

The Role of Active Family Nutritional Support in Navajos' Type 2 Diabetes Metabolic Control

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OBJECTIVE — We examined if active family nutritional support is associated with improved metabolic outcomes for Diné (Navajo) individuals living with type 2 diabetes.

RESEARCH DESIGN AND METHODS — The presence of family support, using variables identified in earlier ethnographic research, was assessed via surveys in a convenience sample of 163 diabetic individuals. Diabetes outcome measures (HbA_{1c}, serum glucose, triglycerides, total cholesterol, creatinine, and systolic and diastolic blood pressure measures) were extracted from participants' medical records. Bivariate analyses and multiple logistic regressions were conducted.

RESULTS — All measures of family support showed a relation with one or more indicators of metabolic control in bivariate analyses. In multivariate analyses, respondents were more likely to be in the best tertile for triglyceride ($P < 0.05$), cholesterol ($P < 0.05$), and HbA_{1c} ($P < 0.05$) if another person cooked most of the meals. Respondents in families who bought/cooked "light" foods were more likely to be in the best tertile for triglyceride ($P < 0.005$) and cholesterol levels ($P < 0.005$), and those in families whose members ate "light" foods with them were more likely to be in the best tertile for triglycerides ($P < 0.005$). When all three support variables were entered into a multivariate model, only the variable "other family members cook the majority of the meals" was significantly associated with being in the lowest triglyceride ($P = 0.05$), HbA_{1c} ($P < 0.05$), or cholesterol tertiles ($P < 0.05$). These relationships were most evident for women with diabetes.

CONCLUSIONS — Active family nutritional support, as measured by culturally relevant categories, is significantly associated with control of triglyceride, cholesterol, and HbA_{1c} levels. The findings suggest that the family is a more useful unit of intervention for Diné individuals than for the individual alone when designing diabetes care strategies.

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D iabetes has reached epidemic proportions among the Diné (Navajo): over one in five adults aged ≥ 20 years (22.9%) have diabetes, which is a prevalence rate five times higher than the age-standardized rate for the U.S. population as a whole (1). Among Diné individuals aged 45–64 years and ≥ 65 years, diabetes prevalence rates increase to 40.1

and 41.3%, respectively (1). Complications from the disease can also be devastating. Nearly one-third (30.9%) of those with the disease had cardiovascular disease, which is a rate 5.2 times greater than age- and sex-matched Diné without diabetes (2). Cerebrovascular disease, peripheral vascular disease, microalbuminuria, and hospital admissions oc-

curred at rates 10.2, 6.8, 4, and 2 times greater, respectively, for Diné with diabetes than for those without the disease (2–4). Among Diné with diabetes, 30% reported problems with vision, 20% with feet, and 17% with kidneys (1). Thus, identification of factors that improve metabolic control in the disease is of paramount importance to the Diné.

Fisher et al. (5) have identified four categories of factors that are associated with diabetes management (patient characteristics, stress, provider-patient relationship, and social support); others note that social support is among the least studied (5–7). Social support may facilitate self-care behaviors (6,8–10) and adaptation to the illness (7,8,11). The association of social support with objective indicators of metabolic control of diabetes, such as HbA_{1c} and serum glucose, has been less demonstrable, and results have been mixed (11–14). Because of the importance of social support, many have called for increased attention to the social contexts of disease management and with it, consideration of the family as a unit of diabetes intervention (5,6,11,14).

Gender and ethnicity may also differentially affect the benefits of support, although results are conflicting. In some instances, socially supported women experience greater weight loss or greater HbA_{1c} control than do men (15,16). However, in other studies, men are more likely to receive support or experience improved glycemic control with support (17,18). Although many point out the particular importance of family support for diabetic individuals among African Americans, Chinese immigrants, Mexican Americans, and Native Americans, often in contrast to Euro-Americans, research also indicates its importance to the latter (6,14,19–21). Collectively, these studies indicate that social context influences social support and, in turn, disease experiences. In particular, gender relations may influence expectations about who cooks and the appropriateness of asking for help with the disease, whereas cultures construct different family units (e.g., ex-

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A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

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tended versus nuclear) and expectations of support among kin networks (16,18,22,23).

