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Originals

The Risk of Diabetic Control: A Comparison of Hospital Versus General Practice Supervision

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Summary. Two groups of insulin-treated outpatients (one followed up at the Hotel-Dieu Hospital and the second mainly supervised by general practitioners) were chosen at random in 1978. The two populations were comparable in age, age at diagnosis, sex, level of education, overall activity and socio-professional and economic status. Outpatients followed up in the diabetic unit had better blood glucose control, with about the same number of hypoglycaemic reactions as patients followed up in general practice. This better control was associated with more social activity and less visits to the physician, despite the fact that patients attending the hospital spent more money on their diet and had more daily insulin injections. All these differences remain significant after adjustment for the duration of diabetes. It may be inferred that attempts to improve control in insulin-treated patients are associated with a more active life and with no increase in the frequency of hypoglycaemic reactions.

Key words: Diabetes mellitus, insulin-treated diabetics, multiple injections, control of diabetes, hypoglycaemia.

Following several controversial publications on the control of diabetes [1, 2], Ingelfinger [3] stressed that 'almost nothing is known of the risks, in particular hypoglycaemia, of attempting to implement control'.

We have studied two groups of insulin-treated diabetic patients, treated either in a diabetic unit or by general practitioners, in order to evaluate the consequences of diabetes and its treatment. Attempts were made to analyse several parameters including the frequency of hypoglycaemic reactions, the quality of social and professional life, exercise and general well-being.

Subjects and Methods

This study deals with two groups of diabetic outpatients selected at random from two populations of diabetic patients who came at least once in 1974 to the clinic at Hotel-Dieu Hospital or who were registered as diabetic in the same geographical area at the Caisse d'Assurance Maladie. This department belongs to the French Social Welfare Administration where, since 1974, a file on all registered diabetic patients has been kept. All patients were clinically examined and interviewed in 1978 at Hotel-Dieu or the Caisse d'Assurance Maladie and data were recorded for the last 12-month period.

All the patients were seen by doctors and economists. Questionnaires were completed, collecting information on social and professional life, exercise and hobbies.

The nine socio-professional categories established by Institut National de la Statistique et des Etudes Economiques (INSEE) [4] divide French households into nine groups based upon social and professional criteria. On account of the small number of subjects in our study, we chose to combine the nine socio-professional categories into three groups (that is low, middle and high income) [5]. Those subjects who were retired or unemployed were allocated to one of the three groups according to their past job and/or their educational level. An index of social life and an assesment of professional life was made using the questionnaire shown in Table 1.

A medical history was taken and a full examination was carried out on every subject. This included measurement of height, weight and arterial blood pressure. Particular attention was paid to the presence or absence of diabetic complications. The control of diabetes was judged by mean fasting and post-prandial blood glucose levels and 24 h glycosuria. Each patient underwent at least four evaluations during the 12 months. Severe hypoglycaemia was defined as coma, the need for glucagon injection, emergency hospitalisation or the need for assistance. These data were obtained both from medical records and by direct questioning.

We used the χ^2 statistics, the comparison of means and classical adjustment techniques: the chi-square of Cochran [6] for fourfold tables for qualitative data, and the two way analysis of variance with unequal sample size for the quantitative ones.

This study deals only with insulin-treated patients. It can be seen from Table 2 that 31% of the patients selected from the Caisse d'Assurance Maladie and 43% from the Hotel-Dieu were insulin-treated ($p < 0.01$). Some patients selected for the study failed to participate. The percentage of insulin-treated patients who did not attend was significantly higher among the Hotel-Dieu patients.

At Hotel-Dieu the insulin-treated patients who failed to partici-

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Table 1. Social and professional life assessment

