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KNOWLEDGE OF DIABETES AND GLAUCOMA IN A RURAL NORTH CAROLINA COMMUNITY

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ABSTRACT: Effective use of time, money, and personnel in the delivery of health care services to rural areas requires baseline information on the target population with respect to the problem being addressed. Prior to the initiation of an educational program on diabetes and glaucoma, the Public Health Department of Davie County, North Carolina, conducted a survey of county residents to determine knowledge, attitudes, and practices concerning these illnesses. The goals of the survey were to determine (1) basic knowledge with respect to the nature of each illness, symptoms, and high-risk groups, (2) the stigma attached to each illness, and (3) health practices in terms of previous tests for diabetes and glaucoma and whether or not the respondents know where to go for such tests. Information was obtained through a telephone survey of randomly sampled households in Davie County. Results of the survey indicated that the level of knowledge for both diabetes and glaucoma is particularly low with respect to identification of high-risk groups and symptoms, and approximately one-quarter of all respondents felt there was some stigma attached to diabetes and glaucoma. The lowest levels of knowledge were observed in the youngest and oldest respondents, males, the unmarried, and those with low levels of educational attainment. The differences in knowledge by age, marital status, and sex were found to be partially a function of differing levels of educational attainment. These data have provided information useful in the selection of content areas for the programs and in the identification of target populations for special emphasis.

Effective health education could significantly improve the quality of life in rural communities. Rural health care in the United States is still deficient in many services, and the rural poor in particular face special barriers such as isolation, immobility, and feelings of alienation from the institutionalized medical system.[1] In addition, the limited and frequently overextended health care and social support systems characteristic of many rural communities necessitate reliance on local resources in the development of new programs.[2] These limitations present formidable problems in the conduct of health education programs, although effective use has been made of local resources such as the rural church[3] and the community newspaper or radio.[4-5]

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The scarcity of health resources in many rural areas emphasizes the need to obtain information prior to the initiation of a new program that will help in best allocating the resources that exist. However, despite the apparent usefulness of surveys to provide information on health needs, attitudes, and practices in rural communities,[6,7] it is generally the case that health education programs are rarely based on formal needs assessments.[8]

The Present Study

Prior to the initiation of a long-term educational program on diabetes and glaucoma, members of the Davie County, North Carolina, Health Department and Home Health Agency decided to conduct a baseline survey to identify areas of needed emphasis and to provide data that could be used to evaluate the effectiveness of the program. A survey was developed which attempted to determine (a) basic knowledge with respect to the nature of diabetes and glaucoma, symptoms of each illness, and individuals at high risk; (b) the perceived stigma attached to diabetes and glaucoma; and (c) health practices in terms of previous tests for these illnesses and whether or not the respondents knew where to go to obtain the tests. In order to identify subgroups in the population that could especially benefit from the program, the questions dealing with knowledge, attitudes, and practices concerning diabetes and glaucoma were also examined by background characteristics of the respondents.

METHOD

Sample

Davie County is a small rural county in North Carolina with a population of approximately 24,600. It is approximately 70 percent rural nonfarm and 15 percent rural farm. Two small towns include most of the remaining population classified as urban. Per capita income in 1977 was estimated to be $5532, as compared to $5916 for North Carolina and $7026 for the United States. The county is located in the Winston-Salem-High-Point-Greensboro SMSA, and approximately 40 percent of the employed labor force works out of the county. Nonfarm employment is largely in local tobacco and textile industries. Many individuals hold jobs in industry and engage in part-time farming.

It was initially decided to obtain a 4-5 percent sample ($N \cong 400$) of the approximately 8500 households in Davie County. Some constraints were placed on the time available for interviewing respondents since the starting date of the education program was predetermined for certain groups and all data collection had to be completed before this time. A simple random sample of households was selected from the telephone directory and one individual in each household was contacted. Due to the relatively low proportion of unlisted telephone numbers in Davie County, sampling

from the telephone directory was considered preferable to the methodologically more rigorous, but also more time consuming, random-digit dialing technique.

Interviews were completed with 372 respondents, 4 of whom were under the age of fourteen and were eliminated from the study. Thus, the final sample consists of 368 respondents age fourteen and older. The response rate was 81 percent, the large majority of nonresponses being due to an inability to contact any individual in a given household after repeated callbacks.

