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Incidence of blindness in southern Germany between 1990 and 1998

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Abstract

Aims/hypothesis. A reduction of diabetes-related blindness by at least one third was declared a primary objective for Europe in 1989 (St. Vincent Declaration). To ascertain a potential change of incidence rates, we collected data on blindness in a German district (population: about 5 million) over 9 years.
Methods. We obtained complete lists of newly registered blindness-allowance recipients between 1990 and 1998 and population data on Württemberg-Hohenzollern, Germany. We estimated incidence rates of blindness in the general population and the diabetic population. To ascertain any time trend, we applied Poisson regression models.
Results. There were 6371 newly registered blindness allowance recipients (1990–1998). Of these 67 % were women and 27 % had diabetes. Mean age was 71.7 years. Standardised results in the diabetic population (incidence rates per 100 000 person-years; standard: diabetic population; 95 % CI): 1990: 72 (61;82); 1991: 88 (76;100); 1992: 77 (67;88); 1993: 82 (71;93); 1994: 62 (53;72); 1995: 82 (71;93); 1996: 70 (60;80); 1997: 69 (59;79); 1998: 59 (49;68). The Poisson model estimated a 3 % decrease of incident blindness in the diabetic population for each year (Relative risk per year 0.97; CI: 0.95; 0.99). No significant change could be observed in the non-diabetic population (Relative risk: 0.99; CI: 0.98; 1.00). Relative risks for each year varied between sub-groups according to sex, diabetic status and cause of blindness between 0.94 and 1.01.
Conclusion/interpretation. A slight reduction of incident blindness could be shown but a reduction by one third has not been reached. Several possible sources of bias in the data have to be considered. [Diabetologia (2001) 44: 147–150]

Keywords Blindness, complications, epidemiology, incidence rate, relative risk, time trend.

A reduction of diabetes-related blindness by at least one third within five years was declared a primary objective for Europe by the World Health Organization (WHO) in 1989 (St. Vincent Declaration) [1]. Following this declaration, a number of initiatives were launched in Germany aiming at the intended reduction of incident blindness [2]. Associations of ophthalmologists and diabetologists founded an action committee and drew up guidelines for the secondary prevention of diabetic retinopathy. Standardised forms for data collection and quality control in diabetic retinopathy were introduced and postgraduate courses for general practitioners were organised.

A few years ago, we published baseline data on the incidence rates of blindness in a large district of southern Germany between 1990 and 1993, based on a nearly complete register of blindness allowance recipients [3]. We continued to collect data until 1998. Our present study aims to ascertain changes in incidence rates of blindness between 1990 and 1998 and to evaluate whether the objective of reducing diabetes-related blindness by at least one third in the population within five years has been achieved.

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Abbreviations: 95 %-CI, 95 % Confidence interval.

To date, only a study from Sweden has reported a substantial reduction in diabetes-related blindness. These results have, however, been questioned because of a potential referral bias [4]. The incidence of blindness did not change in Italy and in Massachusetts (USA) [5, 6]. No data are available in Germany on changes in incidence rates of blindness since the date of the St. Vincent Declaration.

Subjects and methods

A list was made of all subjects newly registered as blind (blindness-allowance recipients with visual acuity of 1/50 or less based on the best corrected value on the better eye or similar reduction of vision) with the welfare administration between 1 January 1990 and 31 December 1998 in Württemberg-Hohenzollern, Germany (population about 5 million). A detailed description of the data base and the methods used, as well as an in-depth analysis of incidence rates, relative risks and attributable risks and the life-span of subjects registered as blind between 1990 and 1993 has been previously published [3, 7]. An expert and written medical and ophthalmological judgement was the basis for a decision. We reviewed the charts of each subject.

In our previous study, the data on all those subjects registered as blind between 1990 and 1993 were combined for the analysis. The exact date of registration as blind was not important [3]. In our present study, however, delayed registrations of blindness could lead to bias by giving the impression of a trend towards decreasing incidence rates. To avoid such a bias, the date of registration of blindness was defined more precisely as the date when the official at the welfare administration office responsible signed the relevant form, stating that the applicant met the criteria of blindness. All files were reviewed and, if necessary, corrected. Some files were missing from the first review of the charts (1994) and in some cases the year of registration was corrected. As a result, the total number of subjects between 1990 and 1993 shown here is slightly higher than the previous publication.