Do you dine out with the family?[a]	
never	(4)
sometimes each year	(3)
sometimes each month	(2)
sometimes each week	(1)
Do you dine at home with the family?[a]	
never	(4)
sometimes each year	(3)
sometimes each month	(2)
sometimes each week	(1)
Do you dine out with friends?[a]	
never	(4)
sometimes each year	(3)
sometimes each month	(2)
sometimes each week	(1)
Do you dine at home with friends?[a]	
never	(4)
sometimes each year	(3)
sometimes each month	(2)
sometimes each week	(1)
Do you go to restaurants?[a]	
never	(4)
sometimes each year	(3)
sometimes each month	(2)
sometimes each week	(1)
Do you go to shows?[a]	
never	(4)
sometimes each year	(3)
sometimes each month	(2)
sometimes each week	(1)
Do you practise sports?[a]	
never	(4)
sometimes each year	(3)
sometimes each month	(2)
sometimes each week	(1)
Do you practise gardening?[a]	
never	(4)
sometimes each year	(3)
sometimes each month	(2)
sometimes each week	(1)
Do you practise other leisure activities?[a]	
never	(4)
sometimes each year	(3)
sometimes each month	(2)
sometimes each week	(1)
How many days have you been unemployed (due to illness or dismissal) in the previous year?	
Does diabetes affect your job?	no
	a little
	more or less
	a lot
Rate your working conditions	poor
	fair
	good
Do you have a fear of difficulties in obtaining a new job?	Yes
	No

[a] An index of social life was obtained by addition of the nine scores, thus ranging from 9 (very active) to 36 (very inactive)

Table 2. Description of the two patient groups

	French Social Welfare Administration	University Hospital (Hôtel-Dieu Paris)	p	p^a
No. of selected diabetics	227	280		
No. of insulin-treated diabetics	71	121		
No. of insulin-treated patients examined (percentage of selected)	64 (90)	83 (69)	< 0.01	
Duration of diabetes (years)[b]	16 ± 8	13 ± 7	< 0.01	
Percentage men	52	48	NS	NS
Age in 1978 (years)[b]	46 ± 13	45 ± 13	NS	NS
Age at diagnosis (years)[b]	30 ± 13	32 ± 13	NS	NS
Body mass index[b, c]	38 ± 6	36 ± 5	< 0.05	NS
Percentage of patients who were hypertensive	16	19	NS	NS

[a] Value when the duration of diabetes was held constant
[b] Results expressed as mean ± SD
[c] Body mass index [7] calculated by the formula

$$100\left(\log \frac{\text{weight (kg)}}{\text{height}^2\text{ (m)}} - 1\right)$$

Table 3. Modes of follow up since the diagnosis of diabetes

	French Social Welfare Administration ($n = 64$)[a]	University Hospital (Hôtel-Dieu Paris) ($n = 83$)[a]	p	p^b
Diagnosis made by:				
General practitioners	56	71	< 0.05	NS
At hospital or in welfare centre	33	16		
By physician practising at place of work	11	13		
Mode of follow-up (since the diagnosis)				
General practitioner only	16	0	< 0.001	< 0.01
Hospital only	14	16		
Both	70	84		
Mode of follow-up in 1978				
General practitioner	42	4	< 0.001	< 0.001
Hospital	58	96		

[a] Expressed as percentage of total patients
[b] Value when the duration of diabetes was held constant

pate were not different from those who attended for examination in respect of age, sex, socio-professional status or body mass index [7]. However, the duration of diabetes was longer among those who failed to participate than in those who attended (17 ± 10 versus 13 ± 7 years, $p < 0.05$). The seven patients from the Caisse d'Assurance Maladie who failed to participate were also not different from the patients who attended for asessment.

Tables 2, 3 and 4 present the two patient groups in terms of their age, socio-economic status and the other factors described. These did not differ in sex, age at examination, age at diagnosis, family size, level of education, and socio-professional status. The Hotel-Dieu patients were more often cared for in the clinic only (or in the clinic and by their private physician) than the patients of Caisse d'Assurance Maladie, who had a higher percentage of care by a private physician alone (42% of patients of this last group were followed by a private physician versus only 4% in the other group).

Since the patients who took part from Hotel-Dieu had a significantly shorter duration of diabetes than those who failed to attend for study, we adjusted all comparisons between the two groups for the duration of the disease. We divided the duration of diabetes into four categories, and for each qualitative variable studied we combined the results obtained in each category following the method described by Cochran [6]; for the quantitative variables we took into account the effect of the duration of the disease by using a two way analysis of variance with unequal sample size. After adjustment for the duration of diabetes, all the significant differences between the two groups remained significant except for the body mass index.