With these considerations in mind, we use culturally relevant support concepts, as derived from earlier ethnographic interviews among Diné living with diabetes, and explore how support may differentially affect Diné men and women living with the disease. Ethnographic research indicated that when families bought or cooked healthy foods for, and/or ate low-fat, low-sugar foods with the individual with diabetes, she/he was more likely to report improved self-care behaviors (unpublished data). The purpose of the present study is to assess the relation of this specific form of nutritional support to measures of diabetes metabolic control, to explore sex differences in observed relations, and to enhance understanding of how social context influences metabolic control.

RESEARCH DESIGN AND METHODS

Ethnographic interviews

In 1992, we interviewed 26 Diné, recently diagnosed with type 2 diabetes, using open-ended survey tools. The convenience sample, which was recruited from the local Indian Health Services hospital diabetes education classes, was interviewed regarding disease history, self-care behaviors, definitions of health and diabetes, sources and kinds of support, and perceptions of health care.

Interview topics were reviewed and revised based on five pilot interviews conducted by Diné staff. Key themes, which were identified from the pilot interviews and from a review of the literature, were applied to subsequent interviews to confirm their salience. This grounded theory approach identified the three forms of active family nutritional support, described below, which are consistent with Diné emphases on active demonstration of k'é (clan) relationships and on sharing and preparing meals (23,24). The interviews also elicited the term "light foods," which refers to low-fat, low-sugar foods. The staff and one of the investigators (C.E.) coded each interview independently and then conferred to reach the final coding decisions.

Table 1—Clinical indicators of study participants

Parameters	Mean	n*
Mean last value (average for last 6 months)		
HbA _{1c} (%)	9.0 ± 2.2	84
Glucose (mg/dl)	201.9 ± 95.4	138
Cholesterol (mg/dl)	192.1 ± 52.3	110
Triglyceride (mg/dl)	239.2 ± 142.5	106
Systolic blood pressure (mmHg)	138.2 ± 15.2	160
Diastolic blood pressure (mmHg)	79.5 ± 8.6	160
Creatinine clearance (ml/min)	76.4 ± 85.3	124
Other indicators of diabetes status		
Years since diabetes diagnosis (years)	8.0 ± 7.9	146
BMI (kg/m ²)	31.8 ± 5.9	147

Data are mean values ± SD. *Not all metabolic indicators were measured for each respondent in the 6 months prior to the medical record review.

Survey tool

A questionnaire was developed for the present study based on locally relevant factors identified in the ethnographic interviews. Questionnaire items assessed family diabetes history, self-perception of diabetes management, medication use, participation in Indian Health Services prevention activities, frequency and kind of family support, and demographic data including religious background, age, household composition, transportation availability, and education. We did not ascertain internal reliability of the survey tool.

The survey sample was a nonrandom convenience sample with participants recruited via word of mouth, flyers placed in the study community, and at meetings held at senior citizen centers, community centers, and similar locales. Diné individuals with diabetes were requested to contact study staff at the tribal college if they wished to participate. Diné staff members were trained in interviewing methods, and at a mutually agreed on site, a staff member read the 42-item tool to the participant in the participant's preferred language, recording responses on the form. The survey was conducted from 1997 to 1998. At the time of the interview, permission was obtained to review the respondent's medical records.

The survey measured active family nutritional support using three variables. The first two obtained the frequency with which "My family buys/cooks 'light' foods for me" (buys/cooks "light" foods) and "My family eats a 'light' meal with me" (eats "light" foods). Responses were categorized as never, rare, occasionally, and

frequently. The third variable assessed who prepared the majority of the meals and was dichotomized into "I cook/ someone else and I cook" or "someone else cooks" (others cook). Good support for buys/cooks "light" foods included responses of "occasionally" and "frequently," whereas good support for eats "light" foods was limited to responses of "frequently" to accommodate the skewed distribution of the latter variable (i.e., nearly 48% said that families ate "light" foods with them frequently).

