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Social status and the quality of care for adult people with Type I (insulin-dependent) diabetes mellitus – a population-based study

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Summary The objective of this study was to assess the degree of diabetes care and education achieved for Type I (insulin-dependent) diabetes mellitus at the community level in relation to social status and to elucidate potential pathways that mediate any social class gradient. A population-based sample of 684 adults with Type I diabetes (41 % women, mean ± SD age 36 ± 11, diabetes duration 18 ± 11 years) in the district of North-Rhine (9.5 million inhabitants), Germany, were examined in their homes using a mobile ambulance. Results: HbA_{1c} (normal 4.3–6.1 %) 8.0 ± 1.5 %, incidence of severe hypoglycaemia (injection of glucose or glucagon) 0.21 cases per patient-year; 62 % of patients had participated in a structured group treatment and teaching programme for intensification of insulin therapy; 70 % used 3 or more insulin injections per day, 9 % were on continuous subcutaneous insulin infusion; 91 % reported to have had measurements of HbA_{1c} during the preceding year, and 80 % to have had an examination of the retina by an ophthalmologist. Care was insufficient with respect to the quality of blood pressure control (70 % of patients on antihypertensive drugs had blood pressure values ≥ 160/95 mmHg), patient awareness of proteinuria/albuminuria (27 % of patients had not heard about it) and prevention of foot complications (only 42 % with a diabetes duration over 10 years had remembered to have a foot examination during the preceding 12 months). There was a pronounced social gradient with respect to micro- and macrovascular complications (prevalence of overt nephropathy 7 vs 20 % for highest vs lowest quintiles of social class [OR 3.5, 95 % CI 1.6–7.5, $p = 0.002$]) and diabetes-specific quality of life. HbA_{1c}, blood pressure and smoking accounted for part of the association between social class and microvascular complications. The social class gradient was not due to inequality to access to health services, but to lower acceptance among low social class patients of preventive and health maintaining behaviour. In conclusion, achieved standards of care are high with respect to the implementation of intensified treatment regimens, the level of patient education achieved, treatment control and eye care, whereas areas for improvement are blood pressure control and preventive measures for foot care. A substantial social gradient in diabetes care persists despite equal access of patients to health services. [Diabetologia (1998) 41: 1139–1150]

Keywords Type I (insulin-dependent) diabetes, quality of care, diabetes education, late complications, HbA_{1c}, hypoglycaemia, diet, cardiovascular complications, quality of life.

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Abbreviations: DTTP, Diabetes treatment and teaching programme; CSII, continuous subcutaneous insulin infusion; OR, odds ratio; CI, confidence interval; PWTSS, preference-weighted treatment satisfaction score; CAPD, continuous ambulatory peritoneal dialysis.

During recent years substantial changes have taken place in the care of persons with Type I (insulin-dependent) diabetes. The implementation of structured diabetes treatment and teaching programmes (DTTP) for intensification of insulin therapy is regarded as the basis for a reduction of diabetes-related acute and late complications, improvement of diabetes care and saving of health care costs by reductions in hospitalisations and periods of sick leave [1]. However, it has been argued that there might be a selection in favour of motivated and better-educated patients to participate in such programmes and that lower social class patients are less likely to profit from these modern treatment facilities.

It is well known that the social class factor is an important predictor of morbidity and mortality in the general population, even in highly industrialised countries [2], although controversy persists about how much of this social class gradient can be explained by known cardiovascular risk factors [3, 4].

In tertiary care centre based or small case-control studies of Type I diabetes, lower social class has been found to be associated with a higher rate of treatment complications and to be an independent predictor of mortality [5–7].

There have been no population-based comprehensive assessments of the quality of care of representative groups of patients with Type I diabetes including socioeconomic and quality of life aspects.

The aim of this population-based study was to assess the degree of diabetes care and education achieved at the community level in the district of North-Rhine, Germany. Social status of the patients was particularly considered and elucidation of potential pathways that may mediate any relation between social status and quality of care.

Subjects, materials and methods

Study hypotheses. The study was based upon the following hypotheses: lower social class is associated with: 1) Higher rates of diabetic late complications (nephropathy, retinopathy). 2) Lower degrees of control of risk factors for diabetic late complications (HbA_{1c}, blood pressure, smoking). 3) Less intensive disease management by health care providers as reflected by fewer diabetes-related diagnostic tests (HbA_{1c}, blood pressure, neurologic foot examination), less prescription or recommendation of modern treatment regimens (multiple daily insulin injections, continuous subcutaneous insulin infusion (CSII)), less provision of modern facilities for disease management (insulin injection pen devices, glucose meters), and less referral by health care providers to specialised institutions for diabetes care (inpatient DTTP, diabetes outpatient clinic, ophthalmologist). 4) Lower degree of disease related knowledge (on HbA_{1c}, acetonuria testing, proteinuria/albuminuria testing), disease/symptom awareness (of having retinopathy, nephropathy, neurologic foot complications), motivation (treatment goals), appropriate disease management behaviour (blood glucose self-monitoring, adaptation of insulin dosages, participation in a DTTP, consultation of a diabetologist), and health promoting behaviour (not smoking). 5) Lower treatment satisfaction, and diabetes-specific quality of life.

Social status classification. Classification of social status was based upon instruments used in previous health surveys in Germany [8, 9]. The social class score was an additive variable of the highest educational level achieved (scores 0–8), the present or last employment level (scores 0–8) and household income (scores 0–8) resulting in a score ranging from 0 to 24, higher scores indicating higher levels of social class. Nett income per household was adjusted for number and age of household members in order to calculate the so-called equivalent income per subject [8]. The mean equivalent income of the total patient group was DM 1780 which is comparable to the equivalent income of DM 1720 for the West German population as calculated for the year 1992 [10]. For descriptive purposes quintiles of the total score were used to divide the patient group into five levels of social class (level I corresponding to the highest and level V to the lowest social class).