Population data were obtained from the state's Statistical Office. The number of subjects with diabetes in each stratum was estimated by multiplying the population of the study area in the stratum by the age and sex-specific prevalence of diabetes in East Berlin obtained from the former East German diabetes registry which is the only age-specific and reliable data available on the prevalence of diabetes for the German population [3].

Statistical analysis. The following stratum-specific and directly standardised incidence rates were estimated for each calendar year between 1990 and 1998 and expressed per 100 000 person years of observation: incidence rates of blindness in the general population of this area, incidence rates in the non-diabetic population, and incidence rates in the diabetic population [3]. To test for a time trend, we applied a Poisson regression model using time difference from 1990 (years), age (categorised into 8 classes), diabetes and sex as independent variables. In addition, we applied separate Poisson models for diabetic and non-diabetic patients, for men and women, and for diabetes-related and non-diabetes-related causes of blindness among diabetic subjects. All calculations were carried out with the SAS statistical package (version 6.12).

Results

Patient characteristics. During the defined period, 6371 new blindness allowance recipients were registered in the study area. 67.1 % of the subjects were women. Mean age was 71.7 years ± 21.7 (SD). The mean age of women was 75.1 years (SD 19.0, range 0–102), of men 64.7 years (SD 25.0, range 0–102). Of the subjects 27.5 % were known to have diabetes. In 40.5 % of them, diabetes was, most likely, the only cause of blindness, in another 28.2 %, diabetes was considered a contributory cause of blindness. In 29.9 %, blindness was probably not related to their diabetes. The cause of blindness could not be determined in 1.4 % of the diabetic subjects.

Epidemiological measures. The incidence rates of blindness did not substantially differ for all the years combined from the rates published on the years between 1990 and 1993 and are therefore not shown here. When all the years are combined and standardised results (with the general population as the standard) are considered, the risk of incident blindness was 5.2-fold (CI: 4.2; 6.4) in the diabetic compared with the non-diabetic population. Incidence rates were 75.6 (CI: 55.4; 95.7) per 100 000 person-years in diabetic women, and 38.8 (CI: 25.5; 52.1) per 100 000 person-years in men with diabetes. Up to 81 % (CI: 76; 84) of the risk of becoming blind in diabetic subjects, and 13 % (CI: 9; 17) of the risk in the general population was due to diabetes. How incidence rates developed over time can be seen on the graphs shown in Figure 1.

The risk ratios derived from various Poisson models are shown in Table 1. The Poisson model estimated a 3 % decrease each year assuming a linear trend in the diabetic population ($p < 0.01$). Although this trend was statistically significant, it fell substantially short of the intended reduction of incident blindness. In the non-diabetic population, the model showed a minimal, non-significant reduction of the incidence ($p = 0.121$). The model for the general population also yielded a minimal, but statistically significant, trend towards decreasing incidence rates ($p < 0.01$). In an additional model, we included an interaction term "year of registration * diabetes". The year of registration was defined as difference from 1990. This interaction term (0.982; CI: 0.961; 1.003; $p = 0.09$) was not statistically significant. The value for the variable "year of registration" was practically unchanged (0.991) but lost its statistical significance ($p = 0.103$). We conclude that a difference in the decrease of incidence rates between the diabetic and the non-diabetic populations cannot be statistically verified by the Poisson model.

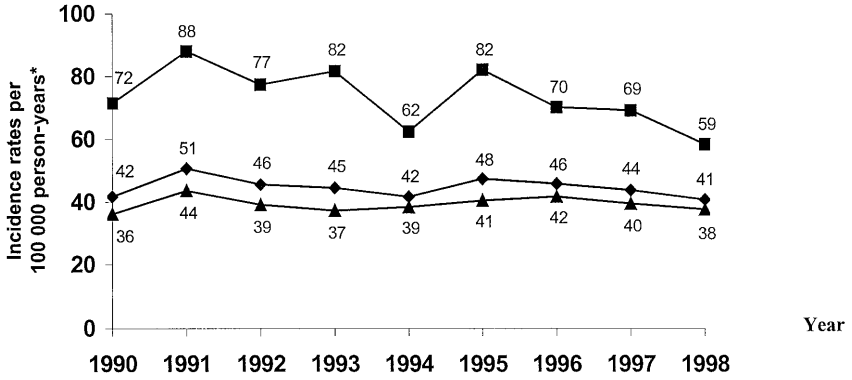

Fig. 1. Standardised incidence rates of blindness in Württemberg-Hohenzollern per 100 000 person-years for the diabetic population (■); the general population (◆) and the non-diabetic population (▲) (Standard: estimated diabetic population)