Results

Outpatients attending the Hôtel-Dieu Hospital had lower blood glucose levels when fasting and after meals than the patients from the other group who were usually treated by general practitioners (Table 5). The majority (91%) of Hotel-Dieu patients gave themselves two or three injections per day, while 42% of patients from Caisse d'Assurance Maladie gave themselves one injection per day. This better control

Table 4. Socio-economic data in the two patient groups

	French Social Welfare Administration ($n = 64$)[a]	University Hospital (Hôtel-Dieu Paris) ($n = 83$)[a]	p	p^b
No. of people living at home:				
1	14	7	NS	NS
2	39	33		
3	17	33		
4	30	27		
Educational level:				
elementary	45	37	NS	NS
secondary	35	27		
higher	20	36		
Percentage of active people	72	65	NS	NS
Income level[c]:				
low income	28	15	NS	NS
middle income	59	75		
high income	13	11		

[a] Expressed as percentage of total patients
[b] Value when the duration of diabetes was held constant
[c] The nine socio-professional categories established by INSEE were combined into three levels of income [4, 5]

Table 5. Treatment, control and hypoglycaemic reactions in the two patient groups

	French Social Welfare Administration ($n = 64$)[a]	University Hospital (Hôtel-Dieu) ($n = 83$)[a]	p	p^b
Fasting blood glucose (mmol/l)[c]	9.6 ± 3.1	8.1 ± 3.6	< 0.05	< 0.05
Post-prandial blood glucose (mmol/l)[d]	12.0 ± 4.6	8.9 ± 3.8	< 0.001	< 0.01
Glysosuria (g/24 h)[e]	16.0 ± 15	11.0 ± 12	NS	NS
No. of daily insulin injections:				
1	42	9	< 0.001	< 0.001
2	50	61		
3	8	30		
Hypoglycaemic reactions during the last year:				
slight: none	8	8	NS	NS
slight: some during the year	16	22		
slight: some each month	24	28		
slight: some each week	52	42		
severe: none	73	69	NS	NS
severe: with hospitalization	11	13		
severe: with glucagon injections	16	18		

Results expressed as mean ± SD
[a] Expressed as percentage of total patients
[b] Value when the duration of diabetes was held constant
[c] Missing information for 12 patients in the first group, and 8 in the second
[d] Missing information for 35 patients in the first group and 12 in the second
[e] Missing information for 34 patients in the first group and 24 in the second

Table 6. Social and professional life data in the two patient groups

	French Social Welfare Administration ($n = 64$)[a]	University Hospital (Hôtel-Dieu) ($n = 83$)[a]	p	p^b
Index of social life[c]	28.56 ± 5.02	25.70 ± 5.41	< 0.01	< 0.01
Dining out with friends:				
never	31	31	< 0.05	NS
sometimes/year	50	31		
sometimes/month	8	21		
sometimes/week	11	17		
Dining at home with friends:				
never	40	29	< 0.05	NS
sometimes/year	42	32		
sometimes/month	10	26		
sometimes/week	8	13		
Do you practise gardening or other leisure activities?				
never	50	37	< 0.05	< 0.05
sometimes/year	19	6		
sometimes/month	8	16		
sometimes/week	23	41		
Do you think you could have difficulty or have you had difficulty in getting a new job?				
percentage of 'yes'	44	69	< 0.01	< 0.05

[a] Expressed as percentage of total patients
[b] Value when the duration of diabetes was held constant
[c] Results expressed as mean ± SD. This index ranging from nine (very active) to 36 (very inactive) was compiled based on nine questions about social and leisure activities

Table 7. Way of life with diabetes in the two patient groups

	French Social Welfare Administration ($n = 64$)	University Hospital (Hôtel Dieu) ($n = 83$)	p	p^a
No. of medical consultations/year	7.9 ± 5.5	3.7 ± 3.0	< 0.001	< 0.001
Percentage of people hospitalized at least once	86	94	NS	NS
Does the special diet entail some additional expenses (patient's view)				
percentage of 'yes'	48	67	< 0.05	< 0.01
Do you know about glucagon?				
percentage of 'yes'	81	99	< 0.001	< 0.001

Results expressed as mean ± SD
[a] Value when the duration of diabetes was held constant

was not associated with a higher incidence of hypoglycaemic reactions (either slight or severe).

It is of interest that 31% of patients from Hotel-Dieu and 27% of patients from Caisse d'Assurance Maladie experienced at least one severe hypoglycaemic reaction during the last year.