Recruitment of physicians and patients. Detailed descriptions of the protocol of this population-based study including selection criteria of physicians and patients, participation, and description of drop outs have been published [11]. Between November 1994 and July 1996 patients were recruited from a random sample of 630 family physician practices using computer lists of the physicians' chamber of North-Rhine, where all physicians are registered. This corresponds to approximately 10 % of all primary health care physicians of North-Rhine. Due to the German health care system patients are not registered with a primary health care physician. It has been estimated that on average each family physician takes care of one to two adults with Type I diabetes. Physicians were asked to obtain written consent to be sent the study protocol and to be contacted by the research team of the Düsseldorf University from each patient fulfilling the inclusion criteria. Physicians were reimbursed for reporting the number of patients fulfilling the inclusion criteria and for each written consent form. Inclusion criteria for patients were: age 18 years and above, initiation of insulin therapy before age 31 years, at least one visit to the respective practice during the preceding 12 months; non-German citizens, mentally disabled and nursing home patients were to be included. In order to ascertain complete registration of all available patients physicians and their paramedical assistants were additionally contacted by phone. A total of 2830 phone calls by I. M. with the practices were documented. Physicians of 30 (5 %) practices refused to participate. At the end of recruitment 56 (9 %) practices had not yet sent written consent forms from their patients; 173 (27 %) practices did not take care of Type I diabetic patients fulfilling the inclusion criteria at the time of the study. The remaining 371 practices reported the care for 932 patients fulfilling the inclusion criteria. Of these patients 58 (6 %) did not give their written consent, from a further 119 (13 %) patients the written consent was not yet available at the end of the study. Of the remaining 755 patients 684 (91 %) participated in the study, whereas 58 (8 %) had declined to participate after having received the study protocol, 7 had moved outside the study area and 6 could not be contacted until the end of the study. The study protocol was approved by the ethics committee of Düsseldorf University.

Evaluation protocol. The examinations were performed in a mobile ambulance as described previously [12] by two principal investigators (I. M. and H. O.) and, on occasion, by other trained investigators (see acknowledgements). The ambulance was converted to allow the mounting of a non-mydriatic CR4–45NM eye camera (Canon Europe, Amstelveen, The Netherlands), and a small laboratory including a Reflotron Reflectance Photometer (Boehringer Mannheim, Mannheim, Germany). Imobile patients were examined in their homes.

The examination protocol used an extended and adapted version of evaluation protocols used in previous studies and included all items of the St. Vincent Declaration data collection form [12–15]. Evaluation forms are available on request from the authors. The examination took about 90 to 120 min for each patient and comprised a structured interview, self-administered questionnaires, physical examination, fundus photography, and laboratory tests. The interview included questions assessing participant characteristics, such as sociodemographic and health status information, along with information on diabetes care and self-management across multiple areas, and questions assessing potential social, behavioural, and health care provider related correlates of self-management.

A venous blood sample and a freshly voided urine sample were taken from each patient and transported on ice to the laboratory of Düsseldorf University Hospital. HbA_{1c} was measured by the Diamat HPLC-method (reference range 4.3–6.1 %). Random C-peptide levels were measured using a human C-peptide assay (Behring, Marburg, Germany). A value of less than 0.1 nmol/l was considered negative. Protein concentration in the urine was measured by the laser turbidimetric method [16]. Body weight was assessed with the patients wearing street clothes and without shoes. Sitting blood pressure was measured twice using a mercury sphygmomanometer according to World Health Organisation (WHO) recommendations including the use of a large cuff for patients with increased upper arm circumferences, and the second blood pressure measurement was used for analysis. Smoking history was assessed as described previously [15]. Cigarette pack years were calculated for each patient, and one cigarette pack-year was equivalent to smoking 20 cigarettes per day for one year. Examination of the feet included palpation of pulses and screening for sensation loss using the Rydel-Seiffer-Tuning Fork as described by Liniger et al. [17]. In the case of a foot lesion or an ulcer, a photograph was taken for documentation. Patients were grouped according to (neuropathic) foot complications: level 1: vibration sensation score at the first metatarsal $> 4/8$ bilaterally, no ulcer, no amputation; level 2: vibration sensation score $\leq 4/8$, no ulcer, no amputation; level 3: acute or healed ulcer or amputation. In addition, patients were grouped according to renal parameters: level 1: proteinuria ≤ 50 mg/l and serum creatinine ≤ 133 µmol/l; level 2: proteinuria 51–499 mg/l and serum creatinine ≤ 133 µmol/l; level 3: proteinuria ≥ 500 mg/l and serum creatinine ≤ 133 µmol/l; level 4: serum creatinine > 133 µmol/l; level 5: renal replacement therapy.

Non-mydriatic photography was performed in the mobile ambulance. In all subjects a macula-centred photograph was obtained of one eye. If there was any hint of retinopathy on this first photograph, a picture of the other retina was taken as well. In cases where the pupils did not sufficiently dilate, whenever possible, pharmacological mydriasis was induced with 1 % tropicamide eye drops. All photographs were examined by two independent experts in Düsseldorf. In addition, patients were given a Diabetic Retinopathy Examination Chart [18] and asked to consult their board certified ophthalmologists and to send back one copy of the filled-in examination chart to the Düsseldorf Study Center. All available eye examination results were used in order to rate the degree of retinopathy for each patient. In case the degree of retinopathy differed between both eyes, and in case the findings differed between methods, the higher degree of retinopathy was used. Best visual acuity was assessed in the ambulance using the visual acuity charts of Ferris et al. [19]. Patients were grouped according to the degree of retinopathy: level 1: no retinopathy; level 2: non-proliferative retinopathy without macular involvement, no history of laser therapy; level 3: pre-proliferative and proliferative retinopathy, macula involvement, macula oedema, history of laser therapy, advanced diabetic eye disease; level 4: blindness of one or both eyes due to diabetes (defined as legal blindness or best visual acuity ≤ 0.1).

Self-administered instruments were used in order to assess diabetes-specific quality of life including preference-weighted treatment satisfaction. A detailed description of these tests including validation procedures is published elsewhere [20]. After factor analysis, the diabetes-specific quality of life scale comprised 59 items which were rated by the patients on a 6-point Likert scale: 1. Treatment goals (10 items); 2. Treatment satisfaction according to treatment goals (10 items); 3. Social relations (11 items): "Diabetes again and again leads me to problems with other people." "Because of my diabetes it is much harder to make friends." 4. Leisure time flexibility (6 items): "Diabetes prevents me from spontaneous physical activities." "Because of my disease I can't spend my leisure the way I would like to." 5. Physical complaints (8 items): "I feel dull or sluggish." "Because of diabetes I often have physical troubles." 6. Worries about the future (5 items): "I am often worried about diabetic late complications." "I often ponder over diabetes and its consequences." 7. Diet restrictions (5 items): "It bothers me that I can't eat like other people." "I have to give up tasty food." 8. Daily hassles (4 items): "It bothers me that I have to spend so much time on my diabetes treatment." "It bothers me that I have to take my medical instruments (e.g. syringes) with me, whatever I do." To estimate a preference-weighted treatment satisfaction score (PWTSS), patients' rating for each treatment goal (1 = totally unimportant; 6 = very important) was multiplied by the corresponding degree of satisfaction with the achievment in these treatment goals (–2.5 = totally dissatisfied; 2.5 = very satisfied). The sum of all 10 products provided the PWTSS [20]. Cronbach's alpha for all subscales ranged between 0.70 and 0.88.

