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Factors Determining Recall of Examination Results in Diabetic Population

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Objective: To determine factors influencing recall of examination results after 4 yr. Research Design and Methods: At two examinations that were 4 yr apart, a diabetic population was asked, "Have you been told that your diabetes has affected the back of your eyes, that is the retina?" Participants were informed by letter whether they had retinopathy. Subjects in this study included younger-onset (*n* = 311) and older-onset (*n* = 279) diabetic subjects who had retinopathy at baseline and did not know it. Results: Forty-two percent of younger-onset and 29% of older-onset subjects recalled at follow-up that they had been told their diabetes had affected their eyes. People in both groups were more likely to recall they had retinopathy if they had more severe retinopathy, had more symptoms of neuropathy and peripheral vascular disease, had seen an opthalmologist within 2 yr, or monitored their blood glucose more often. In addition, younger-onset diabetic subjects with poorer visual acuity or who were on a combination insulin regimen and older-onset people taking insulin, having more education, or who were younger were more likely to recall they had retinopathy. Factors not associated with recall in either group included sex, duration of diabetes, proteinuria, glycosylated hemoglobin, and family income. Conclusions: These results underscore the need to develop better methods to deliver health-care information to people who have diabetes. *Diabetes Care* 14:1097–100, 1991

It has been shown that timely photocoagulation treatment of diabetic retinopathy can prevent much of the vision loss associated with this condition (1). However, the maximum benefit of retinal photocoagulation can only be achieved through the active involvement of primary-care physicians, eye-care providers, and the patients themselves. In particular, these individuals must be knowledgeable about the patients' condition so that treatment may be applied when indicated.

In this investigation, we report on how well diabetic subjects recalled the results of a screening for retinopathy when reexamined 4 yr later, the purpose being to determine the efficiency of the screening for informing diabetic subjects of their condition. In addition, we examined factors such as education and frequency of visits to an eye-care provider, which may influence a subject's knowledge of his/her condition to determine whether any subgroups were less likely to be knowledgeable.

RESEARCH DESIGN AND METHODS

Case identification methods and descriptions of the population appear in previous reports of the Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR; 2–5). Briefly, the study area was comprised of 11 counties in southern Wisconsin. During 1 July 1979 to 30 June 1980, lists of diabetic patients were kept by 452 of 457 primary-care physicians in the area, and 10,135 diabetic subjects were identified. A two-part sample of 2990 of the diabetic subjects was invited to participate in the baseline examination in 1980–1982. The first part consisted of the entire population of insulin-taking subjects diagnosed before 30 yr of age (*n* = 1210) and is referred to as the younger-onset group. The second part consisted of a probability sample, stratified by duration of diabetes, of subjects diagnosed at ≥30 yr of age, regardless of insulin-taking status, but meeting other eligibility criteria (*n* = 1780) and is referred to as the older-onset group. The population was predominantly white; <2% were nonwhite. Surviving members of the sample were invited to participate in a 4-yr follow-up examination in 1984–1986.

Both the baseline and follow-up examinations followed a similar protocol. Pertinent procedures included obtaining informed consent, verifying the participant's address, determining best-corrected visual acuity for distance, dilating the pupils, administering a medical history questionnaire, taking stereoscopic color fundus photographs of seven standard fields, and determining urine protein and glycosylated hemoglobin levels.

To determine severity of retinopathy, all fundus photographs were graded with a modification of the Airlie

House classification scheme as further adapted for the WESDR (4,6). This scheme specifies nine levels of retinopathy. Level 10 represents no retinopathy, levels 21–51 represent increasing levels of nonproliferative retinopathy, and levels 60–80 represent increasing levels of proliferative retinopathy.

After the baseline and follow-up examinations, participants, their primary-care physicians, and their eye-care providers were notified by letter of the results of the examination, which included blood pressure, visual acuity, and intraocular pressure. All letters were successfully delivered. Participants who had any signs of diabetic retinopathy, as evidenced by microaneurysms, blot hemorrhages, hard or soft exudates, or worse, were told that diabetes had affected their eyes. They were also told to continue being followed by their ophthalmologist if they had been seeing one or to consult an ophthalmologist if they did not have one. In addition, if participants had any vision-threatening retinopathy, i.e., new vessels or clinically significant macular edema, they were also notified by telephone and urged to see an ophthalmologist as soon as possible.

As part of the questionnaire at the baseline and follow-up examinations, participants were asked the question, "Have you been told the diabetes has affected the back of your eyes, that is the retina?" This analysis is confined to those participants in whom retinopathy was present at baseline and who indicated they did not know that diabetes had affected their eyes.

All variables reported were levels measured at follow-up. Glycosylated hemoglobin was measured on a rinsed sample using a microcolumn technique (Isolab, Akron, OH). In addition, the medical history questionnaire elicited information regarding treatment regimen, self-monitoring of blood glucose, ophthalmologic care, and symptoms of neuropathy and peripheral vascular disease.