Table 6 shows the significant results from the questions concerning social and professional life. The better control among the Hotel-Dieu patients was associated with a more active social life, including more social eating habits and more participation in leisure activities. The patients followed at Hotel-Dieu Hospital were not different from those of the Caisse d'Assurance Maladie with regard to the number of days of unemployment due to illness or dismissal. There was no difference in relation to the ease of gaining new employment, although the feeling that diabetes was a possible handicap was greater among Hotel-Dieu pa-

tients than among those from Caisse d'Assurance Maladie.

The feeling of well-being was greater in Hotel-Dieu patients than among those from the Caisse d'Assurance Maladie, and this despite the fact that Hotel-Dieu patients spent more money on their diet (Table 7) and had more insulin injections per day (30% of Hôtel-Dieu take three injections versus 8% of Caisse d'Assurance Maladie patients). Finally, patients from Hotel-Dieu were more often hospitalised, but had visited their physician less frequently during the last year, and knew more about their diabetes (as reflected for instance by knowledge of glucagon) than the diabetics of the other group. At Hôtel-Dieu diabetic patients are usually admitted once for evaluation and education.

It is of interest to note that, when controlling for the educational level of the patient, none of the results were significantly altered.

Discussion

We have compared two populations of insulin-treated diabetic patients, one of which was followed up in a diabetic unit and the other by general practitioners. Both populations were subject to a large risk of hypoglycaemic reactions since 27% in Caisse d'Assurance Maladie and 31% at Hotel-Dieu had at least one severe hypoglycaemic episode during the year before the survey. However, the two groups were not different in this regard despite the fact that the group of patients in Hotel-Dieu achieved a better blood glucose control than the other group. The group of patients treated at Hotel-Dieu had no disadvantages compared with the other group: all comparisons between groups showed either no difference or else the difference was always in favour of hospital management. The group managed by the diabetic unit spent more time on social activities and had a greater feeling of well-being. These results may indicate that the quest for better control, including more frequent insulin injections, does not increase the risk of the treatment. We have defined significant hypoglycaemia using several criteria and have shown that about one out of four patients in both groups experienced at least one severe hypoglycaemic reaction per year. We were unable to find figures in the literature that would allow any comparisons with our findings. Data are given for cause of death in patients from the Joslin Clinic, where there was emphasis on obtaining 'tight control'; (in reviews by Marble [8], and Paz-Guevara et al. [9]). Deaths due to hypoglycaemia were rare (0.23%) [8].

Among 3,000 children followed by Lestradet et al. [10] for 30 years, seven died of hypoglycaemia. However, there is virtually no information concerning reversible or irreversible damage to the central nervous system induced by hypoglycaemia. In the Joslin Clinic report [11], two cases were described but overall figures were not given. In another study conducted at Hotel-Dieu Hospital the authors observed that about 25%–30% of insulin-treated patients experienced at least one severe hypoglycaemic reaction per year [12]. Finally, as emphasized by Ingelfinger [3], reliable data indicating the incidence or prevalence of adverse effects induced by the quest for better control are very scarce.

One question remains. Are the insulin-treated patients who where followed up in Hotel-Dieu Hospital different from those who were followed up by general practitioners? For the studied variables (age, sex, level of education, socio-professional and economic status) the two populations of insulin-treated patients were not significantly different (at the 5% level) except for a shorter duration of diabetes among those from Hotel-Dieu. Therefore this variable was taken into account for all the comparisons between the two groups. However, the treatments of the two groups were different since in the specialised unit (Hotel-Dieu) daily insulin injections were more frequent and education was more intensive. Furthermore, the groups of patients (as well as their physicians), probably differed in their attitude: those from Hotel-Dieu came at least once to a specialised clinic and were more often hospitalised for teaching and treatment modification. The patient followed up at Hotel-Dieu Hospital were perhaps looking for more information, more advice, and more rigid control. They were willing to try to achieve good control [13] even if the large majority of them had been referred to this hospital by their general practitioners and were ignorant of the aims of the specialised unit [14]. Psychological tests were not performed on the subjects, but it is likely that the psychological profile of a subject who chooses to be followed up in a specialised unit (or who is referred to a specialised unit) is different from the profile of a patient who is followed up in general practice. Our study is not a randomized study but an observational one and thus we cannot be sure that there is no bias of recruitment. Another further question is whether trying to improve the control of blood glucose and to increase the knowledge about diabetes in a different group of diabetics will lead to the same results, i.e. no increased risks but increased benefits.

