

# Diabetes and Accident Insurance

## A 3-year follow-up of 7,599 insured diabetic individuals

BENT MATHIESEN, MD  
KNUT BORCH-JOHNSEN, MD

**OBJECTIVE** — Individuals with diabetes pay increased premiums and experience limited coverage when taking out accident insurance, despite the lack of scientific support for this practice. The aim of the present study was to analyze whether diabetic individuals have an increased risk of accidents or an increased risk of permanent disability after an accident, compared with two nondiabetic groups.

**RESEARCH DESIGN AND METHODS** — All diabetic members of the Danish Diabetes Association were given free accident insurance for a 3-year period. Based on informed consent, they were also asked to participate in a follow-up study, comparing accident rates in diabetic individuals with a nondiabetic group. A total of 7,599 diabetic members accepted. The control groups were 1) individuals with a leisure-time insurance in the same company (individual issue) and 2) members of full-time group-based insurance (bank employees) in the same company.

**RESULTS** — The risk of accidents was 0.7 per 1,000 person-years in the diabetic group, compared with 4.5 per 1,000 person-years in the first and 5.5 per 1,000 person-years in the second nondiabetic control group ( $P < 0.001$ ). The degree of permanent injury did not differ between the diabetic and the nondiabetic group.

**CONCLUSIONS** — The risk of accidents and permanent disability is not increased in diabetic individuals. Thus, diabetic individuals should be offered accident insurance at a standard premium without limited coverage.

Life and accident insurance is a way of protecting an individual and his or her family from economic disaster in the case of unexpected events and may be a prerequisite when applying for a bank loan or a loan for a house. Patients with chronic diseases such as diabetes are often unable to take out insurance or they have to accept increased premiums and limited coverage.

For individuals with diabetes, differences in conditions for insurance have been found not only between countries (1) but even within countries (2). A previous study found that Danish life insurance premiums should be reduced and that a rather simple algorithm for estimation of life insurance premium could be developed (3). With respect to accident insurance, between- and within-country differences in regulations have also been observed (1,4). Searching the literature, we found, how-

ever, no data to support the assumption that individuals with diabetes have an increased risk of accidents or an increased risk of disability after an accident.

Thus, the aim of the present study was to examine the risk of accidents and the degree of permanent injury after an accident in a representative cohort of diabetic patients, compared with the risk in a nondiabetic cohort.

### RESEARCH DESIGN AND METHODS

#### Diabetic group

In 1991, the Danish Diabetes Association in collaboration with TRYG-Baltica Insurance offered a collective life and accident insurance for all diabetic members of the association for a 3-year period. The insurance

premium was paid by the Danish Diabetes Association, but the member had to notify the insurance company actively, certifying that they wanted the insurance and accepted the invitation to participate in the study, if they were to be included. The coverage of the accident insurance was limited to Dkr100,000 (approximately U.S. \$17,000), covering leisure time only. The insurance was offered to all members, independent of health status, enabling us to follow the risk of accidents in a large diabetic population selected only by their membership in the diabetic association and their willingness to participate in the study. The regional ethical committee approved the study, but accepted register-based follow-up in the morbidity and mortality registers only on the basis of individual informed consent. Consent was obtained from 7,599 individuals. The remaining members of the Danish Diabetes Association were covered by the insurance, but were not included in the study. Table 1 shows the number of individuals in the study group and the members of the Danish Diabetes Association according to age. The overall acceptance rate for participation was 29%, but in the most relevant age range, 18–60 years, it was 57%.

All accidents occurring during the 3-year period from 1 June 1991 to 31 May 1994 were registered with the insurance company and reviewed by one of the authors (B.M.). Accidents with an injury to the person (insurance events) were reported by the insured individual to the insurance company (TRYG-Baltica) following the Danish standard procedures for all accident insurance. The notification of claim was treated as all other notifications in the company and was evaluated by medical specialists based on the report from the insured individual, usually in combination with reports from the general practitioner or relevant specialists. The final decision was made when the degree of disability could be assumed stable. All decisions followed Danish standard disability tables used by all Danish insurance companies (5).