The characteristics of the sample by age, sex, marital status, education, and family income are shown in Table 1. Information from the 1980 census with respect to age and sex indicates that persons age sixty and over are somewhat overrepresented and males are considerably underrepresented. Since women and the elderly are more likely to be home during the day and women are generally more likely to answer the telephone at any time, this is the type of bias that would be expected in a telephone

TABLE 1
Characteristics of the Sample

Characteristics	Sample		Davie County	
	Number	Percent*	Number	Percent
TOTAL SAMPLE	368			
AGE				
14-19	20	5.5	2569	13.3
20-29	66	18.3	3660	18.9
30-39	71	19.7	3932	20.4
40-49	48	13.3	2864	14.9
50-59	59	16.3	2720	14.1
60-69	49	13.6	1925	10.0
70 and older	48	13.3	1613	8.4
Unknown	7			
SEX				
Male	89	24.2	12,097	49.2
Female	279	75.8	12,502	50.8
MARITAL STATUS				
Single	41	11.3		
Married, spouse present	259	71.3		
Other	63	17.4		
Unknown	5			
EDUCATION				
8 years or less	62	17.1		
Some High School	94	25.9		
High School graduate	118	32.5		
Some College	61	16.8		
College graduate or more	28	7.7		
Unknown	5			
FAMILY INCOME				
Under $5,000	58	19.3		
5,000 - 10,000	48	16.0		
10,000 - 15,000	61	20.3		
Over 15,000	133	44.3		
Don't know/unknown	68			

*Percentages are based on totals omitting unknown cases

survey. Due to the fact that older individuals have lower knowledge of diabetes and glaucoma and women have higher knowledge, errors in overall population estimates resulting from the overrepresentation of these groups will tend to partially cancel one another. However, detailed analyses by age and sex have been conducted to specify the effect of these variables.

Detailed 1980 census data are not yet available for other characteristics, and it is not possible to directly determine the representativeness of the sample. Based on the 1970 proportional distribution for most variables, and recent estimates of income attainment, it appears that the sample is representative with respect to marital status, education, and income.

Data Collection

Since most households in Davie County have telephone service, a telephone survey was selected as the most economical and efficient method of data collection. It is important to note that the small proportion of households without telephone service (estimated to be less than 5 percent) will differ from the general population. Families and individuals without a telephone tend to be the most economically deprived and poorly educated. Statistically, these families and individuals represent a numerically small group and will have virtually no effect on overall estimates of knowledge and attitudes related to diabetes and glaucoma. Substantively, of course, they are very important and represent a group in considerable need of health education and health services. It is important to emphasize, however, that in counties that have a high proportion of households with telephones, a sample based on telephone subscribers will be highly representative.

Interviews were conducted by employees of the Public Health Department. All interviewers were trained by means of a half-day workshop which included detailed instructions with respect to goals of the study and administration of the interview schedule, role playing in which trainees took the part of both the interviewer and respondent, and practice interviews. Interviewers were instructed to make every effort to contact the telephone numbers sampled through repeated callbacks. Approximately two-thirds of the respondents were reached at the first call, 20.4 percent were contacted on the second call, and 14 percent required three or more callbacks.

Measurement

Respondents in each household were first asked a series of questions dealing with diabetes and then similar questions concerning glaucoma. Measures of general knowledge, attitudes, and practices concerning diabetes and glaucoma were obtained in a straightforward manner; the questions are presented in detail along with the results. Identification of symptoms and high-risk groups was obtained through open-ened questions (e.g., Can you name some types of people who have a greater chance of getting diabetes?).

Summary scores which measure knowledge of diabetes and glaucoma were obtained by tallying correct answers to questions for each illness. The scores range from 0 (all answers wrong) to 8 (all answers correct.) The computation of these scores will be described in detail in the results section.

Statistical Analysis

Initial analysis of the data was by means of frequency and percentage distributions. Analysis of the relationship between background characteristics and the knowledge scores was by means of simple analysis of variance and factorial analysis of variance. The results of these analyses are presented in a multiple classification analysis table, which allows inspection of mean knowledge differences between categories of a variable such as sex before control for other background variables (simple analysis of variance) and after controlling for other variables (factorial analysis of variance).