Table 1. Results of Poisson Models: Relative decrease of incident blindness

Sub-group	Relative Risk per calendar year	95 % Confidence Interval
General population[a,b]	0.99	[0.98; 0.995]
Non-diabetic population[a]	0.99	[0.98; 1.00]
Non-diabetic men	0.98	[0.96; 0.999]
Non-diabetic women	1.00	[0.98; 1.01]
Diabetic population[a]	0.97	[0.95;0.99]
Diabetic men		
All	1.00	[0.97; 1.03]
Diabetes unrelated to blindness	0.96	[0.90; 1.02]
Diabetes only cause of blindness	0.97	[0.92; 1.02]
Diabetes contributory cause of blindness	1.01	[0.97; 1.05]
Diabetic women		
All	0.96	[0.94; 0.98]
Diabetes unrelated to blindness	0.95	[0.91; 0.98]
Diabetes only cause of blindness	0.94	[0.91; 0.97]
Diabetes contributory cause of blindness	0.97	[0.94; 0.99]

All relative risks (RR) are adjusted for age.
[a] Additional adjustment for sex.
[b] Additional adjustment for diabetes.

Discussion

Over the past 9 years, a slight reduction of incident blindness could be shown with some variability between sub-groups according to sex, diabetic status and causes of blindness. The estimated relative risk for each calendar year varied between 0.94 and 1.01. In diabetic subjects, there was a slight tendency towards decreasing incidence rates of blindness. This trend could, however, be found only in women. The variability of the slight decrease in incident blindness between sub-groups could be due to chance or to the differential effects of sex, diabetic status and cause of blindness.

Possible sources of bias might, in part, conceal an existing time trend or suggest a non-existent one. We had to rely on the information from the administrative records. The causes of blindness described are subject to some diagnostic uncertainty. Another possible source of error is the estimation of the diabetic population from the registry of a different area. Due to the lack of regularly updated data on age- and sex-specific prevalence of diabetes, we had to assume that the stratum-specific prevalence of diabetes remained constant between 1988 and 1998. If this prevalence increased over this period of time, an actual reduction of the incidence of blindness in the diabetic population would be masked. Although such an effect is possible, it is not likely that such sources of bias conceal a considerable reduction in the incidence of blindness. Other limitations and possible sources of bias have been discussed in depth in our previous publication [3]. It is possible that more people suffering from incident blindness have applied for the allowance in recent years than in the past. The completeness of registers has been questioned in other countries [8]. We have good reasons to believe, however, that the records we are using have a high degree of completeness due to the substantial financial incentive to register [3, 7]. It is possible too that checks to see whether applicants fulfill the criteria of blindness are done more thoroughly now by ophthalmologists and the administration than some years ago. It is not likely that these forms of bias might be different in diabetic than in non-diabetic subjects. Another factor that might mask an existing time trend or create a non-existent one is a possibly changing time interval between the occurrence of blindness and registration, perhaps because of the process within the administration. By using a more precise definition of the date of registration, we were able to minimise such bias.

A slight reduction in incident blindness is plausible against the background of increased efforts to improve diabetes care over the past decade [2]. Nevertheless, despite a number of activities aiming at more effective prevention of diabetic eye complica-

tions, the goal of a reduction by one third within five years as proclaimed in the St. Vincent Declaration a decade ago, has not been reached. In clinical settings, effective methods for the prevention and treatment of diabetic retinopathy are available, such as structured treatment and teaching programs, good glycaemic control, tight blood pressure control and laser photocoagulation [9, 10]. Our study indicates, however, that these clinical improvements do not translate into clear improvements in the population. It is possible, however, that improved care is already present but that its full preventive effects on the incidence of blindness will only be clear after a greater time lag. This analysis suggests that more effective and more specific, well-designed interventions are needed in the future to reduce the loss of vision.

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