Six months after the end of the 3-year period, all cases were registered, including data on sex, age, type of treatment for diabetes, date of accident, date of notification, cause of accident, diagnosis, and degree of

From TRYG-Baltica Insurance (B.M.), Ballerup, and the Steno Diabetes Centre (K.B.-J.), Gentofte, Denmark. Address correspondence and reprint requests to K. Borch-Johnsen, MD, Steno Diabetes Centre, Niels Steensensvej 2, DK-2820 Gentofte, Denmark. E-mail: kbjo@novo.dk.

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Table 1—Participants in the present project and members of the Danish Diabetes Association according to age and type of diabetes

Age (years)	ITDM individuals participating in project	ITDM members of DDA	Participation rate (%) for ITDM members	NIDDM individuals participating in project	NIDDM members of DDA	Participation rate (%) for NIDDM members
0–18	216	757	28.5	2	—	—
19–30	1,278	1,976	64.7	11	—	—
31–40	1,470	2,340	62.8	94	177	53.1
41–50	1,664	2,584	64.4	387	864	44.8
51–60	1,211	2,856	42.4	613	1,083	56.6
61+	365	8,739	4.2	288	4,434	6.5
Total	6,204	19,252	32.3	1,395	6,558	21.3

For individuals below 30 years of age, type of treatment is not registered by the Danish Diabetes Association. DDA, Danish Diabetes Association; ITDM, insulin-treated diabetes mellitus.

permanent injury as decided by the insurance company (the degree of disability 1 year after the accident according to the standard tables [5]).

### Control groups

The first control group consisted of all the individuals in the company with an individually issued leisure-time insurance in the same period. The risk of accidents per 1,000 patient-years in the 1992–1994 period was computed from the registered data (number of accidents recorded in the 3-year period) in the company. The age and sex distribution in this group was the same as for the present study population (Table 1). Data regarding lifestyle and risk factors were not recorded in a computerized manner in the individuals, and thus we did not have access to data that could be used for confounder control in the control group. Data were provided by the actuarial department of TRYG Insurance.

The second control group consisted of individuals with a collective full-time accident insurance. The group consisted of all employees in a Danish bank. As this was a collective insurance no data had been collected on the individual members by the insurance company. Age and sex distribution was only recorded by the insurance company at the time when the agreement with the bank was made, and thus current data on age and sex distribution were unavailable. The age-range of the insured population was 20–70 years with a median age of approximately 40–45 years, and there is a moderate female predominance (55–60% females). The risk of accidents per 1,000 years in the years 1991–1993 was calculated as for the diabetic group, but included accidents at work and at leisure.

The observed and expected number of accidents in the diabetic group were com-

pared using  $\chi^2$  statistics. The expected number was calculated based on the accident rate of the two control groups combined.

The study was approved by all regional Ethical Committees in Denmark (KA 91022) and the Danish Data Protection Agency.

**RESULTS** — Table 1 shows the number of participants in the present study according to age and type of diabetes, compared with the total population of diabetic patients in the Danish Diabetes Association in 1991. In the age-group where most individuals are actively working and often responsible for the welfare of a family, age 19–60 years, the response rate was 58% for insulin-treated patients and 52% for patients treated with oral hypoglycemic agents or diet.

Table 2 shows the basic characteristics of the 7,599 diabetic patients participating in the study and of the control group. A total of 6,204 patients were treated with insulin, 877 by oral hypoglycemic agents, and 518 by diet only. The mean age among insulin-treated patients was 45.1 years and 53.5 years among the oral hypoglycemic agent- and diet-treated patients. The first control

group consisted of 62,876 individuals aged 0–90 years who had individual leisure-time insurance in the company and the second of 13,564 bank employees aged 20–70 years.

During the 3-year period, 24 notifications of claims were received. Eight of these were excluded for the following reasons: accident occurring before 1 June 1991 or after 31 May 1994 ( $n = 2$ ), medical disease without accident ( $n = 5$ ), or dental accident not covered by the insurance ( $n = 1$ ). Thus, during the 3-year period, the total number of notified accidents was 16. Table 3 shows age, type of treatment, mechanism of accident, type of injury, and degree of permanent injury (expressed as a percentage) for each case. As seen in the table, two cases were closed without evaluation of degree of permanent injury. These two individuals sent only the primary notification of a claim, but never responded to further correspondence from the company. The two cases are however included as accidents in the total number of reported cases. Table 4 shows the number of accidents per year in the diabetic group and in the two nondiabetic control groups. The average number of accidents in the diabetic group was 0.7 per 1,000 person-years, compared with 4.5

Table 2—Basic characteristics of the diabetic study group and nondiabetic control groups

	Diabetic group	Nondiabetic	
		Control group 1	Control group 2
<i>n</i>	7,599	62,876	13,564
Age (years)	43.6 (3–93)	38.1 (0–90)	(20–70)
Sex (% males)	55	52	—
Treatment			
Insulin	6,204 (82)	—	—
Oral hypoglycemic agents	877 (11)	—	—
Diet only	518 (7)	—	—

Data are *n* (%) or means (range).