Statistical analyses. For comparison of means analysis of variance and for comparison of proportions Fisher's exact test was used. For calculation of 95 % confidence intervals for odds ratios based upon simple 2×2 tables the Mantel-Haenszel method was used. In order to investigate the effect of social status on various response variables with adjustment for age and diabetes duration a number of multiple regression models were calculated. We applied linear regression for continuous response, logistic regression for binary response and the proportional odds model for ordinal response. If the assumption of proportional odds was violated the ordinal response was dichotomized and binary logistic regression was applied. Social status, age and diabetes duration were used as continuous covariates. To adjust for age and diabetes duration the linear and quadratic terms were considered. Hence, all models contained the covariate social status together with the appropriate linear and quadratic terms of age and diabetes duration. For the responses retinopathy and nephropathy the additional covariates HbA_{1c}, blood pressure and cigarette pack years were considered. The validity of the regression models was checked by scatter plots, residual plots, the Hosmer-Lemeshow goodness-of-fit test and the score test for the proportional odds assumption. To assess the effect size of social status adjusted odds ratios based upon logistic regression were calculated for a difference of 5 units (corresponds to approximately 1 social class level). All hypotheses tests were two-tailed. A p-value below 0.05 was regarded as significant. Due to the hypotheses-generating character of the study no adjustments for multiple hypotheses testing were performed. For computations the statistics packages SPSS and SAS were used.

Results

Mean age of the total group was 36 (range 18 to 77) years and mean diabetes duration was 18 (0.3 to 55) years with some differences across social status

Table 1. Patient characteristics and metabolic control in relation to social status

Social status	*n*	Gender (% women)	Age (years)	Diabetes duration (years)	Body mass index ($kg \cdot m^{-2}$)	C-peptide negative (% patients)	HbA_{1c} (%)	Ketoacidosis[a] since diabetes manifestation/during preceding year (% patients)	Mild hypoglycaemia[a] during preceding week (% patients)	Severe hypoglycaemia[a] since diabetes manifestation/during preceding year (% patients)	Carrying emergency carbohydrates[a] (% patients)
I	131	42	36 ± 10	19 ± 11	24.3 ± 2.8	91 (*n* = 125)	7.6 ± 1.2	14/0	72	46/13	87
II	141	41	33 ± 8	15 ± 9	24.2 ± 2.7	89 (*n* = 136)	7.9 ± 1.3	13/2	70	46/13	84
III	136	40	36 ± 10	18 ± 11	25.0 ± 4.0	89 (*n* = 134)	8.0 ± 1.5	31/2	68	50/13	89
IV	146	36	38 ± 12	19 ± 12	24.8 ± 3.6	86 (*n* = 146)	8.2 ± 1.6	23/3	54	45/12	83
V	130	48	39 ± 12	20 ± 12	24.9 ± 3.7	80 (*n* = 127)	8.4 ± 1.7	31/5	62	51/12	83
All	684	41	36 ± 11	18 ± 11	24.6 ± 3.4	87 (*n* = 668)	8.0 ± 1.5	22/2	65	48/13	85

Social status I = highest, V = lowest
Values are means ± SD or percent of patients
[a] for definiton see Results

Table 2. Insulin therapy and dietary habits in relation to social status

Social status	*n*	Injections per day < 3/ ≥ 3/CSII (% patients)	Previously recommended by a physician to inject more often[a] (% patients)	Using a pen device[b] (% patients)	Insulin dose adaptation according to blood glucose values (% patients)	Insulin dose adaptation according to carbohydrate intake (% patients)	Following a meal plan (% patients)	Skipping main meals at least once per week (% patients)	Consuming sugar never/several times per week or daily (% patients)	Alcohol consumption (g/week)
I	131	11/74/15	64 (*n* = 14)	73 (*n* = 111)	86	77	18	41	21/47	57 ± 71
II	141	15/79/6	42 (*n* = 21)	76 (*n* = 132)	84	72	23	42	10/50	55 ± 92
III	136	19/68/13	46 (*n* = 26)	71 (*n* = 119)	82	65	28	33	9/37	52 ± 105
IV	146	21/72/8	53 (*n* = 30)	70 (*n* = 135)	75	53	36	24	23/37	39 ± 76
V	130	39/56/5	47 (*n* = 51)	70 (*n* = 124)	63	41	44	24	28/31	23 ± 47
All	684	21/70/9	49 (*n* = 142)	72 (*n* = 621)	78	62	30	33	18/40	45 ± 82

Social status I = highest, V = lowest
Values are means ± SD or percent of patients
[a] for patients who use < 3 injections/day
[b] for patients not using CSII

($p < 0.001$ and $p = 0.0075$, respectively, analysis of variance, Table 1). There were no significant associations between social status and gender and body mass index (Table 1). Of 668 patients with measurements of C-peptide 581 (87 %) were C-peptide negative (Table 1).

Metabolic control (Table 1). Mean HbA_{1c} for the total patient group was 8.0 % (range 4.5 to 12.8 %); 9 % of the patients had an HbA_{1c} value ≤ 6.1 %, 39 % ≤ 7.5 % and 22 % > 9 %. Lower social status was associated with higher HbA_{1c} values ($p < 0.0001$). Accordingly, there was a tendency of more patients from higher social class reporting at least one mild hypoglycaemic reaction during the preceding week. A total of 325 (48 %) patients had a history of severe hypoglycaemia necessitating treatment with glucose i. v. or glucagon injection. For the preceding 12 months 86 (13 %) patients reported a total of 141 events of severe hypoglycaemia (incidence 0.21 cases per patient-year). A post-diabetes-manifestation life-time history of ketoacidosis (emergency treatment in hospital) was reported by 22 % of the patients, 16 (2 %) patients reported a total of 21 cases of ketoacidosis for the preceding 12 months (incidence 0.03 cases per patient-year). There was a clear trend of more lower social class patients experiencing ketoacidosis.