Medical record review

Medical records of consenting respondents were reviewed between 1998 and 1999, using a standardized data collection form to abstract data from chemistry profiles; foot, eye, and other related examinations; hospitalizations and clinic visits; prescriptions filled; and indicators of diabetes complications.

Assessment of metabolic control of diabetes consisted of six outcome measures: HbA_{1c} and serum glucose to monitor glycemic control; total cholesterol, triglyceride levels, and blood pressure values to assess cardiovascular disease; and creatinine clearance to measure renal involvement, according to Ferri's (25) formulas for women ($0.8 \times [140 - \text{age}] \times \text{weight [kilograms]}/72 \times \text{serum creatinine}$) and men ($[140 - \text{age}] \times \text{weight [kilograms]}/72 \times \text{serum creatinine}$). Diabetes diagnosis was confirmed by the physician statement of diagnosis in the medical record.

Data analysis

Survey data were entered into Excel for visual inspection and SPSS for data analysis with suspicious or extreme variables checked against the original questionnaires. Medical record data were organized using Access Software and entered into SPSS for analysis with survey data.

Outcome measures were calculated by averaging all laboratory values occurring 6 months before record review, for each outcome, by each individual. On average, the medical record review occurred 13 months after the survey. Because the variables lacked a normal distribution and several exhibited large standard deviations (Table 1), we created categorical variables, depending on whether the respondent was in the highest, middle, or lowest tertile of the distribution for each outcome.

Relations between the three family support variables and the six measures of diabetes control were assessed using contingency tables (and χ^2 tests for association) and ANOVA. The effects of confounders on the relationship between family support and diabetes outcomes were controlled using logistic regression. Potential confounders, dichotomized at the mean, included age (≤ 57.9 vs. > 57.9 years), time since diagnosis (≤ 8 vs. > 8 years), BMI (≤ 31.8 vs. > 31.8 kg/m²), and education (≤ 7.9 vs. > 7.9 years). For logistic regression, each diabetes outcome was dichotomized into “good control” (i.e., those in the lowest tertile) versus “moderate/poor control.” The values measured for “good control” were HbA_{1c} ($< 7.6\%$), serum glucose (< 155.3), cholesterol (< 171), triglyceride (< 158.7 mg/dl), systolic (< 130.7) and diastolic (< 75.5 mmHg) blood pressure, and creatinine clearance (< 73.6 ml/min). Data analyses were stratified by sex.

Permission for the project was obtained from Diné College and the Navajo Nation Human Research Review Board.

RESULTS

Study participants' characteristics

Medical record data were available for 163 of the 234 individuals who were interviewed. Participants who consented to having their medical records reviewed were significantly older and had fewer years of education than those who denied consent (data not shown). The study participants were all Diné, predominately