Differences among proportions of participants recalling the results of the baseline examination were tested for significance by χ^2 statistics and Mantel-Haenszel tests for trend (7).

RESULTS

Of 996 younger-onset diabetic subjects participating in the baseline examination, 311 had some degree of retinopathy, indicated that they did not know diabetes had affected their eyes, and participated in the follow-up examination. Of 1370 older-onset diabetic subjects participating in the baseline examination, 279 met the same criteria. Despite having been notified by letter that diabetes had affected their eyes, only 42.1% (131 of 311) of young-onset subjects and 29% (81 of 279) of older-onset subjects recalled this fact at follow-up.

This recall proportion varies among different segments of the population as shown in Table 1. In the older-onset group, younger subjects are more likely to recall their retinopathy status. There is no such trend in the younger-onset group. Also, there are no statistically significant associations between the recall proportion and duration of diabetes, sex, glycosylated hemoglobin, proteinuria, and family income (data not shown). Both younger- and older-onset subjects who monitor their blood glucose more often and are on more intensive treatment regimens are more aware of their retinopathy, as are subjects with more signs and symptoms of neuropathy and peripheral vascular disease. Diabetic subjects with more severe retinopathy are more likely to know they have it. Younger-onset subjects with poorer visual acuity are more likely to recall their retinopathy status. This is not true of older-onset subjects. Diabetic subjects who had seen an ophthalmologist more recently also have a higher retinopathy recall. Also, older-onset subjects but not younger-onset subjects with more education also have more knowledge regarding their retinopathy. Finally, the recall proportion varies significantly by occupation in the older-onset group but not in the younger-onset group. Diabetic subjects who were farmers and operatives/laborers had distinctly lower recall proportions.

CONCLUSIONS

In earlier work with this population, we found that a survey questionnaire designed to determine the presence of diabetic retinopathy to be insensitive (8). Having been examined and notified of the results of fundus photography, it was thought that on reexamination these people would be more aware of their condition. However, only 42% of younger-onset subjects and 29% of older-onset subjects who were initially ignorant of having retinopathy recalled 4 yr later that they had been told diabetes had affected their eyes. The remainder represents diabetic subjects who either had forgotten or did not wish to admit they had retinopathy. Even among those with proliferative retinopathy, 30% did not know it. This is particularly distressing because effective treatment in the form of photocoagulation exists to prevent much of the loss of vision associated with diabetic retinopathy (1). Thus, there is a need for more effective education programs that would change patients' behavior and attitudes regarding recognition of and ophthalmologic care for diabetic retinopathy.

Diabetic subjects who are more active in managing their diabetes, through methods such as self-monitoring of blood glucose and more intensive treatment regimens, are also more knowledgeable regarding their retinopathy status. In addition, diabetic subjects with more severe retinopathy are more aware they have it. The younger-onset group with poorer vision also had better recall of retinopathy. The fact that this is not true in the older-onset group is probably because in the older diabetic subjects the decrease in vision is often due to causes other than retinopathy (9). Visits to an ophthalmologist have a beneficial effect on patient knowledge. Subjects who had seen an ophthalmologist within 2 yr of the examination were more likely to recall they had retinopathy. However, even among younger-onset sub-

TABLE 1
Association of recall of retinopathy with characteristics of population in younger- and older-onset diabetic subjects

