Appendix SA2: List of variables included in different matching methods (all variables are based on the year 2004)

1. ELSID matching: mandatory variables = region, age group, gender, most expensive pharmacy cost group (PCG), number of PCGs, number of diagnostic cost groups (DCGs)); optional variables: number of sick days, insurance status

2. modified ELSID matching (10 most predictive variables selected by general boosted regression): diabetes medication, age group, region, number of quarters with an HbA1C-measurement, overall costs, number of outpatient consultations, diabetes diagnosis without complications, prescription costs, sick days, costs for home health care, therapeutic aids and appliances.

3. Variables included in the data set 'sel var':

Socio-demographic variables
Age
Gender
Insurance status: employed member, retired member, family member
Region: North Rhine, Hesse, North Wurttemberg

DXG codes identified by logistic regression model:
Inpatient codes:
sdxg106: Diabetes mellitus type 2 without other clearly defined symptoms
sdxg111: Diabetes mellitus type 1 without complications
sdxg173: Diseases of the oesophagus, but no ulcer or bleeding
sdxg183: Osteomyelitis
sdxg44: Malignant neoplasm of the oesophagus, bronchiae, lungs, or pleura
sdxg451: Emphysema, chronic bronchitis (age > 17)
sdxg60: Malignant neoplasm of the colon
sdxg70: Malignant neoplasm of the kidney or renal pelvis
sdxg92: Neoplasm of unknown origin, not respiratory system, kidney, urinary tract, bladder, skin or central nervous system
Outpatient codes:
adxg100: Diabetes mellitus type 2 with complications of the vascular system
adxg101: Diabetes mellitus type 1 with complications of the nervous system
adxg104: Diabetes mellitus type 2 with diabetic ketoacidosis or diabetic coma
adxg106: Diabetes mellitus type 2 with other secondary diseases
adxg108: Diabetes mellitus type 2 with complications of the eye
adxg110: Diabetes mellitus type 2 without complications
adxg111: Diabetes mellitus type 1 without complications
adxg112: Diabetes mellitus type 2 with multiple not specified complications
adxg113: Diabetes mellitus type 1 with multiple not specified complications
adxg117: Diseases of the pituitary gland, thymus, parathyroid or pluriglandular diseases
adxg119: Congenital metabolic disorders
adxg145: Liver cirrhosis
adxg147: Chronic hepatitis, not caused by viral infection
adxg150: Viral hepatitis, without liver coma, not caused by HAV or other not specified agents adxg173: Diseases of the oesophagus, but not ulcer or bleeding
adxg182: Diseases of the joints with infection
adxg198: Osteoarthritis of the knee
adxg244: Not further specified dementia
adxg264: Episodes of depression, major depressive disorder

adxg306: Paraplegia
adxg321: Peripheral neuropathy/myopathy
adxg323: Diabetic neuropathy
adxg328: Epilepsy (age > 17)
adxg33: Metastatic disease of the lymph nodes
adxg34: Metastatic disease of the lungs or digestive system
adxg35: Metastatic disease of other organs
adxg358: Chronic heart failure
adxg36: Malignant neoplasm without specified location, or primary malignant neoplasm in several locations
adxg362: Post-myocardial infarction syndrome
adxg385: Hypertensive heart disease without chronic heart failure
adxg387: Primary hypertension
adxg389: Secondary hypertension
adxg399: Cerebral bleeding
adxg400: Occlusion of pre-cerebral or cerebral arteries with cerebral infarction
adxg418: Delayed effects of cerebro-vascular disease, not specified
adxg428: Atherosclerosis
adxg470: Pleurisy, not pleural effusion
adxg534: Status after kidney transplantation/ renal complications
adxg64: Malignant neoplasm of the breast (age > 44)
adxg645: Femur fracture
adxg68: Malignant neoplasm of the testicles/ male genitals