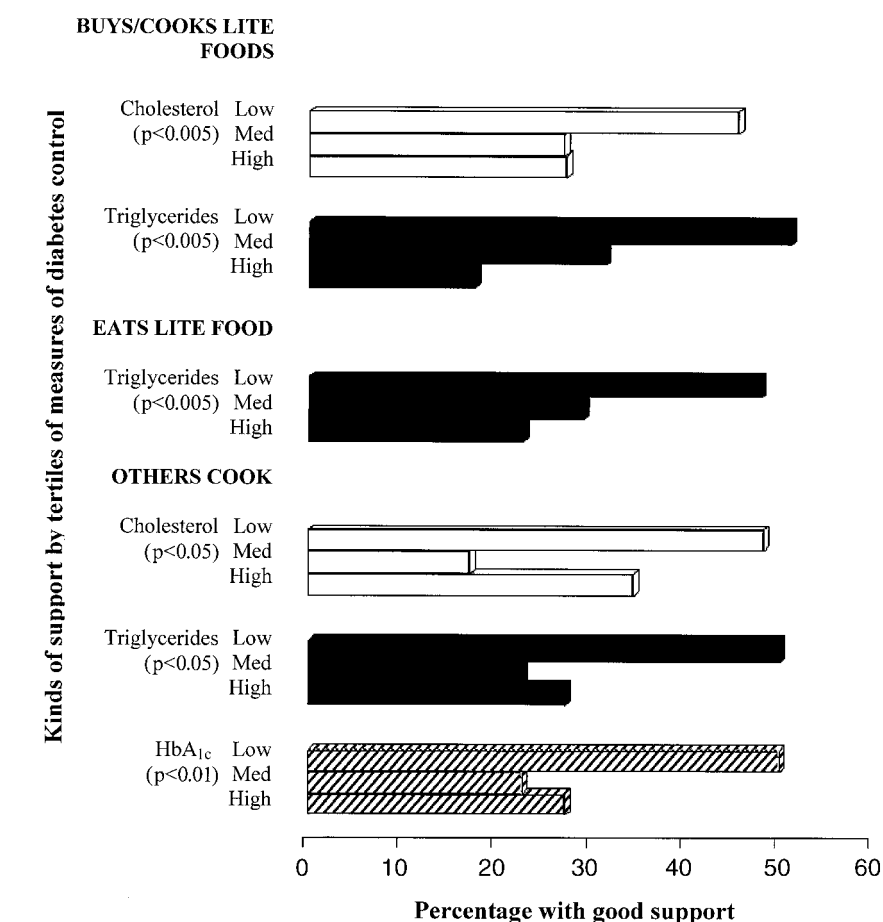


Figure 1—Percent with good support, in three kinds of family support, by tertile of measures of diabetes control.

women (70%), Christian (57%), and middle aged (mean age 57.9 years). Most respondents used both Diné and English as primary languages (59%). Study participants had an average of 7.9 years of schooling and a mean annual income of \$11,406.

All individuals reported that families ate “light” foods with them at least some of the time with 48% receiving this support frequently (i.e., good support). Fifty-two percent reported that their families bought or cooked “light” foods for them occasionally to frequently. Forty percent of the respondents reported that someone else cooked for them.

As shown in Table 1, the study sample experienced moderate success in non-fasting triglyceride and serum glucose levels but experienced less success with long-term glycemic control (mean HbA_{1c} 9.0 ± 2.2%) and weight control (mean BMI 31.8 kg/m²) (1). Although 73% of the study participants perceived that they

were managing their diabetes well, 34% ($n = 55$) had experienced a diabetes-related complication, including retinopathy (16%, $n = 26$), neuropathy (17%, $n = 27$), cardiovascular complications (10%, $n = 17$), or renal complications (5%, $n = 8$). Most respondents (95%, $n = 155$) were on oral medications and/or insulin for their diabetes.

Relation of family support to diabetes metabolic control

Using bivariate analyses, three indicators of diabetes control showed a relation with some measures of family nutritional support (as shown in Fig. 1) with some relations producing unstable odds ratios (OR) (data not shown). For each kind of support, those in the lowest (i.e., healthiest) tertile for triglycerides, cholesterol, and/or HbA_{1c} were significantly more likely to report “good support” than those in the other two tertiles, although for “others cook,” there was no significant

Table 2—Significant OR (CI) for being in the best tertile for each metabolic outcome associated with each measure of family support

	Triglycerides	HbA _{1c}	Cholesterol
Bivariate analyses			
Family buys/cooks light foods	5.32 (2.2–13.1)*	—	3.33 (1.4–7.8)*
Eats light foods	3.53 (1.5–8.3)*	—	—
Someone else cooks	3.45 (1.1–10.9)†	5.80 (1.6–20.5)‡	3.73 (1.3–10.8)†
Multivariate analyses			
Family buys/cooks light foods	4.76 (1.9–12.3)*	—	2.75 (1.1–6.7)*
Women	6.32 (1.9–21.3)*	—	7.80 (2.3–26.6)*
Eats light foods	2.99 (1.2–7.5)*	—	—
Women	4.59 (1.4–14.6)‡	—	—
Someone else cooks	4.32 (1.1–16.3)†	8.37 (1.6–42.9)†	3.93 (1.2–12.7)†
Women	—	11.2 (2.13–58.9)*	—
Multivariate analyses with all three independent variables			
Family buys/cooks light foods	—	—	—
Eats light foods	—	—	—
Someone else cooks	3.86 (1.0–15.3)†	9.01 (1.7–47.9)†	4.48 (1.3–15.7)†
Women	—	43.98 (1.7–1,153)†	—