	Younger onset				Older onset			
Characteristic	Parameter	*n*	Percent recalling retinopathy	*P**	Parameter	*n*	Percent recalling retinopathy	*P**
Age (yr)	0–14	3	33.3		30–54	34	47.1	
	15–24	66	31.8		55–64	67	29.9	<0.05
	25–29	61	49.2	0.42	65–74	104	27.9	
	30–34	53	45.3		≥75	74	21.6	
	35–39	41	53.7					
	≥40	87	37.9					
Self-monitoring of blood glucose	0	125	33.6		0	215	27.0	
	<1/day	98	45.9		<1/day	38	23.7	<0.01
	≥1/day	22	40.9	<0.05	≥1/day	26	53.8	
	≥2/day	35	51.4					
	≥3/day	31	54.8					
Treatment regimen	Long-acting insulin	100	31.0	<0.05	None/diet/oral	88	18.2	<0.01
	Short- and long-acting insulin	205	46.3		Insulin	191	34.0	
Symptoms of neuropathy and peripheral vascular disease	0	157	33.1		0	98	23.5	
	1	72	40.3	<0.001	1	68	17.6	<0.005
	2	42	54.8		2	57	38.6	
	≥3	40	67.5		≥3	56	42.9	
Retinopathy	10	6	33.3		10	17	17.6	
	21	50	32.0		21	44	22.7	
	31	67	29.9	<0.001	31	80	18.8	<0.001
	41	104	35.6		41	93	28.0	
	51	16	56.2		51	12	50.0	
	≥60	68	69.1		≥60	30	70.0	
Visual acuity	≥20/20	234	38.5		≥20/20	106	28.3	
	<20/20	60	50.0	<0.05	<20/20	130	28.5	0.70
	<20/40	17	64.7		<20/40	38	31.6	
Ophthalmologic care	Ophthalmologist visit ≤2 yr	191	54.5		Ophthalmologist visit ≤2 yr	165	37.6	
	Ophthalmologist visit >2 yr	49	26.5	<0.001	Ophthalmologist visit >2 yr	33	24.2	<0.001
	Other	71	19.7		Other	81	13.6	
Education (yr)†	≤11	26	46.2		≤11	110	20.9	
	12	100	44.0	0.75	12	105	33.3	<0.05
	13–15	73	49.3		≥13	63	34.9	
	≥16	42	47.6					
Occupation‡	Professional	63	41.3		Professional	40	30.0	
	Farmer	18	38.9		Farmer	54	18.5	
	Business owner/manager	39	43.6		Business owner/manager	43	25.6	
	Clerical	51	49.0	0.69	Clerical	32	50.0	<0.05
	Sales	15	26.7		Sales	17	41.2	
	Craftsman	28	46.4		Craftsman	30	33.3	
	Operative/laborer	62	33.9		Operative/laborer	46	15.2	
	Service	28	46.4		Service	16	43.8	

*Based on Mantel-Haenszel test for trend or χ^2 test (treatment regimen and occupation).
†Restricted to age ≥25 yr in younger-onset group.
‡Based on family member with highest occupation.

jects this proportion is barely a majority. Finally, people with more symptoms of neuropathy and peripheral vascular disease are more aware of their retinopathy. This may be because they come in contact with the health-care system more often and are more likely to have their retinopathy diagnosed.

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Split-Mixed Insulin Regimen With Human Ultralente Before Supper and NPH (Isophane) Before Breakfast in Children and Adolescents With IDDM

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Objective: Fasting hyperglycemia is common in patients with insulin-dependent diabetes mellitus (IDDM) treated with twice-daily subcutaneous insulin regimens. We postulated that substituting human ultralente insulin for the presupper dose of intermediate-acting insulin would improve overnight glycemic control in children and adolescents with IDDM. Research Design and Methods: This 6-mo double-blind crossover study compared a conventional insulin regimen, a mixture of human NPH and regular given before both breakfast and supper (NPH), with a novel twice-daily regimen in which human ultralente replaced NPH before the evening meal (ultralente). This study was comprised of 20 children and adolescents (mean age and duration of IDDM 11.3 ± 2.9 and 2.4 ± 1.3 yr, respectively) from the Youth Clinic of the Joslin Diabetes Center, all of whom regularly performed self-monitoring of blood glucose (SMBG) and had been treated exclusively with human insulin (mean daily dose 0.75 ± 0.22 U/kg). Subjects performed SMBG on a prescribed schedule with a glucose meter with an electronic memory, and recorded results of blood glucose measurements, insulin dosages, and episodes of hypoglycemia. Monthly measurements were obtained for height, weight, and HbA_1, and mean daily insulin dosages and average blood glucose level before breakfast, lunch, supper, bedtime snack, and between 0200 and 0300 were calculated. Nonfasting serum lipids were measured at entry, crossover, and the end of the study. Results: After 3 mo, mean HbA_1 did not differ significantly (9.1 ± 1.7 vs. 9.5 ± 1.4%, NPH and ultralente, respectively). Mean fasting blood glucose was significantly lower on ultralente (9.6 ± 1.9 vs. 10.3 ± 2.2 mM, $P < 0.05$, and blood glucose showed a similar trend ($0.05 < P < 0.1$) before lunch (8.9 ± 1.7 vs. 9.8 ± 2.6 mM. Mean blood glucose before bedtime snack was significantly lower ($P < 0.01$) on NPH (8.4 ± 1.9 vs. 10.0 ± 2.1 mM) but did not differ significantly before supper or between 0200 and 0300. On the two regimens, growth and serum lipids were normal and similar, and no differences were observed in the incidence or severity of hypoglycemia. Conclusions: Compared with a mixed dose of regular and NPH, a similar dose of a mixture of regular and human ultralente insulin before supper caused a modest reduction in fasting blood glucose levels but was associated with higher blood glucose levels before the bedtime snack. Overall glycemic control, reflected in HbA_1 values, was not significantly improved. *Diabetes Care* 14:1100–106, 1991

Hyperglycemia before and after breakfast occurs in most patients with insulin-dependent diabetes mellitus (IDDM) treated with twice-daily subcutaneous insulin regimens (1,2). When the second dose of a standard split-mixed insulin regimen