Insulin therapy (Table 2). Mean insulin dosage for all 684 patients was 0.65 ± 0.22 $IU \cdot kg^{-1} \cdot day^{-1}$; 70 % used 3 or more insulin injections per day, 9 % used CSII, 49 % injected insulin 4 to 5 times per day, and 9 % injected even more often; 570 patients (83 %) used regular insulin. There was a strong association between social class and the number of daily insulin injections and the use of CSII ($p < 0.0001$, OR 1.62, CI 1.38–1.9). Patients who used less than 3 injections per day were asked whether they had been recommended by a physician to inject insulin more often; 49 % answered "yes", and there was no respective association with social status. In addition, there was no relationship between the usage of a pen device and social status.

Table 3. Metabolic monitoring in relation to social status

Social status	n	Blood glucose measurements per day 0/ < 1/ 1–2/ ≥ 3 (%)	Owning a blood glucose meter (%)	Accurate blood glucose measurements[a] (%)	Aware of materials for measuring acetonuria (%)	Aware of HbA_1/HbA_{1c} measurements[a] (%)	Knowing last HbA_1/HbA_{1c} value[b] (%)	Aware of upper normal HbA_1/HbA_{1c} reference value[b] (%)
I	131	1/8/16/76	87	87 (n = 105)	98	100	89 (n = 131)	75 (n = 131)
II	141	2/10/16/72	87	84 (n = 109)	96	99	85 (n = 140)	65 (n = 140)
III	136	2/15/18/65	88	84 (n = 108)	93	98	90 (n = 132)	64 (n = 132)
IV	146	4/10/16/69	91	87 (n = 119)	90	93	81 (n = 136)	54 (n = 135)
V	130	9/17/19/55	85	87 (n = 97)	82	86	66 (n = 113)	38 (n = 113)
All	684	4/12/17/68	88	86 (n = 538)	92	95	83 (n = 652)	60 (n = 651)

Social status I = highest, V = lowest
[a] for definiton see results section
[b] for patients aware of HbA_1/HbA_{1c} measurements

Metabolic monitoring (Table 3). Lower social class patients reported performing blood glucose measurements less often than high social class patients ($p = 0.0001$, OR = 1.38, CI 1.18–1.61). There was no association between social class and the percentage of patients using a blood glucose meter. The accuracy of blood glucose self-measurements was assessed by comparing the value obtained by the patient using his own method with the laboratory measurement using Reflotron. A difference of less than 20 % between the two results was considered as an acceptable accuracy. There was no association between the percentage of patients with accurate measurements and social status. More high social class patients were aware of methods for self-monitoring of acetonuria. Of the total group 652 (95 %) patients knew about HbA_1/HbA_{1c} measurements, i. e. they could roughly explain what they stand for; 83 % of patients reported to know their last value. High social class patients were better informed about their HbA_1/HbA_{1c} measurements than low social class patients.

Insulin dose adaptation (Table 2). Of the 684 patients 532 (78 %) reported adapting insulin dosages on a day-to-day basis according to blood glucose self-measurements and 420 (62 %) according to varying amounts of carbohydrate intake. More high social class than low social class patients adjusted insulin dosages ($p < 0.0001$, OR = 1.61, CI 1.33–1.94 and $p < 0.0001$, and OR = 1.73, CI 1.46–2.05, respectively).

Nutritional habits (Table 2). Of the total group 30 % reported using a meal plan; fewer high social class patients used a meal plan ($p < 0.0001$, OR 0.69, CI 0.58–0.81); 33 % reported skipping main meals at least once per week; more high social class patients reported skipping main meals; there was a trend of more high social class patients reporting consuming sugar and sugar-containing nutrients on a regular basis; self-reported alcohol consumption for the preceding week was significantly higher among high social class patients.

Diabetes education (Table 4). Of the total patient group 62 % reported that they had participated in a 5–12 day structured inpatient DTTP for groups of up to 10 patients (delivered by a diabetes educator according to a curriculum). Higher social status was associated with a higher percentage of patients who had participated in a DTTP ($p = 0.0013$, OR = 1.29, CI 1.10–1.50). Of the 261 patients who had never participated in a DTTP 34 % reported that they had previously been recommended by a physician to participate in such a DTTP, but there was no association with social class ($p = 0.69$, OR 0.95, CI 0.74–1.23). Of the 261 patients who had not participated in a DTTP 43 % reported having received diabetes education including some kind of training in insulin dose adaptation (e. g. individual counselling, education during a stay in a so-called diabetes rehabilitation hospital). Thus, a total of 535 (78 %) patients received some kind of training in insulin dose adaptation.

Specialized outpatient care (Table 4). Of the 684 patients 50 % reported having consulted a diabetologist on an outpatient basis or had visited a specialized diabetes outpatient clinic at some time and 27 % had done so during the preceding year. Higher social class was associated with a higher percentage of patients who had consulted a specialized diabetes outpatient clinic at some time ($p < 0.0001$, OR = 1.36, CI 1.17–1.56). Of the patients who had never consulted a diabetologist 28 % reported that they had previously been recommended by a physician to do so, but there was no association with social status ($p = 0.83$, OR 1.03, CI 0.81–1.29).

Family physician contacts (Table 4). 583 patients were asked about the number of consultations in their family physician's office during the preceding year. Patients of higher social class reported fewer consultations than patients of lower social class ($p = 0.0039$, OR 0.80, CI 0.69–0.93).

