formative assessment resulted in both textual (qualitative) and numeric (quantitative) data. At each site, textual data (from field notes and taped information) were expanded or transcribed and entered into the computer. Selected numeric data were tabulated and recorded on standardized forms that were provided in each of the units. All textual and numeric data were sent to 1 site for coding and tabulation. Field sites provided summaries of key information by completing a series of tables containing priority question matrixes from which the data were combined to give cross-site summaries. The textual and numeric data were also used as a reference database for intervention development. These data were coded, managed, and analyzed by using the software packages GOFER (version 2.0; Microlytics Inc, Pittsford, NY) and ANTHROPAC (version 3.2; Analytic Technologies, Inc, Natick, MA). A complete set of the data analyses conducted was archived at the coordinating center. One of the primary analyses identified and prioritized specific obesity risk behaviors on which to base intervention strategies (**Table 2**). These



TABLE 2
Obesity-related risk behaviors based on Pathways formative assessment data

Eating behavior	
Home and community setting	
	Children drink a lot of sugar drinks at home and in the community ¹
	Children eat high-fat foods at home meals ¹
	Parents encourage children to finish all their food ¹
	Children eat a lot of fried foods at home ¹
	Children eat while watching television ²
	Children drink a lot of whole milk at home and in the community ²
	Children eat a lot of fast foods outside the home ²
	Children eat a lot of high-fat snacks at home ²
	Family uses limited food-preparation methods at home ²
	Foods high in fat and sugar are used as rewards at home ²
	Family does not eat main meal together ³
	Food is used for comfort at home ³
	Children drink little water during meals at home ³
	Children do not consume enough fruit or vegetables at home ³
School setting	
	Food-service staff encourages children to finish all their food ¹
	Children eat high-fat foods at school meals ¹
	Children eat "seconds" of high-fat foods at school ¹
	Children drink a lot of whole milk at school ²
	Foods high in fat and sugar are used as rewards at school ²
	High-fat and high-sugar foods are offered at special events at school ²
	Children eat lunch quickly at school ²
	Children eat a lot of high-fat snacks at school ²
	Food-service staff does not follow existing school recipes ²
	Teachers encourage children to finish all their food ²
	Children eat a lot of fried foods at school ²
	Children do not consume enough fruit or vegetables at school ²
	Positioning of low-fat milk at school makes it less accessible ³
	Not enough social network food role-modeling in school (eg, by teachers) ³
	Children drink a lot of sugar drinks at school ³
Physical activity	
Home and community setting	
	There are few family-based activities, especially outside the home ¹
	There are few opportunities for physical activity at home ¹
	Children watch a lot of television, movies, and videotapes ¹
	There is little encouragement to do physical activity at home ¹
	There is little home-based role-modeling for physical activity ¹
School setting	
	There are not enough physical activities for schoolchildren ¹
	Children watch a lot of television in class ¹
	There is not enough general encouragement to do physical activities in school ³

¹⁻³Priority of risk behavior based on data: ¹high, ²moderate, ³low.

behaviors were refined and prioritized by using the following 4-stage process: 1) team of 4 researchers conducted analyses of the formative assessment database to assign estimated prevalence scores for each risk behavior as high, moderate, or low, indicating the extent of evidence supporting the existence of a risk behavior at a particular site; 2) field teams at individual sites (including American Indian staff) then reviewed the scores and offered suggestions for potential changes; 3) additional risk behavior data were collected and analyzed to refine prevalence scores for some behaviors; and 4) final prioritization scores were assigned by site and then summarized across all sites.

SELECTED RESULTS

Three cases illustrate the application of this model in the Pathways study. For each case, the formative assessment data leading to identification of a high-priority risk behavior are summarized and the application of this information to intervention strategy development is addressed.