Table 3—Characteristics of the 16 accidents in the diabetic group

Case no.	Sex	Age	Treatment	Mechanism	Type of injury	Percentage disability
1	M	31	INS	Metal splinter in eye	Blind in one eye	20
2	M	40	INS	Football	Knee, torn ligament	8
3	M	53	INS	Circular saw	Amputation of three fingers	50
4	M	56	INS	Fall on street	Colles fracture	5
5	M	61	INS	Fall from roof	Multiple spine fractures	20
6	F	23	INS	Fall when dancing	Fracture 5th metatarsi	Unknown*
7	F	32	INS	Skiing	Knee, torn ligament	10
8	F	34	INS	Fall from wheelchair	Contusion of amputation-end	0
9	F	46	INS	Fall in home	Hip fracture	5
10	F	47	INS	Fall on street	Colles fracture with dystrophy	20
11	F	56	INS	Fall in home	Colles fracture	Unknown*
12	F	62	INS	Fall on street	Hip, Colles, and ankle fractures	5
13	M	53	OHA	Car hit his wheelchair	Multiple traumata	50
14	M	59	OHA	Fall in home	Rotator cuff lesion	8
15	F	50	OHA	Car accident	Whiplash lesion	25
16	F	52	OHA	Fall on street	Rotator cuff lesion	8

INS, insulin-treated; OHA, oral antidiabetic agents. \*Case closed without final medical report because the insured person did not answer correspondence from the company.

and 5.5 per 1,000 patient-years in the two nondiabetic groups ( $P < 0.001$ ).

Based on the data from control group 1, a total of 102 accidents were expected, while 16 were observed ( $P < 0.0001$ ).

As seen in Table 3, the degree of permanent injury (expressed as a percentage) ranged from 0 to 50% (0–10%, six cases; 11–25%, six cases; >25%, two cases; closed without evaluation, two cases). This distribution does not differ from what would be expected from the nondiabetic population.

**CONCLUSIONS** — In 1986, the European office of the International Diabetes Federation conducted a survey of social rights of diabetic patients in Europe (1). It showed that in most countries, a diabetic individual will have to pay increased accident insurance premiums and also accept various limitations in coverage, but with great variation

in insurance terms (and premiums) between countries. This suggests that insurance premiums and conditions have been based on assumptions rather than scientific evidence from actuarial studies. The fact that diabetic patients have an increased mortality and a risk of developing late diabetic complications (neuropathy, retinopathy, macroangiopathy, etc.) (6) has led to the assumption that the diabetic individual has an increased risk of experiencing an accident and that the degree of permanent injury after an accident may be higher in a diabetic than in a nondiabetic individual.

In the present study, we followed almost 7,600 diabetic individuals for 3 years (predominantly patients with IDDM). They were all members of the Danish Diabetes Association. In 1991, the Danish Diabetes Association had ~31,000 members, of whom 5,000 were supporting members (relatives, health professionals, etc.). Among the

remaining 26,000, ~50% were 18–60 years of age (FK. Johansen, Director, Danish Diabetes Association, personal communication; see Table 1). Thus, 57% of all the members of the association, aged 18–60 years, participated in the study. The remaining 43% of the members did not give written consent for participation and could not therefore be included in the study because of the restrictions set by the Ethical Committee. Based on recent Danish data on the prevalence of IDDM in Denmark, it can be estimated that the number of IDDM patients in Denmark aged 18–60 years is 13,000–14,000 (7). The present study includes 5,700 insulin-treated patients aged 18–60 years, and the majority of these are assumed to have IDDM, while a minority would have insulin-treated noninsulin-dependent diabetes. Thus, our sample of insulin-treated diabetic patients comprises 40–45% of all Danish IDDM patients in this age range.