Table 4. Specialized diabetes care, family physician contacts, and membership of patient associations in relation to social status

Social status	n	Participation in a DTTP (% patients)	Previously recommended by a physician to participate in a DTTP[a] (% patients)	Education about insulin dose adaptation outside a DTTP[a] (% patients)	Visit in a diabetes out-patient clinic (% patients)	Previously recommended by a physician to visit a diabetes out-patient clinic[b] (% patients)	Family physician contacts during preceding year < 5/5–8/ > 8 (% patients)	Member of patient association (% patients)
I	131	69	34 (n = 41)	54 (n = 41)	63	29 (n = 49)	28/23/48 (n = 124)	31
II	141	72	41 (n = 39)	51 (n = 39)	54	26 (n = 65)	20/23/57 (n = 114)	16
III	136	58	32 (n = 57)	49 (n = 57)	47	29 (n = 72)	15/27/58 (n = 110)	19
IV	146	57	30 (n = 63)	38 (n = 63)	47	32 (n = 78)	18/24/58 (n = 126)	15
V	130	52	34 (n = 61)	31 (n = 61)	38	23 (n = 81)	16/18/66 (n = 109)	11
All	684	62	34 (n = 261)	43 (n = 261)	50	28 (n = 345)	20/23/57 (n = 583)	18

Social status I = highest, V = lowest
[a] for patients who had never participated in a DTTP
[b] for patients who had never visited a diabetes out-patient clinic

Table 5. Blood pressure and smoking in relation to social status

Social status	n	Blood pressure measurements by the family physician during preceding year 0/1–4/ > 4 (% patients)	Aware of hypertension for all patients/for patients with hypertension[a] (% patients)	Drug treatment for hypertension (% patients)	Blood pressure systolic/ diastolic (mm Hg)	Blood pressure control level 1/2/3[b] (% patients)	Blood pressure self monitoring (% patients)	Non-smokers/ex-smokers/smokers (% patients)	Cigarette pack years
I	131	18/64/18 (n = 131)	18/47 (n = 49)	16	136/76 ± 17/10	62/27/11	34	55/19/26	6 ± 10
II	141	24/56/20 (n = 140)	15/53 (n = 40)	11	133/74 ± 19/12	72/18/10	26	42/13/45	8 ± 11
III	136	18/47/35 (n = 135)	24/52 (n = 56)	18	137/77 ± 21/11	64/21/15	30	35/23/43	11 ± 15
IV	146	21/49/31 (n = 146)	23/48 (n = 67)	19	139/75 ± 21/12	54/26/20	34	38/15/47	11 ± 13
V	130	16/38/47 (n = 129)	28/60 (n = 58)	22	139/77 ± 26/12	56/19/25	24	32/20/48	14 ± 19
All	684	19/51/30 (n = 681)	21/52 (n = 270)	17	137/76 ± 21/11	62/22/16	30	40/18/42	10 ± 14

Social status I = highest, V = lowest
Values are means ± SD or percent of patients
[a] systolic ≥ 140 or diastolic ≥ 90 mm Hg or drug treatment for hypertension
[b] level 1 = systolic < 140 and diastolic < 90, level 2 = ≥ 140 < 160 or ≥ 90 < 95, level 3 = ≥ 160 or ≥ 95 mm Hg

Member of self help group or diabetes association (Table 4). Fewer patients of low social class were members of self-help groups or a diabetic patient association.

Blood pressure (Table 5). Of the 684 patients 147 (21 %) reported having hypertension, and 202 (30 %) reported measuring blood pressure themselves at least sometimes; of the 147 patients with known hypertension 96 (65 %) performed blood pressure self monitoring; 81 % of all patients reported having had at least one blood pressure measurement in the family physician's office during the preceding 12 months; 118 (17 %) of patients reported taking antihypertensive drugs (one patient without known hypertension). There was a tendency towards more patients of the lowest social class undergoing more blood pressure measurements by the family physician and more of them being aware of having hypertension (Table 5). Of the 536 patients without known hypertension 29 (5.4 %) had blood pressure values 160 mmHg or more systolic or 95 mmHg or more diastolic. Of the 147 patients with known hypertension 117 (80 %) were being treated with antihypertensive drugs, and 30 (20 %) of them had normal blood pressure values (< 140/90 mmHg), whereas 82 (56 %) had blood pressure values 160 mmHg or more systolic or 95 mmHg or more diastolic. There were significant differences with respect to blood pressure control across social class levels. Fewer patients of low social class had blood pressure values under 140/90 mmHg and more had uncontrolled blood pressure (≥ 160/95 mmHg) (p = 0.049; OR 0.81, CI 0.66–0.99).

Smoking (Table 5). Of the 282 women 100 (35 %) and of the 402 men 186 (46 %) were smokers. High social class patients were less likely to be smokers (p = 0.0002, OR 0.74, CI 0.64–0.87) and had fewer cigarette pack years (p < 0.001).

Diabetic nephropathy (Table 6). Of the total patient group 14 % knew that they had diabetic renal complications, 69 % were aware that proteinuria/albuminuria had been measured at some time, whereas 27 % were not aware that such diagnostic tests exist. For the group of patients with 'at least microalbuminuria' (combined nephropathy levels 2 to 5, n = 225) there was no significant difference between awareness and

Table 6. Patient awareness of diagnosed complications and performed screening examinations in relation to social status

Social status	n	Aware of nephropathy for all patients/for patients with at least microproteinuria (% patients)	Aware of proteinuria/albuminuria measurements (% patients)	Aware of eye complications for all patients/for patients with any retinopathy (% patients)	Examination of the retina during preceding year (% patients)	Aware of neurologic foot complications (% patients)	Examination of the feet during preceding year (% patients)	Examination with the tuning fork at any time (% patients)
I	131	12/45 (n = 29)	77	38/77 (n = 60)	83	13	41	86 (n = 130)
II	141	10/29 (n = 38)	73	31/70 (n = 54)	77	12	38	81 (n = 139)
III	136	18/43 (n = 44)	68	40/84 (n = 64)	83	20	39	82 (n = 132)
IV	146	12/32 (n = 57)	70	36/65 (n = 72)	76	17	39	76 (n = 143)
V	130	17/28 (n = 57)	57	49/78 (n = 73)	79	26	45	78 (n = 125)
All	684	14/34 (n = 225)	69	39/75 (n = 323)	80	18	40	81 (n = 669)

Social status I = highest, V = lowest

Table 7. Micro- and macrovascular complications, drug therapy, and hospital days in relation to social status

Social status	n	Nephropathy levels 1/2/3/4/5[a] (% patients)	Retinopathy levels 1/2/3/4[a] (% patients)	Foot complications levels 1/2/3[a] (% patients)	Macrovascular complications[b] (% patients)	Drug therapy (except antihypertensive drugs) (% patients)	Hospital days per patient during preceding year
I	131	78/15/5/0/2 (n = 131)	54/25/18/2 (n = 130)	86/8/5 (n = 131)	5	24	2 ± 8
II	141	73/21/4/0/2 (n = 141)	61/27/9/3 (n = 139)	944/1 (n = 141)	1	24	5 ± 12
III	136	67/18/8/3/4 (n = 135)	52/20/22/5 (n = 134)	83/11/6 (n = 136)	4	32	7 ± 18
IV	146	61/25/5/4/4 (n = 146)	50/24/19/7 (n = 143)	84/12/4 (n = 143)	8	42	9 ± 28
V	130	55/24/13/5/2 (n = 128)	42/26/25/6 (n = 126)	63/25/11 (n = 126)	19	47	8 ± 16
All	684	67/21/7/2/3 (n = 681)	52/25/19/5 (n = 672)	83/12/5 (n = 677)	7	34	6 ± 18