This method of analysis also provides a rough estimate of the strength of each relationship before (η) and after (β) controlling for the other variables. The η coefficient is a measure of association used with simple analysis of variance and η^2 is interpreted as the proportion of variance explained by a particular independent variable (e.g., age) before controlling for other independent variables. The β coeffiecient cannot be interpreted in as straightforward a manner, in terms of explained variance but shows the relative importance of each independent variable after controlling for the other independent variables in the analysis.

The Pearson correlation coefficient was used to examine the relationship between knowledge of diabetes and knowledge of glaucoma. The criterion for statistical significance in all analyses is $p < .05$, two-tailed test.

RESULTS

In the course of interviewing respondents, 18 diabetics and 5 persons under treatment for glaucoma were identified. Although the responses of these individuals had little effect on the overall results, the intent of the survey was to obtain baseline information on individuals not currently under treatment. Thus, they were eliminated from the respective analyses.

Knowledge of Diabetes

The questions concerned with general knowledge of diabetes reveal a wide range of results (Table 2). Most respondents were able to identify either diet, medication, or both as methods of treating diabetes. Over 80 percent also knew that a person with diabetes had too much suger in the blood, while about two-thirds knew that diabetics produced too little insulin. Less than 20 percent, however, knew that the pancreas was responsible for diabetes.

A family history of diabetes and obesity were identified as risk factors for diabetes by about 30 percent of the sample. Other risk factors were infrequently identified, and it is particularly important to note that almost half of the sample was unable to identify any risk factors.

A similar situation was found with respect to the symptoms of diabetes. Slightly less than half of the respondents could not identify any symptom. Ap-

proximately 28 percent identified extreme thirst as a symptom and 23.1 percent named tiring easily. Other factors that received mention by at least 10 percent of the sample were excessive urination and changes in vision.

Perceived Stigma of Diabetes

Most respondents perceived no stigma attached to diabetes with respect to contagion, feelings of discomfort when people are around diabetics, and the ability of diabetics to live normal lives (Table 3). It is important to emphasize, however, that a substantial minority of respondents (about 25 percent) either feel that most people are uncomfortable around diabetics and that most diabetics should not expect to live normal lives or are not sure. Also of interest is the fact that a separate analysis of 18 diabetics interviewed revealed that approximately the same percentage responded negatively to

TABLE 2
Knowledge of Diabetes

Item	Percent with Correct Answer*
GENERAL KNOWLEDGE	
What organ in the body causes diabetes? (Pancreas)†	18.3
Does a person with diabetes have too much or too little insulin in their body? (too little)	68.6
Does a person with diabetes have too much or too little sugar in the blood? (too much)	84.9
How is diabetes treated? (medication—52.9%, Diet—3.4%, Both—34.6%)	90.9
IDENTIFICATION OF RISK FACTORS	
Blood relative of diabetic	30.6
Persons 35 years or older	10.6
Persons who are overweight	32.0
Women who gave birth to a baby weighing over nine pounds	0.3
Percent who named at least one risk factor	52.3
IDENTIFICATION OF SYMPTOMS	
Excessive thirst	27.7
Excessive urination	14.6
Unexplained weight loss	8.6
Tire easily	23.1
Slow healing of cuts and bruises	5.1
Changes in vision	11.1
Intense itching	1.4
Pain in fingers and toes	0.9
Percent who named at least one symptom	52.3

*Percentages are based on N = 350; eighteen diabetics in the sample were omitted.
†Correct answer is in parentheses.

these two questions. Analysis of factors associated with the tendency to perceive diabetics negatively suggest that the very old and the poorly educated are most likely to have negative perceptions.

Health Practices—Diabetes

Respondents were asked two questions: their knowledge of where to obtain a diabetes test and whether they have ever been tested for diabetes. The interviewers probed for complete answers concerning all sources of testing in Davie County. Twenty-two percent of the respondents were able to name the hospital, a physician, or the public health department; approximately 51 percent were able to name two of the three; and 17 percent were able to name all three. Thus, all but 10 percent were able to name at least one place where they could be tested for diabetes.

When asked if they ever had a test, slightly greater than 60 percent said they had been tested at some time in their life. A larger percentage of older people and a larger percentage of the better educated respondents reported they had been tested for diabetes.