"Improved metabolic outcomes" refers to those in the lowest one-third of the distribution for each of the three indicators. Multivariate analyses include adjustment for age, time since diagnosis, BMI, and education. * $P < 0.005$; † $P < 0.05$; ‡ $P < 0.01$.

difference between the low and high tertiles of cholesterol.

Logistic regression was used to determine the odds of being in the best tertile for each outcome reflecting diabetes control after adjusting for potential confounders. As shown in Table 2, respondents whose families bought and/or cooked "light" foods for them were significantly more likely to be in the lowest tertiles for both triglycerides (OR 4.76, CI 1.9–12.3) and cholesterol (2.75, 1.1–6.7) after adjusting for confounders. Similarly, respondents whose families ate "light" foods with them were significantly more likely to be in the lowest tertile for triglycerides (2.99, 1.2–7.5). Respondents for whom others cooked most of the meals had a significantly greater likelihood of being in the lowest tertiles for triglycerides (4.32, 1.1–16.3), cholesterol (3.93, 1.2–12.7), and HbA_{1c} (8.37, 1.6–42.9) after adjustment for confounders.

Because of the overlap between the independent variables, we also entered all three family support variables into the logistic model simultaneously to assess which one had the strongest relation with diabetes control (Table 2). When all three support variables were entered into the model, only the variable "others cook" was significantly associated with better control of triglycerides (OR 3.86, CI 1.0–

15.3), cholesterol (4.48, 1.3–15.7), or HbA_{1c} (9.01, 1.7–47.9).

Because stratification indicated significant effect modification by sex, separate models were run for men ($n = 49$) and women ($n = 114$). For men, the three support variables were not significantly associated with any of the diabetes control measures (data not shown). But for women, the pattern of significant associations was somewhat similar to that noted for the sample overall (Table 2). When all three support variables were entered into the model, the variable "others cook" was again the only support measure significantly associated with diabetes outcomes, specifically, with women having a greater likelihood of being in the lowest tertile for HbA_{1c} ($P < 0.05$) and a trend toward the lowest tertile for cholesterol levels (OR 3.60, $P < 0.10$).

CONCLUSIONS— The current study indicates that active support by family members is associated with clinical measures of metabolic control for Diné individuals with diabetes. Specifically, when family members cooked the majority of the meals for the respondent, the individual was significantly more likely to have lower triglyceride, cholesterol, and HbA_{1c} levels. The two other support variables (purchasing or cooking "light" foods

for or eating a "light" meal with the individual) were also associated with improved triglyceride and/or cholesterol levels and may be more amenable to intervention than changing who cooks for the family.

Relatively few studies explore associations between support and diabetic individuals' metabolic outcomes (other than HbA_{1c}), and fewer still report a significant association between support and triglycerides or cholesterol levels (16,26,27). To our knowledge, only Trento et al. (26) have shown a beneficial association of support with both lipids and glycemic levels for individuals with type 2 diabetes. Gilliland et al. (27) found that those exposed to a treatment entailing social support maintained steady HbA_{1c} levels, whereas control subjects did not; however, treatment participants did not experience reduced triglyceride or cholesterol levels. Given that nearly one-third of Diné with type 2 diabetes experience cardiovascular disease (30.9%), the identification of factors associated with lower cholesterol and triglyceride levels is critical (2).