Social status I = highest, V = lowest
Values are means ± SD or percent of patients
[a] for definition see methods section
[b] for definition see results section

social status. The distribution of patients with respect to levels of nephropathy is shown in Table 7. Of the 19 patients on renal replacement therapy, 11 were undergoing haemodialysis, 4 continuous ambulatory peritoneal dialysis and 4 had a renal transplant. The proportional odds model could not be used to describe the association between levels of nephropathy and social status. Instead, binary logistic regression analyses were performed. Using the response variable 'at least microproteinuria' (combined levels 2 to 5, $n = 225$) compared with patients with normal proteinuria (level 1, $n = 456$) and using the response variable 'at least macroproteinuria' (combined levels 3 to 5, $n = 83$) compared with combined levels 1 and 2 ($n = 598$) higher social status was associated with a lower risk of nephropathy (Tables 8 and 9). In order to assess to what extent the association between social class and nephropathy could be explained by established risk factors for nephropathy the same logistic regressions were performed, with additionally adjusting for HbA_{1c}, systolic and diastolic blood pressure and smoking status (cigarette pack years). In these models, the association between social status and the response variables was attenuated but still statistically significant (Tables 8 and 9).

Diabetic retinopathy (Table 6). Of the total patient group 264 (39 %) reported having diabetic eye complications. On examination, 8 % of these 264 patients had a normal fundus, whereas 20 % of the 410 patients who reported not being aware of complications had some retinopathy (76 patients level 1, 5 patients level 2). Of the total group, 80 % reported having had an eye examination to screen for diabetic complications during the preceding year; 81 % of these patients reported that the last examination had been performed after dilation of the pupils, an additional 4 % had a photograph of the retina without dilation of the pupils. There was no association between social status and awareness of eye complications. The frequencies of the various levels of retinopathy in the total patient group and across the various levels of social class are shown in Table 7. There was a significantly lower risk of retinopathy for higher social class patients, an association which was, however, no longer statistically significant after adjustment for established risk factors for retinopathy (Table 10).

Foot complications (Tables 6 and 7). Of the total patient group 120 (18 %) reported having diabetic neurologic foot complications, 81 % remembered having had a foot examination with the tuning fork at some time, but 51 % did not remember having had any foot examination to screen for diabetic complications

Table 8. Binary logistic regression for nephropathy (at least microproteinuria)

Variables	Logistic coefficient	Standard error	p-value	Difference for odds ratio	Odds ratio (95 % CI)
Adjustment for age², diabetes duration² (Hosmer and Lemeshow goodness-of-fit $p = 0.378$)					
Intercept 1	– 0.2024	0.0257	0.4312	–	–
Social status[a]	– 0.0661	0.0167	0.0001	1 level	0.719 (0.610–0.846)
Age² (years)	– 0.0003	0.0002	0.0315	–	–
Diabetes duration² (years)	– 0.0015	0.0003	0.0001	–	–
Additional adjustment for HbA_{1c}, blood pressure, smoking (Hosmer and Lemeshow goodness-of-fit $p = 0.10$)					
Intercept 1	– 5.6681	0.8902	0.0001	–	–
Social status[a]	– 0.0474	0.0178	0.0078	1 level	0.789 (0.663–0.939)
Age² (years)	– 0.0007	0.0002	0.0001	–	–
Diabetes duration² (years)	0.0016	0.0003	0.0001	–	–
HbA_{1c} (%)	0.2132	0.0622	0.0006	1 %	1.238 (1.096–1.398)
Systolic blood pressure (mm Hg)	0.0269	0.0050	0.0001	5 mm Hg	1.144 (1.089–1.202)
Cigarette pack years	0.0242	0.0070	0.0005	10 pack years	1.274 (1.112–1.460)

[a] Higher social class levels are associated with a lower risk of nephropathy (at least microproteinuria)

Table 9. Binary logistic regression for nephropathy (at least macroproteinuria)

Variables	Logistic coefficient	Standard error	p-value	Difference for odds ratio	Odds ratio (95 % CI)
Adjustment for age², diabetes duration, diabetes duration² (Hosmer and Lemeshow goodness-of-fit $p = 0.68$)					
Intercept 1	– 5.6231	0.9331	0.0001	–	–
Social status[a]	– 0.0892	0.0254	0.0005	1 level	0.640 (0.499–0.821)
Age² (years)	– 0.0003	0.0002	0.0990	–	–
Diabetes duration (years)	0.3625	0.0682	0.0001	–	–
Diabetes duration² (years)	– 0.0050	0.0013	0.0001	–	–
Additional adjustment for HbA_{1c}, blood pressure, smoking (Hosmer and Lemeshow goodness-of-fit $p = 0.407$)					
Intercept 1	– 15.9398	1.9339	0.0001	–	–
Social status[a]	– 0.0674	0.0286	0.0186	1 level	0.714 (0.539–0.945)
Age² (years)	– 0.0008	0.0002	0.0020	–	–
Diabetes duration (years)	0.3610	0.0751	0.0001	–	–
Diabetes duration² (years)	– 0.0049	0.0014	0.0003	–	–
HbA_{1c} (%)	0.4251	0.1091	0.0001	1 %	1.530 (1.235–1.894)
Systolic blood pressure (mm Hg)	0.0493	0.0074	0.0001	5 mm Hg	1.280 (1.190–1.376)
Cigarette pack years	0.0009	0.0090	0.9207	10 pack years	1.009 (0.845–1.205)

[a] Higher social class levels are associated with a lower risk of nephropathy (at least macroproteinuria)

outside a hospital stay; during the preceding 12 months 40 % underwent a foot examination (42 % of the 511 patients with a diabetes duration of more than 10 years) with a trend of more patients of low social class being aware of diabetic (neurologic) foot complications. There was no association between patients who had an examination of the feet during the preceding year and social status and no relationship between social status and a foot examination using the tuning fork. Foot pulses could not be assessed in 11 patients (amputation, oedema etc.), and were palpable on both sides (dorsalis pedis or tibialis posterior) in 639 (95 %) of the 672 remaining patients. Impaired vibration sensation with a tuning fork score 4/8 or less at the first metatarsal was found in 76 (13 %) of 668 patients bilaterally and in an additional 29 (4 %) unilaterally. A total of 17 patients (5 women) had a total of 27 amputations of the lower extremities (15 below ankle, 9 below knee, 3 above knee). A total of 27 healed ulcers were reported by 23 (3 %) patients, a total of 13 acute ulcers were present in 12 (2 %) patients. A total of 33 (4.8 %) patients had a healed or acute ulcer and 37 (5.4 %) had a healed or acute ulcer or an amputation. Fewer patients of high social status had foot complications ($p = 0.001$, OR 0.69, CI 0.55–0.86).