Case 1: children eating high fat foods at school meals

Before the formative assessment was initiated, no data were available on the fat content of school meals; the menu planning, food purchasing, and food preparation practices of food service personnel; or the interest of the food service personnel in preparing and serving lower-fat meals in schools on reservations. The formative assessment of school food service included in-depth interviews with food service personnel and direct observations of food service activities at all field centers. Food service personnel, including the supervisor or director, were interviewed at each school and were asked detailed questions on all aspects of the planning, preparing, and serving of school meals. Trained Pathways staff members observed the school cafeteria, the meals served, and what children ate on several different days. Paired child interviews, in which a child is interviewed in the presence of a friend to reduce discomfort for the child, were used to ask children questions about school meals and food likes and dislikes.

The assessment of the school meals showed that lunch menus were high in fat, often because butter or other fat was added in the cooking process; ground meat was usually fried and drained of excess fat, but was infrequently rinsed and drained. The children often consumed second portions of high-fat foods and drank whole rather than low-fat milk; fruit and vegetable consumption was low. Food service workers and teachers commonly encouraged children to finish all their food. In 3 of the 4 field sites, skim or 1%-fat milk was not available. Whole milk was available at all sites, and children frequently chose it. In some cases, the positioning of low-fat milk made it less accessible. In all schools, children were allowed to have second portions of food and usually returned for the higher-fat items. There was also evidence that fruit and vegetables were disliked, and plate waste was high for these items. Because almost all the children ate the school lunch, and 50–100% ate the school breakfast, school meals appeared to contribute greatly to the overall energy and nutrient contents of the children's diets.

Based on the formative assessment data and results from other effective intervention studies (35–39), 8 behavioral guidelines were formulated for implementation by food service personnel at each intervention school: 1) rinse and drain cooked ground beef, 2) offer low-fat milk (1% or skim), 3) purchase and use lower-fat vendor products, 4) use low-fat cheese, 5) use less or no butter or other fat in food preparation, 6) remove butter and other fats from the serving lines, 7) offer choices of fruits and vegetables, and 8) if seconds are offered, serve fruit, vegetables, and bread. Many schools had tribal and school policies requiring food service personnel to offer second helpings of foods to the students. The Pathways staff worked with the tribe, school administration, and school food service staff to encourage second helpings of only lower-fat foods, such as fruit, vegetables, and breads. The success of modifications of school meals hinges on training and working cooperatively with the food service personnel. The formative assessment was the first step in this collaborative process.

Case 2: not enough physical activities for children in school

At the beginning of Pathways, little was known about the

physical activity of American Indian children at school. The formative assessment data related to physical activity were collected from interviews with principals, focus groups with classroom and physical education teachers, direct observation of recess, and paired child interviews.

The amount of physical activity available to children varied greatly between study schools, from no physical education classes to 3–4 classes/wk. Teacher interest in conducting physical education classes ranged from little to considerable. Facilities, staff, scheduling, and creation of programs that increased moderate-to-vigorous physical activity were identified as primary concerns of the Pathways physical activity intervention component.

Several important observations played a significant role in the development of an appropriate intervention: exercise facilities at the Pathways schools consisted of indoor gymnasiums and outdoor playgrounds; existing physical education equipment was limited and in need of repair, and recess time was predominately 10–20 min of unstructured free play once or twice a day, with the students engaging in various levels of physical activity.

Qualified physical education specialists on school staff were few. One of the schools employed a physical education teacher who taught classes 2–3 times/wk. In the other schools classroom teachers taught physical education classes, which varied in frequency from one 45-min class/wk to two 30-min classes/wk. The type of activity in physical education and recess consisted of various levels of low-to-moderate activity, ranging from participation in ball games to free play on playground equipment.

School bus schedules, adverse weather conditions, limited classroom teacher availability, lack of physical education teachers, limited space, and scheduling were cited as constraints for integrating additional physical activity time into the school day. Based on this information, the goal of the intervention was to create a comprehensive physical activity program to increase energy expenditure and develop motor, personal, and social skills through a variety of culturally appropriate activities. The program developed consisted of 3 components: 1) daily 30-min physical education classes (with $\geq 50\%$ of time devoted to active movement) using the Pathways physical education curriculum that includes traditional American Indian games, 2) a classroom exercise break of 1–10 min with a minimum acceptable frequency of 3 breaks/wk, and 3) free-play recess for ≥ 20 min/d.