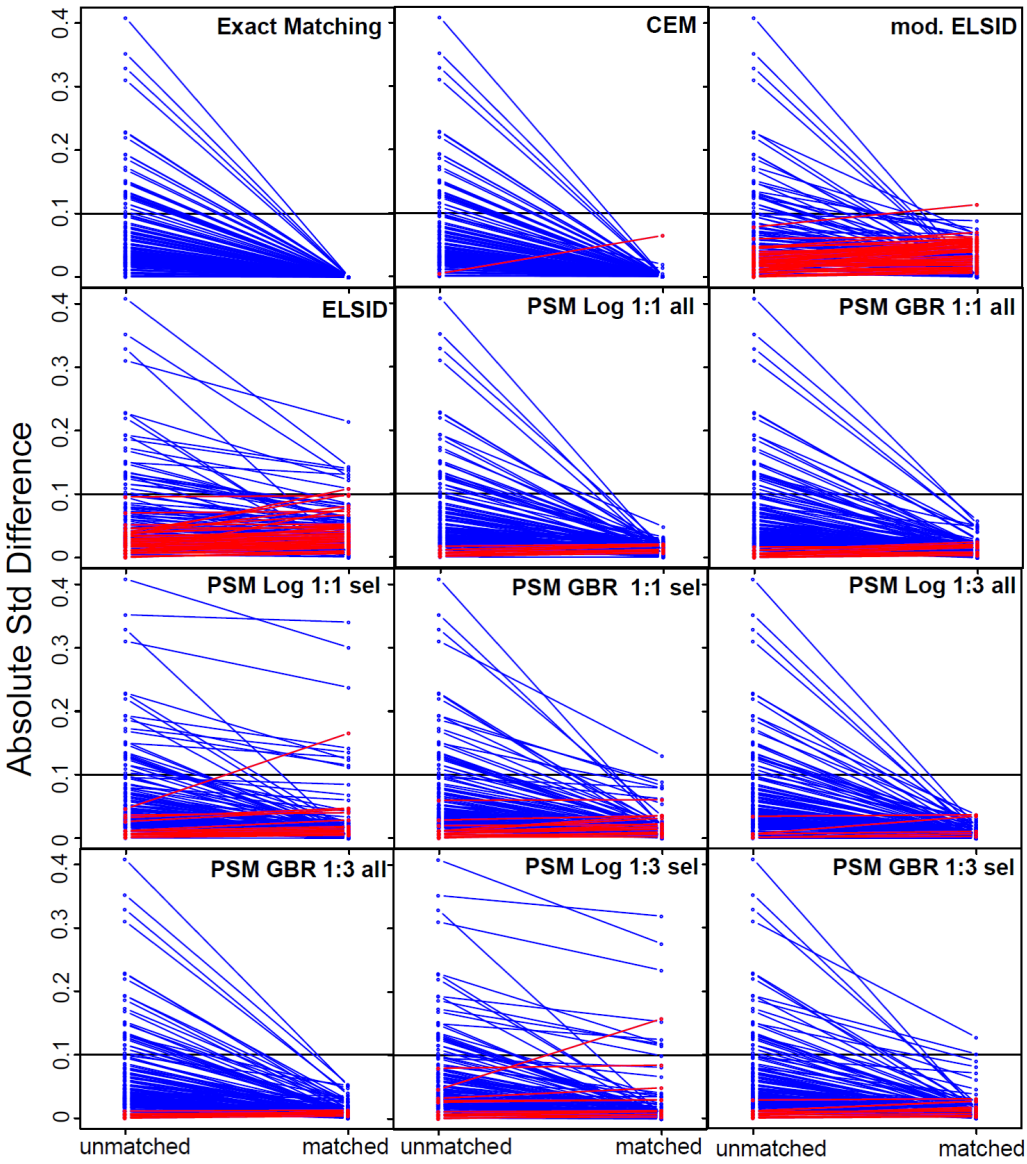
ATC codes identified by logistic regression model
a02b: Medication for peptic ulcer and gastro-oesophageal reflux disease
a07f: Antidiarrheal microorganisms
a10b: Oral blood glucose lowering drugs
b01a: Antithrombotic agents
b03x: Other antianemic preparations
b05b: I.V. solutions
c01a: Cardiac glycosides
c03a: Low-ceiling diuretics, Thiazides
c03e: Diuretics and potassium-sparing agents in combination
c07a: Beta blocking agents
c09b: ACE inhibitors, combinations
c09d: Angiotensin-II-antagonists, combinations
c10a: Lipid modifying agents, plain
g03x: Other sex hormones and modulators of the genital system
h03c: Iodine therapy
h04a: Glycogenolytic hormones
j01a: Tetracyclines
l01c: Plant alkaloids and other natural products
l02b: Hormone antagonists and related agents
m01a: Antiinflammatory and antirheumatic products, non-steroids
m02a: Topical products for joint and muscular pain
m03b: Muscle relaxants, centrally acting agents
m05b: Drugs affecting bone structure and mineralization
n04b: Dopaminergic agents
n05a: Antipsychotics
n05c: Hypnotics and sedatives
n06a: Antidepressants
r06a: Antihistamines for systemic use
s02a: Antiinfectives

v03a: All other therapeutic products
v04c: Other diagnostic agents
v20: Surgical dressings