Macrovascular complications (Table 7). 23 (3.4 %) patients had a history of angina pectoris, 18 (2.6 %) patients had survived a myocardial infarction; coronary bypass surgery or angioplasty was reported by 13 (1.9 %) patients; 11 (1.6 %) patients reported having had a cerebral infarction (ischaemia duration for more than 24 h), claudicatio intermittens was report-

Table 10. Proportional odds model for retinopathy (3 levels[a])

Variables	Logistic coefficient	Standard error	p-value	Difference for odds ratio	Odds ratio (95 % CI)
Adjustment for age, age^2, diabetes duration, diabetes duration^2 (score test for the proportional odds assumption $p = 0.736$)					
Intercept 1	– 8.6635	1.0370	0.0001	–	–
Intercept 2	– 6.9568	1.0127	0.0001	–	–
Social status[b]	– 0.0475	0.0162	0.0034	1 level	0.789 (0.673–0.924)
Age (years)	0.1581	0.0527	0.0027	–	–
Age^2 (years)	– 0.0020	0.0006	0.0020	–	–
Diabetes duration (years)	0.3390	0.0392	0.0001	–	–
Diabetes duration^2 (years)	– 0.0040	0.0080	0.0001	–	–
Additional adjustment for HbA_{1c}, blood pressure, smoking (score test for the proportional odds assumption $p = 0.846$)					
Intercept 1	– 13.4630	1.3967	0.0001	–	–
Intercept 2	– 11.6519	1.3659	0.0001	–	–
Social status[b]	– 0.0295	0.0170	0.0825	1 level	0.863 (0.730–1.019)
Age (years)	0.1359	0.0556	0.0146	–	–
Age^2 (years)	– 0.00185	0.0007	0.0056	–	–
Diabetes duration (years)	0.3467	0.0407	0.0001	–	–
Diabetes duration^2 (years)	– 0.0015	0.0008	0.0001	–	–
HbA_{1c} (%)	0.3023	0.0650	0.0001	1 %	1.353 (1.191–1.537)
Systolic blood pressure (mm Hg)	0.0183	0.0047	0.0001	5 mm Hg	1.096 (1.047–1.147)
Cigarette pack years	0.00477	0.0066	0.4689	10 pack years	1.049 (0.922–1.193)

[a] retinopathy level 1, level 2 and combined levels 3 and 4
[b] Higher social class levels are associated with a lower risk of retinopathy

ed by 30 (4.4 %) patients, and a peripheral bypass operation or angioplasty was reported by 14 (2 %) patients. In total, 50 (7.3 %) patients (14 women) had at least one of the mentioned clinically manifest macrovascular complications. As expected, there was a strong relationship between the percentage of patients with macrovascular complications and the level of nephropathy (level 1: 4 %, level 2: 8 %, level 3: 13 %, level 4: 29 %, level 5: 47 %). Fewer patients of high social class had macrovascular complications ($p = 0.0013$, OR 0.56, CI 0.739–0.79).

Time spent in hospital (Table 7). There was an inverse association between number of days in hospital during the preceding year and social status.

Drug therapy. Apart from antihypertensive drug therapy (Table 5), 231 (34 %) patients were taking at least one drug on a regular basis. About twice as many patients of the lowest social class were taking drugs compared to patients of the highest social class (Table 7).

Quality of life. Detailed results have been published elsewhere [20]. Social status was significantly associated with physical complaints ($p < 0.001$), diet restrictions ($p < 0.001$) and worries about future ($p < 0.05$), i. e. quality of life scores improved with increasing social status. When accounting for HbA_{1c} within the regression model, the statistical asssociations between social status and the subscales physical complaints and diet restrictions were still significant ($p < 0.001$), whereas worries about the future were no longer significantly associated with social status. Social status was not significantly associated with the total PWTSS, but there were relevant associations between social status and patients' preferences for certain treatment goals. Thus, more patients with a lower social status were aiming for normal and stable blood glucose values, but at the same time were striving more intensively to avoid even mild hypoglycaemia and to avoid blood glucose self-monitoring ($p < 0.005$). Regarding treatment satisfaction, patients with a lower social class were less satisfied with their flexibility during leisure time ($p < 0.01$), but more satisfied with their perceived protection against late complications ($p < 0.05$) despite higher HbA_{1c}-levels ($r = 0.19$ for social status and HbA_{1c}, $p < 0.001$).

Discussion

This study presents, for the first time, a comprehensive assessment of the quality of care of adult persons with Type I diabetes under the conditions of the availability of modern approaches of intensified treatment on a population-based basis. The results show that in North-Rhine (approximately 9.5 million inhabitants) the achieved standards of diabetes care are high with respect to the implementation of intensified treatment regimens, the level of patient education achieved and treatment control by the physicians (measurements of HbA_{1c}). The achieved degree of metabolic control with a mean HbA_{1c} of 8.0 % and an incidence of severe hypoglycaemia of 0.21 cases per patient-year in a population with a mean diabetes duration of 18 years compares favourably with other studies [21–23]. In the 10-year follow-up of the Wisconsin study during 1990–1992, mean HbA_{1c} was 9.4 %, only 23 % of patients used 3 or more insulin injections per day, 1 % used CSII, but 2 % had a pancreas transplant. In the present study, about 70 % used 3 or more insulin injections and 9 % CSII.