In insulin-treated diabetic patients who nowadays hope for a long life expectancy without physiological or social handicaps, an improvement of control will probably be beneficial in lowering the occurrence and

severity of microangiopathy [15], although the relationship between blood glucose control and the evolution of microvascular disease in diabetes is still under discussion [1, 2]. The results of this study may indicate that the desire for better control does not increase the social restrictions placed on the diabetic or the risk of more frequent hypoglycaemic reactions. Furthermore, several studies of self-monitoring of blood glucose have shown that those techniques which improve control by increasing knowledge, particularly in well motivated patients, will also improve their well-being [16, 17].

Finally our results also showed that the better controlled patients spent less time visiting physicians. This can certainly be added to the list of the benefits, not only for the patient but also for the medical and social welfare administration.

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References

1. Cahill GF, Etzwiler DD, Freinkel N (1976) Control and diabetes. N Engl J Med 294: 1004–1005
2. Siperstein MD, Foster DW, Knowles HC Jr, Levine R, Madison LL, Roth J (1977) Control of blood glucose and diabetic vascular disease. N Engl J Med 296: 1060–1063
3. Ingelfinger FJ (1977) Debates on diabetes. N Engl J Med 296: 1228–1230
4. INSEE (1980) Code des catégories socio-professionnelles, 7ème edn. INSEE, Paris
5. INSEE (1978) Données sociales. La documentation française. INSEE, Paris, p 48
6. Cochran WG (1968) The effectiveness of adjustment by subclassification in removing bias in observational studies. Biometrics 24: 295–313
7. Schwartz D, Lellouch J, Anguerra FG, Beaumont JL, Lenegre J (1966) Tobacco and other factors in the aetiology of ischemic heart disease in men. Results of a retrospective survey. J Chronic Dis 19: 35–56
8. Marble A (1971) Hypoglycaemia due to insulin. In: Marble A, White P, Bradley RF, Krall LP (eds) Treatment of diabetes mellitus, 11th edn. Lea & Febiger, Philadelphia, pp 297–301
9. Paz-Guevara AT, Hsu TH, White P (1975) Juvenile diabetes mellitus after forty years. Diabetes 24: 559–565
10. Lestradet H, Papoz L, Hellouin de Menibus Cl, Levavasseur F, Besse J, Billaud L, Battisteli F, Tric Ph, Lestradet F (1981) Long-term study of mortality and vascular complications in juvenile-onset (Type 1) diabetes. Diabetes 30: 175–179
11. Marble A (1959) Hypoglycaemia due to insulin. In: Joslin EP, Rooth HF, White EP, Marble A (eds) The treatment of diabetes mellitus, 10th edn. Lea & Febiger, Philadelphia, pp 319–320
12. Goldgewicht C, Slama G, Papoz L, Gin H, Soria J, Desplanque N, Tchobroutsky G (1981) Les hypoglycémies vécues par les diabétiques insulino-traités. In: Journées Annuelles de Diabetologie Hotel-Dieu, Flammarion, Paris, pp 247–256
13. Malins J (1968) Management of diabetes. In: Malins J (ed) Clinical diabetes mellitus. Eyre & Spottiswood, London, pp 447–448
14. Denys H, Traynard PY, Manuellan PE (1981) Les aspects psycho-sociaux dans le traitement des diabétiques insulino-dépendants. Le rôle de l'équipe soignante. In: Journées Annuelles de Diabetologie Hotel-Dieu, Flammarion, Paris, pp 237–246
15. Tchobroutsky G (1978) Relation of diabetic control to development of microvascular complications. Diabetologia 15: 143–152
16. Peterson CM, Rorhan SE, Jones RL (1980) Self-management: an approach to patients with insulin-dependent diabetes mellitus. Diabetes Care 3: 82–87
17. Sönksen PH, Judd S, Lowy C (1980) Home monitoring of blood glucose: new approach to management of insulin-dependent diabetic patients in Great Britain. Diabetes Care 3: 100–107

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