The Diabetes Knowledge Score

In order to obtain a general picture of the factors related to knowledge of diabetes, a summary knowledge score ranging from 0 to 8 was computed. Respondents were assigned one point for each correct answer to the general knowledge questions shown in Table 2, one point was assigned for naming at least one risk factor, and one point was given for identifying at least one symptom. Also included in the score is one point for correctly answering that diabetes is not contagious and one point for disagreeing with the statement that most diabetics cannot live normal lives. The third statement dealing with perceived stigma (most people are uncomfortable around diabetics) has no

TABLE 3
Questions Dealing with the Perceived Stigma of Diabetes

Item	Percent Responding*		
	False	Not Sure	True
Diabetes cannot be caught by contact with a person who has it.	10.6	3.7	85.7
Most people feel uncomfortable when they are around people who have diabetes.	75.7	6.8	17.4
People with diabetes should not expect to lead normal lives.	77.4	4.3	18.3

*Percentages are based on N = 350.

empirically verifiable "correct" answer and was not included in the knowledge score. A separate summary stigma score was not computed since a score focusing on the attitude components of only three statements nonrandomly selected for use in this sample would have very low reliability and doubtful validity.

The distribution, mean, and standard deviation of the diabetes knowledge score are shown in Table 4. The tendency for the scores to be skewed toward the upper end is somewhat misleading. The score reflects good knowledge of general information on diabetes but does not assign strong weight to knowledge of symptoms and risk factors. In its present form the score should be viewed as a measure of relative rather than absolute knowledge; that is, an individual with a high score on this scale does not necessarily know all that is required to engage in good health practices concerning diabetes. He or she simply knows more than a person with a low score. Annalysis of the individual questions is most important for identifying specific deficiencies in knowledge. The total score is a means of identifying in summary form the factors related to knowledge of diabetes.

Multivariate Analysis of the Diabetes Knowledge Score

The preliminary analysis of background factors in relation to the diabetes knowledge score included age, sex, marital status, education and income and previous exposure to diabetes.

These analyses indicated that education and income were positively correlated with one another and explained much of the same variation in the knowledge score. Since education has a stronger direct relationship, income was eliminated from all subsequent analyses.

Marital status was found to have a weak initial relationship with

TABLE 4
Distribution of Diabetes Knowledge Score

Score	Number	Percent
0	2	0.6
1	5	1.4
2	19	5.4
3	30	8.6
4	47	13.4
5	76	21.7
6	76	21.7
7	59	16.9
8	36	10.3
Total	350	100.0

$\bar{X} = 5.31$ $s = 1.75$

knowledge of diabetes, widowed and single respondents having a lower score than married respondents. However, this relationship was found to be a function of education and, to a lesser extent, age. The youngest and oldest respondents have the lowest educational level as well as being the most likely to be single and widowed, respectively. The relationship between marital status and the diabetes knowledge score disappeared when controlling for education and age and was judged to be spurious.

All other independent variables showed a significant relationship with knowledge of diabetes both before and after the introduction of controls. The results are shown in Table 5 and can be summarized as follows:

1. Age has a curvilinear relationship with knowledge of diabetes. The youngest and oldest respondents have the lowest knowledge scores. The relationship is attenuated somewhat when controlling for the other in-

TABLE 5
Multivariate Analysis of Factors Associated with Knowledge of Diabetes

Variable	N	Mean Knowledge Score		Strength of Relationship	
		Original	Adjusted[a]	Eta	Beta[a]
TOTAL SAMPLE	339	5.32			
AGE					
14-19	20	4.70	5.39		
20-29	65	5.68	5.33		
30-39	69	5.55	5.32		
40-49	43	6.14	5.77		
50-59	55	5.57	5.64		
60-69	47	4.75	5.17		
70 or older	40	4.10	4.52	.35#	.20†
SEX					
Male	81	4.93	4.88		
Female	258	5.44	5.46	.13*	.14†
EDUCATION					
8 years or less	55	3.95	4.21		
9 to 11 years	90	4.86	4.90		
High School Degree	111	5.54	5.42		
Some College	58	6.31	6.18		
College Degree or more	25	6.72	6.83	.48#	.42#
DIABETES IN FAMILY					
No—don't know	234	5.01	5.06		
Yes	105	6.02	5.89	.27#	.18#
HAD TEST FOR DIABETES					
No—don't know	132	4.74	4.93		
Yes	207	5.69	5.57	.27#	.18#

$R = .622^{\#}$, $R^2 = .387$

[a]Controlling for all other independent variables.
*$p < .05$, †$p < .01$, #$p < .001$

dependent variables, primarily as a result of controlling for education, but a significant direct effect remains.