Improvement of care appears, however, necessary with respect to the quality of blood pressure control. Only 27 % of patients on antihypertensive drug therapy had normal blood pressure values (< 140/90 mmHg), whereas as many as 70 % had uncontrolled hypertension (≥ 160/95 mmHg). These findings are in accordance with our previous reports that suggested that blood pressure control in diabetes outside clinical trials is a neglected area [12, 24]. A comprehensive hypertension treatment and teaching programme as part of specialized outpatient care appears necessary in order to achieve optimal blood pressure control in Type I diabetes [12]. It has been shown that such an integrative approach of care of patients with late complications can substantially retard the manifestation of renal insufficiency and reduce mortality [25]. The high level of uncontrolled hypertension and the low level of patient awareness of measurements of proteinuria or albuminuria in the present population-based study underscore the need for specialized care for Type I diabetic patients with late complications.

A further area for improvement of care as identified in this study is the prevention of foot complications. Only 42 % of patients with a diabetes duration of more than 10 years remembered having undergone foot examination during the preceding 12 months, and 51 % of patients could not remember having ever had any foot examination outside a hospital stay. The high proportion of 81 % of patients reporting having had an examination with the tuning fork is obviously due to appropriate medical care during hospital stays.

Overall health status of low social class patients was worse than that of high social class patients as reflected by a higher rate of micro- and macrovascular complications, more patients using pharmacological medication and more hospitalisation days. In accordance with the study hypothesis there was a significant association between social class and late complications. Clinically overt nephropathy and foot complications were more than three times and retinopathy almost twice as prevalent among patients of the lowest social class compared with those of the highest social class. This association was partly explained by a lower control of risk factors. Thus, lower social class patients had higher HbA_{1c} levels, a lower degree of blood pressure control and more of them were smokers. However, it should be stressed that even patients of the lowest quintile of social class had a mean HbA_{1c} level of 8.4 % which is still substantially lower than the 9.4 % for the total Wisconsin Type I diabetic population [21].

In accordance with these findings and with our pre-study assumptions, treatment strategies were less effective in lower social class patients. Thus, fewer lower social class patients had intensified insulin substitution regimens, they measured blood glucose less often, fewer of them adapted insulin dosages on a day-to-day basis, and fewer had participated in a DTTP or had consulted a diabetologist on an outpatient basis. However, in contrast to our pre-study assumptions, these differences were not due to a lower standard of care provided by their family physicians and the health care system in general. Thus, there were no significant differences across social class levels with respect to the percentage of patients who had been recommended by their physicians to inject insulin more often, to participate in a DTTP or visit a diabetes clinic. In addition, diagnostic screening tests for late complications were performed to a similar extent in all patients irrespective of social class, if anything, there was even a trend towards more physician contacts and medical examinations in lower social class patients. In addition, in contrast to the study hypothesis, low social class patients were equally well aware of their late complications, and there was no difference with respect to the provision of these patients with modern treatment facilities such as pen-devices or blood glucose meters.

Diabetes-related quality of life was lower in low social class patients. Interestingly, low social class patients showed a tendency to have unrealistic treatment goals. They were striving for low blood glucose values even more intensively than higher social class patients, but were less ready to accept potential disadvantages of achieving good glycaemic control such as mild hypoglycaemia and frequent blood glucose self-monitoring. If patients of lower social class have the same access to modern insulin therapy and diabetes care as higher social class patients, but less treatment success, their specific preferences for certain treatment goals reflect important deficits in health motivation. In addition, if these patients feel more protected against late complications despite higher HbA_{1c}-levels they might prefer coping strategies relying on unrealistic optimism.

Possible limitations of the study are the following: there is no possibility in the German legal system with its exceptionally strict personal data protection system to definitely prove the representativeness of the patients recruited. However, as has been described in detail elsewhere, several observations indicate that the recruited patients are indeed representative of the general population of Type I diabetic patients in North-Rhine, Germany [11]: the estimated numbers of adults with Type I diabetes in this area are in accordance with the actually available number of subjects from the approximately 10% of recruited family physician practices in North-Rhine. Overall, physician compliance was high, and 73% of all available patients could be examined. In contrast to previous tertiary care centre based studies [13, 22] with approximately equal numbers of male and female subjects, in the present population-based study, the proportion of men was as high as 59%. This figure is in accordance with population based diabetes registers of the former GDR (East Germany) [26] and of Scandinavia [27]. Usually, women show a higher participation in studies on health issues than men. In fact, in the present study, the proportion of men was even somewhat higher in the group of subjects who could not be recruited in comparison to those who participated [11]. Mentally disabled patients (approximately 5%), non-German citizens (5.4%) and patients living in nursing homes were not excluded from the present study. However, in comparison to the general population of North-Rhine, there appeared to be fewer non-German citizens and there was a trend towards a somewhat higher educational level among the diabetic subjects, although statistical analysis was not possible due to different methods of assessment and classification of social class parameters between the present study and the data available for the general population of North-Rhine which had been obtained in the context of a 1993 microcensus [10]. The difference in age between the patients of the present study and the general population of North-Rhine (age groups 18–75 years) of approximately 8.5 years reflects the persisting lower life expectancy of Type I diabetic patients [10].

The design of the present study was cross-sectional. While we have shown that risk factor adjustment attenuates the association between social status and nephropathy and retinopathy, respectively, it is likely that a single measurement of these risk factors at one point does not adequately represent exposure over the life course. Patients who manifest vision impairing retinopathy or overt nephropathy may improve metabolic and blood pressure control and stop smoking. Therefore, given the biologic variability and the errors associated with measurement of these risk factors on one occasion, it is possible that the impact of these risk factors may be even larger than assessed here.

The accuracy of some of the data may be compromised because they were based on self-reports and not objectively verified and they were assessed retrospectively. Therefore, reporting bias is possible and some of the results should be regarded as estimates rather than objective figures. Imprecise assessment and analyses of a large number of parameters may result in spurious associations claiming statistical “independance” for a particular variable. Unfortunately, information about the magnitude of such bias is unavailable in most epidemiologic studies [3]. In addition, given that social status, biologic, behavioural, and psychosocial variables were assessed at the same point in time, it is not possible to disentangle the important relations between these risk factors. A more complete explanation would require an understanding of why people in low social classes are more likely to display the constellation of biologic risk factors, behaviours, and psychosocial characteristics that increase their risk of late complications.

In conclusion, the present population-based study shows that in the district of North-Rhine, Germany a high standard of care has been achieved for adult patients with Type I diabetes especially with respect to the implementation of intensified insulin treatment and education regimens. Improvement of care for patients with late complications is warranted. A substantial social gradient is apparent in the care of Type I diabetic patients, which is not due to insufficient facilities for diagnoses and treatment offered by the present German health care system.

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