The variety of activities proposed allowed for differences in site needs, school facilities, and weather conditions. A curriculum was created that was easy for the teacher to administer and was fun and challenging for the students. Where necessary, physical education teachers were hired and equipment was purchased, and training sessions were offered for teachers on implementing the proposed programs. A structured physical activity program was developed and tested as an alternative to recess during the feasibility stage of the Pathways study, but was postponed to avoid overwhelming the schools with too many new programs at one time.

Case 3: children drink a lot of sugar drinks at home and in the community

Paired child interviews were conducted to obtain an estimate of the frequency of children's consumption of different foods. Cards were used that showed 20 foods identified as frequently mentioned foods from previously collected formative assessment data, and some additional foods of interest (water, diet soft drinks, and low-fat milk). Children were asked to sort the cards into labeled piles

that came closest to the frequency with which the foods were consumed as follows: every day or almost every day, sometimes, and never or hardly ever. The results showed that most students drank soft drinks and Kool-Aid (Kraft General Foods, Glenview, IL) every day or sometimes, and almost half never drank diet soft drinks. In follow-up interviews with caregivers about specific household beliefs and behaviors, soft drinks appeared on the list of the 3 most common snacks at all field sites.

Other formative assessment methods that helped to place drinking sugar drinks at home and in the community as a high-priority behavior included observations of purchases and consumption by children in local convenience stores and supermarkets, and from street vendors. Each site identified its main sources for children, eg, vending machines, convenience stores, street vendors, and the home. Observations were then conducted at these sources. At all sites, soft drinks and Kool-Aid were seen repeatedly. Other commonly consumed beverages were Tang (Kraft General Foods), sports drinks, punch, and other powdered drink mixes.

Assuming that frequent consumption of these beverages is a contributor to the development of obesity, components of the intervention were developed to lower their consumption. The 2 intervention components best able to address this behavior were the classroom curriculum and family components; we found that the family component reinforced the classroom activities.

A sugar-drink component is included in the launch for the grade 3 classroom intervention, a "Family Fun Night" to which all the children and their families are invited. This event is intended to prepare and motivate the families for their subsequent role in the Pathways intervention. The event is set up in a carnival style with booths of educational activities. One such booth has a soft drink taste-test challenge to encourage children to drink diet soft drinks, sugar-free Kool-Aid, and water. A poster displays the amount of sugar in each of these drinks. Using beverages that are popular at the site, children guess the amount of sugar in each.


The grade 3 children learn about "everyday" foods (foods and beverages lower in fat and beverages lower in sugar) in 45-min lessons in the classroom. They practice identifying and choosing these foods. One of the 24 lessons is devoted to lower-sugar beverages. The curriculum in grade 4 expands the emphasis on everyday beverages. In 2 of the 24 lessons, what was learned and practiced in the third grade is reinforced and additional opportunities for distinguishing everyday and "sometimes" beverages (a new concept in the grade 4) with taste tests of a variety of beverages, and goal setting. As in grade 3, family activities are related to these activities. The curriculum for grade 5 expands on these common themes.

CONCLUSIONS

Formative assessment is essential for developing interventions in new and diverse cultural settings for which existing information is limited. A combination of qualitative and quantitative approaches in such an assessment can give meaning to existing information and provide insight into the belief systems and behavior of the community. The assessment data are also vital in identifying the barriers to and opportunities for intervention and the community strengths that will contribute to the development and implementation of a strong intervention.

In the Pathways feasibility phase, a formative assessment was conducted successfully and the results formed the basis of an



intervention to reduce obesity in American Indian schoolchildren. The prioritization scoring of obesity risk behaviors was used to structure and focus all components of the Pathways intervention. A comparison of data across sites and across schools within sites enabled us to develop an intervention that addresses common factors. By linking the assessment data with factors of social learning theory and input from American Indian nations, Pathways developed an intervention that is theoretically sound and culturally appropriate. 

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