2. Males have a lower diabetes knowledge score and the relationship is unaffected by controlling for the other variables.
3. Education has a strong direct relationship with knowledge of diabetes, before and after controlling for the other variables. The higher the level of education, the higher the knowledge score.
4. Exposure to diabetes through a family member's experience and personal experience with a test for diabetes are both positively related to knowledge. Respondents who have a family member with diabetes and those who have had the test have higher diabetes knowledge scores.

The overall ability to predict diabetes from the five independent variables is relatively high; almost 40 percent of the variation in the diabetes knowledge score is explained by the joint effect of these variables.

Knowledge of Glaucoma

General knowledge of glaucoma, as measured by the four questions shown in Table 6, is relatively high. Over 80 percent of the respondents were aware that glaucoma affected the eyes and that it can cause blindness, and over 70 percent correctly assumed that this illness develops slowly and that it can be controlled by medical treatment.

In contrast, identification of risk factors is poor. The only risk factor to be identified by an appreciable proportion of respondents was people over age thirty-five (older people was an acceptable answer), and approximately two-thirds of the sample could not identify even one risk factor.

A similar situation exists with respect to symptoms. Blurred or foggy vision was the only risk factor to be identified by a significant proportion of respondents (32 percent) and approximately 60 percent were unable to name any symptoms.

Perceived Stigma of Glaucoma

Responses to the questions dealing with the perceived stigma of glaucoma are similar to the results previously reported for diabetes. Overall, about a quarter of the sample (range 18.7-30.3 percent) appear to perceive some stigma with respect to glaucoma (Table 7). Approximately 80 percent of the respondents felt that glaucoma was not contagious, and 76.8 percent disagreed with the statement that people feel uncomfortable around someone with glaucoma. Perhaps the most interesting result is with respect to the final item. While 69.7 percent of the respondents disagreed with the statement that people with glaucoma should not expect to lead normal lives, the fact that approximately 30 percent either agreed or were not sure suggests that a sub-

stantial minority may feel that glaucoma *usually* leads to blindness. Unfortunately, we did not directly check for this perception.

As was the case with diabetes, the poorly educated are more negative in their perceptions of people with glaucoma. Although there is also a tendency for older respondents to perceive glaucoma more negatively, this relationship was not statistically significant.

Health Practices—Glaucoma

Most respondents were able to identify at least one source (hospital, physician, public health department) of treatment for glaucoma. Approximately 17 percent were unable to name any source. This is a higher percentage than observed with respect to sources of testing for diabetes and suggests a possible need for added emphasis on publicizing information on testing for glaucoma.

When asked if they had ever been tested for glaucoma, 58.3 percent

TABLE 6
Knowledge of Glaucoma

Item	Percent with Correct Answer*
GENERAL KNOWLEDGE	
What part of the body is affected by glaucoma? (eyes)†	80.7
Can glaucoma cause blindness? (yes)	89.8
Does glaucoma develop slowly over time or does it strike people suddenly? (slowly)	71.9
Can glaucoma be controlled by medical treatment? (yes)	70.8
IDENTIFICATION OF RISK FACTORS	
Blood relative	5.8
People over 35	22.6
People with a previous bad eye injury	1.4
People who have diabetes	8.0
Percent who named at least one risk factor	34.2
IDENTIFICATION OF SYMPTOMS	
Frequent change of glasses	2.5
Inability to adjust eyes to darkened room	0.6
Loss of side vision	7.4
Blurred or foggy vision	32.0
Rainbow colored rings around lights	5.2
Unexplained eyebrow aching	1.9
Percent who named at least one symptom	41.9

*Percentages are based on N = 363; five people in the sample with glaucoma were omitted.
†Correct answer is in parentheses.

said yes. As was the case with diabetes, a larger proportion of older people and a larger proportion of the better educated reported they had been tested.