4. Additional variables included in the data set 'all var':
Hospital costs
Prescription costs
Home health care costs
Costs for therapeutic measures, aids and appliances
Overall costs
Number of PCGs
Number of DCGs
Number of sick days
Hospital utilization: number of hospital admissions
Number of hospital days
Outpatient utilization: number of EBM codes on different days (excl. those from laboratories)
Ischaemic heart disease: outpatient diagnoses I20-I25
Number of prescriptions for therapeutic measures
Number of prescriptions for therapeutic aids and appliances
Diabetes medication: none, only oral, oral insulin, only insulin (identified through ATC codes A10A/A10B)
Number of quarters with Hba1c measurement: EBM code 3722
Annual eye examination performed: EBM code 1242
Diabetes diagnosis without complications: outpatient diagnoses ICD10 E10-E14.9
Diabetes diagnosis with multiple complications: outpatient diagnoses ICD10 E10-E14.7
Diabetes complications related to the eye: outpatient diagnoses ICD10 E10-E14.3, H35 or H36
Ketoacidosis: outpatient diagnoses ICD10 E10-E14.1
Hypoglycaemia: outpatient diagnoses ICD10 E10-E14.0 or E15
Neuropathy: outpatient diagnoses ICD10 E10-E14.4, G59 or G63
Renal disease: outpatient diagnoses ICD10 E10-E14.2 or N18
Complications of the vascular system: outpatient diagnoses ICD10 E10-E14.5
Adipositas: outpatient diagnoses ICD10 E66
Hypertension: outpatient diagnoses ICD10 I10-I15
COPD/Asthma: outpatient diagnoses ICD10 J40-J47
Depression: outpatient or inpatient diagnoses ICD10 F32 or F33
Osteoporosis: outpatient diagnoses ICD10 M80-M82
Diseases related to alcohol consumption: inpatient or outpatient diagnoses ICD10 F10 or K70
Dementia: inpatient or outpatient diagnoses ICD10 F00-F03 or G30
Cancer: outpatient diagnoses ICD10 C1-C98
Cancer-related hospital admissions: main inpatient diagnosis ICD10 C1-C98
Dialysis: inpatient or outpatient diagnoses ICD10 N180, Z992 or Z49
Cerebro-vascular disease: outpatient diagnoses ICD10 I60-I69
Blindness: outpatient diagnosis ICD10 H54

Appendix SA3: Standardized mean differences of all covariates before and after matching

The standardized mean differences for all covariates before matching are plotted on the left of each subplot; the standardized mean differences after matching are plotted on the right. A blue line indicates a decrease in the mean standardized difference after matching, a red line indicates an increase. The solid horizontal black line indicates a standardized mean difference of 0.1.



Appendix SA4: Table of balance measures before and after the application of different matching techniques

Table - Balance measures
Balance measures before and after the application of different matching techniques; SMD = standardized mean difference; KS = Kolmogorov-Smirnov Statistic.

Matching Method	Mean SMD	Max. SMD	Mean KS	Max KS	L_1
Before Matching	0.6563	0.4084	0.0209	0.2036	0.975
Exact Matching	0.0000	0.0000	0.0000	0.0000	0.000
CEM	0.0007	0.0645	0.0018	0.0842	0.404
ELSID matching	0.0402	0.2142	0.0108	0.1036	0.977
Mod. ELSID matching	0.0269	0.1141	0.0056	0.0301	0.945
PSM LogR all var 1:1	0.0112	0.0477	0.0040	0.0599	0.982
PSM GBR all var 1:1	0.0131	0.0579	0.0038	0.0309	0.967
PSM LogR sel var 1:1	0.0243	0.3405	0.0088	0.1646	0.978
PSM GBR sel var 1:1	0.0147	0.1297	0.0047	0.0627	0.974
PSM LogR all var 1:3	0.0068	0.0371	0.0032	0.0608	0.977
PSM GBR all var 1:3	0.0096	0.0532	0.0028	0.0257	0.965
PSM LogR sel var 1:3	0.0218	0.3195	0.0079	0.1545	0.978
PSM GBR sel var 1:3	0.0121	0.1272	0.0039	0.0629	0.971

Appendix SA5: Patient selection

Selection of patients into the German DMP program:
Enrolment of patients into the German disease management program is optional. The official requirements for enrolment are:

- An assured diagnosis of type 2 diabetes or treatment with diabetes-specific medication
- Ability and willingness of the patient to actively participate in the program and attend patient training sessions
- Expectation for improvement of quality of life or life expectancy

Selection of type 2 diabetic patients in insurance routine data set:
Since ICD10 codes in insurance routine data sets are known to have low validity, especially regarding the third digit, we used a combination of inpatient and outpatient diagnosis codes, outbilling patient codes (‘EBM’ codes), prescription data (ATC codes) and hospital procedure and billing codes (‘OPS’ and ‘DRG’) to identify patients with type 2 diabetes:
In a first step we selected patients with at least two ICD-10 outpatient and/or one inpatient diagnoses E10-E12 or E14 in the years 2004-2006 (with at least one

diagnosis in 2005) and/or at least one prescription for antidiabetic drugs in the year 2005 (ATC codes A10A or A10B).
In a second step, we excluded patients with type 1 diabetes by selecting all patients with at least one ICD-10 in- or outpatient diagnosis E10 without a contradictory type 2 diabetes diagnosis (E11). In the case of inconsistent diagnoses, inpatient diagnoses were considered more valid than outpatient diagnoses. In order to exclude patients with gestational diabetes, all women with a pregnancy in 2005 (identified through an inpatient DRG O01-O05,O40,O60-O65 and/or an inpatient billing code 5-72 – 5-75 or 9-26 and/or an outpatient billing code (EBM) 32007 and/or an in-/outpatient ICD-10 diagnosis O10-O99 or Z34-35) were removed from the sample. Finally, we also excluded all patients who died or left the insurance fund in 2005.