Table 4—Accidents per year in the diabetic group and the nondiabetic control groups

	Diabetic group			Control group 1			Control group 2		
	Number of insured	Number of accidents	Accidents per 1,000 years	Number of insured	Number of accidents	Accidents per 1,000 years	Number of insured	Number of accidents	Accidents per 1,000 years
Year 1*	7,599	3	0.39	62,876	250	4.0	14,960	56	3.74
Year 2	7,542	10	1.33	62,876	307	4.9	13,422	78	5.81
Year 3	7,465	3	0.40	62,876	283	4.5	12,309	90	7.31
Total 1–3	22,606	16	—	188,628	840	—	40,691	224	—
Average	7,535	5.33	0.71	62,876	280	4.5	13,564	75	5.50

\*Year 1 in diabetic group, 1 July 1992 to 30 June 1993; in nondiabetic groups, 1 January to 31 December 1992. Diabetic group vs. control groups 1 and 2,  $P < 0.0001$ .

As stated above, all the members of the Danish Diabetes Association were covered by the insurance. To participate in the present study, the individual had to give written informed consent. To make sure that the members realized that they had an insurance covering accidents, the Danish Diabetes Association had regular notifications in the journal *Diabetesbladet* sent to all members of the association. This included an annual message from the association, one short paper by the authors of the present study, and two editorials during the 3-year period. Thus, all the members of the association were aware that they had insurance.

The study is based on members of the Danish Diabetes Association, and it is likely that there is some degree of selection bias, since members actively chose to be members and pay for membership. However, we do not have data on the sociodemographic variables from individuals with diabetes who are not members of the association. Thus, it is difficult to evaluate the type and degree of selection bias. With >40% of the target group included in the study, we find it unlikely that there should be selection bias at a level that would change the final conclusion of our paper.

In our study, we compared the risk of accidents in a group of diabetic patients with the risk among individuals with individual leisure-time insurance and with a group having a collective full-time accident insurance. The ideal control group would have been another collective leisure-time insurance, but apart from highly selected groups of professional soldiers no other collective insurance covered leisure time only. The potential bias from using individually issued insurance would be that these individuals would be more likely to know that they actually had an insurance, but as discussed above, all the members of the Danish Diabetes Association were informed about the insurance on a regular basis. Thus, we believe that no major bias was introduced by our choice of control group. Another problem with the control groups was that we had very limited information on the patients' personal characteristics,

since the insurance company had either not collected the information or had not stored the data in a computerized form. Thus, data on smoking habits and alcohol consumption were unobtainable for the control groups, and for one group (the collective insurance), we did not even have access to precise data on age stratification and sex.

The present study is the first study to analyze the risk of accidents (insurance events) and the degree of permanent injury after an accident in a representative group of diabetic patients. The study shows that the risk of accidents was not increased in diabetic patients, and it was even significantly lower than in the control groups. The reason for the latter unexpected finding remains unclear, and one can only speculate on potential explanations.

The distribution of the degree of disability or permanent injury (Table 3) after an accident did not differ between the diabetic and the control groups. The number of cases in our group was too low to enable an analysis of degree of disability related to the specific type of injury, but the overall risk disability after an injury was not increased in our cases.

The most frequent mechanism of injury was fall (10 cases) and, with the remaining six cases, evenly distributed between leisure activity, sport, and traffic accidents. Hypoglycemia was not notified as a direct or contributory cause of accidents in any of the cases, and in both of the traffic accidents, the diabetic individual was not at fault. With the limited number of accidents, any detailed analysis of the mechanism of injury was impossible, but no major difference from the distribution of accidents in the general population seemed to occur (8).

In conclusion, we have shown through a study of a representative sample of diabetic individuals aged 3–93 years covering more than 22,000 person-years that the risk of accidents is at least not increased in diabetic individuals. There are serious methodological problems associated with this type of analysis due to selection bias in the diabetic population, potential underreporting, and the fact that insurance com-

panies have very limited data on their policy holders, making analysis of the effects of potential differences in the distribution of confounding variables impossible. We do not, however, see any other alternative unbiased design for a study with this aim. Based on our findings, we find no support in this or previously published studies for the continuation of the practice of increased insurance premiums and limited coverage for individuals with diabetes.

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