The Glaucoma Knowledge Score

The summary glaucoma knowledge score was computed in the same way as the diabetes score. Four points were assigned for correctly answering the general knowledge questions, one point each for identifying at least one risk factor and at least one symptom and two points for correctly answering the questions dealing with whether or not glaucoma is contagious and whether or not people with glaucoma could expect to lead normal lives.

The distribution and summary statistics for the glaucoma knowledge score are shown in Table 8. It should again be emphasized that this summary score is intended to measure relative rather than absolute knowledge.

Multivariate Analysis of the Glaucoma Knowledge Score

The multivariate analysis of the factors associated with knowledge of glaucoma was conducted in the same way as for diabetes. With only one exception, the results are very similar to those found for the diabetes knowledge score. Age is the only independent variable to show a slightly different relationship in that the initial relationship between age and knowledge of glaucoma is somewhat weaker than was the case for diabetes, and this relationship is reduced below the level of statistical significance after controlling for the other independent variables. The nature of the relationship is the same, however, and age has been included in the final multiple classification analysis presented in Table 9 for purposes of comparison with the diabetes results.

It is also of interest to note that the percentage of individuals who

TABLE 7
Questions Dealing with the Perceived Stigma of Glaucoma

Item	Percent Responding*		
	False	Not Sure	True
Glaucoma cannot be caught by contact with a person who has it.	10.7	8.0	81.3
Most people feel uncomfortable when they are around people who have glaucoma.	76.8	9.9	13.2
People with diabetes should not expect to lead normal lives.	69.7	12.7	17.6

*Percentages are based on N = 363.

report a family history of glaucoma differs considerably from diabetes. Approximately 31 percent of the respondents have a relative with diabetes as compared to only 7.4 percent who reported having a relative with glaucoma. The reduced variation in the variable dealing with family history of glaucoma together with the weaker effect of age largely accounts for the poorer predictability attained with respect to knowledge of glaucoma. The five independent variables acting together account for 29 percent of the variation in the knowledge of glaucoma score as compared to almost 40 percent variation explained in the knowledge of diabetes score.

Relationship between Knowledge of Diabetes and Knowledge of Glaucoma

The summary scores for diabetes and knowledge show a moderate positive correlation ($r = .56$, $p < .001$). Individuals who know more about diabetes also tend to have high knowledge of glaucoma. The relationship exists for the entire sample and when controlling for age, sex, education, marital status, or previous exposure to each illness. The implications of this relationship will be discussed in the next section.

DISCUSSION

The results of this baseline survey of knowledge, attitudes, and practices related to diabetes and glaucoma have revealed that with some exceptions, general knowledge of these illnesses is relatively widespread but knowledge of symptoms and risk factors is deficient. Since the latter are particularly important for early detection programs, the results emphasize a need for educational efforts with respect to both symptoms and risk factors.

TABLE 8
Distribution of Glaucoma Knowledge Score

Score	Number	Percent
0	9	2.5
1	9	2.5
2	14	3.9
3	24	6.6
4	45	12.4
5	56	15.4
6	88	24.2
7	80	22.0
8	38	10.5
Total	363	100.0

$\bar{X} = 5.40$ $s = 1.92$

Most respondents did not have negative perceptions of people with glaucoma or diabetes in terms of contagion, feelings of discomfort in the presence of those suffering from either illness, or the possibility of victims living a normal life. The only variable to clearly emerge as a predictor of the minority with negative perceptions is level of education. The more poorly educated are more likely to perceive some stigma attached to diabetes and glaucoma. Age is also a significant factor in the perceptions of diabetes, with older people having more negative perceptions. Keeping in mind the limited definitions of stigma used in this study, the results suggest that education programs aimed at the poorly educated, and possibly the elderly, would benefit from placing increased emphasis on correcting misperceptions of diabetes and glaucoma.