We suggest that the associations of support with beneficial reductions in glycemic and lipid levels may be due to the culturally sensitive nature of our support variables, a benefit that researchers using standardized social support scales may lack (8,11). For many Diné, active support appears to be more meaningful than either perceptions of support or measures of network size (16). Indeed, most of the study's respondents perceived their family members as being supportive, yet we found no relation between these perceptions and the diabetes control measures (data not shown). Because our active nutritional support variables were developed from detailed ethnographic findings, we assessed behaviors that were culturally valued, that were more likely to be incorporated into families' routines, and that were more likely to reflect several key family dynamics simultaneously (17,28,29). For example, behaviors beneficial to diabetes control, such as cooking or buying "light" foods, signal family accommodation to the disease. Cooking for the individual signifies assumption of care-giving roles and, potentially, a willingness to shift roles, as when having someone else cook shifts a diabetic woman's role from caregiver to care receiver. Such dynamics are consistent with as-

pects of successful disease management noted elsewhere, such as perceptions of diabetes management as part of living (as opposed to rules or work) (29,30), promotion of a woman's empowerment within the family (14), and joint family ownership of the disease (31). Culturally sensitive approaches have also proven particularly valuable in the design and implementation of efficacious community and cross-cultural interventions (32).

The protective effect of having another person cook was particularly salient for women (although lack of significance for men may be attributable to their small numbers). Other research has noted that whereas women may cook special meals for a chronically ill husband, they are less likely to alter cooking habits for their own disease, because to do so may place them in conflict with maternal and domestic roles that emphasize others' needs over their own (17,18,22,29). This dilemma may disappear for a diabetic woman when others cook for her. The act of cooking for the respondent also reinforces the Diné values of interconnectedness (by reminding the respondent of her/his importance within the family) and autonomy (by modeling behaviors that the individual can choose to follow, as opposed to intrusive verbal reminders that may deter self-management) (33,34). The metabolic benefits associated with "others cook" may also reflect this variable's association with "buys/cooks 'light' foods" ($P < 0.05$). Receiving this type of active support may also buffer stress, which may in turn improve metabolic control; unfortunately, stress measures were not obtained (12,35). Women for whom others cooked did not differ significantly from women who cooked for themselves in age, presence of spouse or partner in the household, or diabetes complications (data not shown).

There are limitations to the study. First, our project focused on a convenience sample of Diné with diabetes who seek care through the Indian Health Service. Thus, the findings may lack generalizability to those Diné who do not seek western medical care for their diabetes and other portions of the Diné. In comparison with Will et al. (1), who reported that Diné women were 27% more likely to have diabetes than men ($n = 575$), our study overrepresents women. The results are also limited by the accuracy and completeness of the medical records. LDL and

HDL levels were not routinely measured at the time of the study. The serum glucose outcome is also limited because the available data included random blood glucose results. Because our study did not gather dietary histories or interview family members, the pathways by which family support may affect (or be affected by) metabolic control remain uncertain. The absence of reliability testing for the survey may also limit findings. Finally, the use of clinical outcomes did not permit assessment of lifestyle measurements of disease control, such as the individual's ability to function independently or to engage in work and daily routines.

The strengths of the study are, however, numerous. First, we combined the benefits of qualitative methods (greater cultural sensitivity via use of ethnographically identified support categories) with those of quantitative analyses (hypothesis testing in a larger sample size and use of clinical outcome measures) (32). The focus on active support affords insights into actual behaviors, as opposed to perceptions of support, and permits assessment of familial incorporation of dietary shifts and role changes and assumption of caregiving roles. Because these kinds of support were already present in many of the Diné families, our independent variables had cultural salience, and thus could reflect many families' responses to the disease.

To conclude, this study suggests that active family support may be a critical factor for the control of glucose, triglyceride, and cholesterol levels for Diné living with type 2 diabetes. Interventions designed to enhance family support may benefit from using ethnographic data to identify "naturally occurring" support dynamics, as such dynamics will likely be culturally relevant and already accommodate families' exigencies as they deal with diabetes (28,29). Consistent with an increasing number of scholars, we strongly recommend that culturally relevant, family-based approaches become a central element in the medical management of diabetes (5,28,29,31).

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