The analysis of factors associated with overall knowledge of diabetes

TABLE 9
Multivariate Analysis of Factors Associated with Knowledge of Glaucoma

Variable	N	Mean Knowledge Score		Strength of Relationship	
		Original	Adjusted[a]	Eta	Beta[a]
TOTAL SAMPLE	353	5.44			
AGE					
14-19	19	4.53	5.31		
20-29	65	5.28	5.30		
30-39	71	5.93	5.78		
40-49	47	5.87	5.65		
50-59	56	5.91	5.69		
60-69	48	5.13	5.31		
70 or older	47	4.62	4.79	.27#	.17
SEX					
Male	87	4.94	5.02		
Female	266	5.60	5.58	.15†	.13†
EDUCATION					
8 years or less	60	4.55	4.87		
9 to 11 years	92	4.92	4.99		
High School Degree	113	5.55	5.38		
Some College	61	6.16	6.12		
College Degree or more	27	7.07	6.96	.38#	.32#
GLAUCOMA IN FAMILY					
No—don't know	327	5.35	5.38		
Yes	26	6.62	6.21	.18#	.12*
HAD GLAUCOMA TEST					
No—don't know	147	4.69	4.83		
Yes	206	5.98	5.87	.34#	.27#

$R = .539^{\#}$, $R^2 = .290$

[a]Controlling for all other independent variables.
*p<.05, †p<.01, #p<.001

and glaucoma indicated that age (less important for glaucoma), sex, level of education, family history of either illness, and previous experience in being tested for either illness are significant predictors of knowledge. The personal characteristics are probably most important in terms of targeting educational programs. In general, the very young and the very old, males, and the poorly educated have the lowest levels of knowledge.

In addition to isolating the direct effects of these variables, the multivariate analyses presented here can also identify very specific subgroups in need of special emphasis. A characteristic of the multiple classification analysis approach is that the adjusted means can be expressed in terms of deviations from the grand mean. Thus, the cumulative effect of specific categories of each variable being considered can be estimated by subtracting and adding the adjusted deviations from the grand mean. For example, the results shown earlier in Table 5 indicate that males age 14 to 19, with 8 years or less of education, who did not report a family history of diabetes and who have not been tested for diabetes would have a predicted diabetes knowledge score of 3.19. By way of comparison, males age seventy or older with all other characteristics similar to young males in the previous example would have a predicted knowledge score of 2.32. These data suggest that the elderly male is somewhat in greater need of educational efforts. When it is necessary to specifically target resources and manpower, information of this nature can help in decision making.

In addition to the specific results obtained, the identification of a positive correlation between knowledge of diabetes and knowledge of glaucoma may be important with respect to development and focus of health programs. This relationship together with the similarity of results found for the factors related to knowledge of diabetes and knowledge of glaucoma suggest a general pattern with respect to knowledge dealing with health and illness. Certain types of people (e.g., the elderly, the poorly educated) may have generally lower knowledge regardless of the illness or health practice in question.

Thus, it might be concluded that the simplest approach is to target all health programs toward these groups. However, two points are important with respect to this issue. The relationship between knowledge of diabetes and knowledge of glaucoma is far from perfect ($r^2 = .31$, indicating that 31 percent of the variation in knowledge of diabetes can be explained by the variation in knowledge of glaucoma). Thus, respondents' general knowledge of the two diseases varies independently to a considerable degree.

Second, needs assessments that focus on particular illnesses or health behaviors will identify specific areas in which knowledge is deficient as well as determining which subgroups in the population have the greatest need for service. For these reasons, it appears that the most useful approach to the study of knowledge, attitudes, and practices concerned with health behavior is to

deal with individual illnesses to obtain the detailed information necessary to target health programs, while at the same time compiling information on both the similarities and differences between diseases.

Telephone surveys of the type described here are particularly feasible and cost-effective in rural communities that have relatively complete telephone coverage. Well-trained interviewers can obtain detailed information on a variety of health issues, and the results of such a survey can serve to help focus the program, as was the case in Davie County. It is also of interest to note that the survey itself can have an educational effect. Several respondents in the present study were motivated to ask questions about diabetes and glaucoma at the end of the interview, and others obtained information about the functions of the public health department.

In general, baseline surveys of populations in need of health education efforts can help to identify needed areas of emphasis, identify subgroups with special needs, and provide a basis for evaluating the results of the program. Obtaining funding for health education is difficult under the best of circumstances, and as funds become even more difficult to obtain, there will be increased pressure to focus efforts in the areas of greatest need. Systematic evaluation of programs will also become more important as the competition for funds and resources becomes greater. Since rural communities must cope with the problems of allocating limited funds and resources among a population that is more widely dispersed than in urban areas, the use of preliminary surveys should become increasingly valuable to program planners and administrators.

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