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Regional differences in the prevalence of known type 2 diabetes mellitus in 45–74 years old individuals: Results from six population-based studies in Germany (DIAB-CORE Consortium)

S. Schipf[1], A. Werner[1], T. Tamayo[2], R. Holle[3], M. Schunk[3], W. Maier[3], C. Meisinger[4], B. Thorand[4], K. Berger[5], G. Mueller[5], S. Moebus[6], B. Bokhof[6], A. Kluttig[7], K. H. Greiser[7,8], H. Neuhauser[9], U. Ellert[9], A. Icks[2,10], W. Rathmann[2] and H. Völzke[1]

[1]Institute for Community Medicine, Ernst Moritz Arndt-University Greifswald, Greifswald, [2]Institute of Biometrics and Epidemiology, German Diabetes Centre, Leibniz Center for Diabetes Research at Heinrich-Heine-University, Düsseldorf, [3]Helmholtz Zentrum München, German Research Center for Environmental Health (GmbH), Institute of Health Economics and Health Care Management, Neuherberg, [4]Helmholtz Zentrum München, German Research Center for Environmental Health (GmbH), Institute of Epidemiology II, Neuherberg, [5]Institute of Epidemiology and Social Medicine, University of Muenster, [6]Institute for Medical Informatics, Biometry and Epidemiology, University Hospital of Essen, University Duisburg-Essen, [7]Institute of Medical Epidemiology, Biostatistics and Informatics, Martin-Luther-University Halle-Wittenberg, Halle (Saale), [8]Division of Cancer Epidemiology, German Cancer Research Center (DKFZ), Heidelberg, [9]Department of Epidemiology, Robert Koch Institute, Berlin, Germany, [10]Department of Public Health, Faculty of Medicine, Heinrich-Heine University Düsseldorf, Düsseldorf, Germany

ACorrespondence to: S. Schipf, Institute for Community Medicine, Ernst Moritz Arndt University, Walther Rathenau Strasse 48, D–17487 Greifswald, Germany.
E-mail: sabine.schipf@uni-greifswald.de

Abstract

Aim In Germany, regional data on the prevalence of Type 2 diabetes mellitus are lacking for health-care planning and detection of risk factors associated with this disease. We analysed regional variations in the prevalence of Type 2 diabetes and treatment with antidiabetic agents.

Methods Data of subjects aged 45–74 years from five regional population-based studies and one nationwide study conducted between 1997 and 2006 were analysed. Information on self-reported diabetes, treatment, and diagnosis of diabetes were compared. Type 2 diabetes prevalence estimates (95% confidence interval) from regional studies were directly standardized to the German population (31 December 2007).

Results Of the 11 688 participants of the regional studies, 1008 had known Type 2 diabetes, corresponding to a prevalence of 8.6% (8.1–9.1%). For the nationwide study, a prevalence of 8.2% (7.3–9.2%) was estimated. Prevalence was higher in men (9.7%; 8.9–10.4%) than in women (7.6%; 6.9–8.3%). The regional standardized prevalence was highest in the east with 12.0% (10.3–13.7%) and lowest in the south with 5.8% (4.9–6.7%). Among persons with Type 2 diabetes, treatment with oral antidiabetic agents was more frequently reported in the south (56.9%) and less in the

northeast (46.0%), whereas treatment with insulin alone was more frequently reported in the northeast (21.6%) than in the south (16.4%).

Conclusion The prevalence of known Type 2 diabetes mellitus showed a southwest-to-northeast gradient within Germany, which is in accord with regional differences in the distribution of risk factors for Type 2 diabetes. Furthermore, the treatment with antidiabetic agents showed regional differences.

Keywords DIAB-CORE, population-based studies, prevalence, regional differences, Type 2 diabetes

Introduction

Epidemiological data on the prevalence of Type 2 diabetes mellitus on a regional level are scarce in Germany as well as in other countries [1–6]. In Europe, the prevalence of known Type 2 diabetes mellitus showed regional differences without a clear pattern [7,8]. In Germany, previous data suggest geographical variations in known prevalence of Type 2 diabetes, with differences between northeast and southwest. However, the estimates are based on different data sources and related to different age groups. For example, health insurance data (age < 39–90 years) provided prevalence estimates for the German Federal State of Hesse, a region in central Germany, of 5.9% in 1998 and 7.9% in 2004 [9], whereas in 2005 nationwide practice-based data (age 18–99 years) yielded prevalence estimates for east and west Germany of 17.0% vs. 13.0% for men, and of 12.0% vs. 9.0% for women [10]. In addition to differences between east and west, these data also demonstrated sex-specific differences with higher prevalence estimates for men than for women [10]. For example, population-based data (age 55–74 years) from the south [Cooperative Health Research in the Region of Augsburg (KORA S4)] revealed prevalence estimates of known Type 2 diabetes of 9.3% for men and of 8.0% for women in 2000 [11].

Regional differences in the distribution of risk factors for Type 2 diabetes mellitus have also been reported previously. The prevalence of the metabolic syndrome varies between 16.0% and 24.0% across the German Federal States with the highest prevalence found in the northeast [10,12]. These data correspond to regional differences in the prevalence of obesity and hypertension, which are considerably higher in the northeast than in the southwest of Germany [13,14].

Therefore, the aim of the present study was to compare data from five regional studies and one nationwide study within the Diabetes Collaborative Research of Epidemiologic Studies (DIAB-CORE) to provide, for the first time, population-based information on regional variation of known Type 2 diabetes prevalence in Germany.

Methods

Study population

For this meta-analysis based on individual data, we included data from five regional population-based studies and one nationwide study carried out in Germany (Fig. 1): northeast: the Study of Health in Pomerania (SHIP), Mecklenburg West Pomerania; east: the Cardiovascular Disease, Living and Ageing in Halle Study (CARLA) in the city of Halle, Saxony-Anhalt; west: the Dortmund Health Survey (DHS) in the city of Dortmund, North Rhine–Westphalia; west: the Heinz Nixdorf Recall Study (HNR) in the cities of Essen, Bochum and Mülheim of the Ruhr-Area; north Rhine-Westphalia, South: the Cooperative Health Research in the Region of Augsburg Survey 4 (KORA S4) study, Augsburg and surrounding rural districts, Bavaria; and nationwide: the German National Health Interview and Examination Survey 1998 (GNHIES 98). The terms east and west, in this context, refer to the northeastern territory of the former German Democratic Republic (East Germany) and to the southwestern states of the Federal Republic of Germany (West Germany). Data collection was performed between 1997 and 2006. We included all relevant population-based studies that used comparable methods of data collection and for which the same definition of Type 2 diabetes could be applied. The DIAB-CORE studies are very similar regarding study design (population-based sampling), selection of study population (two-stage cluster sampling, stratified random sampling) response rates (between 61% and 69%), and measurement methods, mainly derived from the MONICA project (CARLA, KORA S4, SHIP) and from the German National Health Interview and Examination Survey 1998 (DHS, HNR) (Table 1). Specific study details and methods have been described elsewhere [11,15–20]. All studies were approved by local ethics committees and public data protection agencies. Informed written consent was obtained from all participants. All studies were monitored by review boards of independent scientists.

Ascertainment of diabetes

In all studies, Type 2 diabetes was defined based on self-reported diabetes or self-reported diabetes treatment with oral antidiabetic agents, insulin, a combination of both, or exclusively dietary treatment and age at diagnose. owing to a lack of information about the diabetes type across all studies, a restriction was imposed for the age at diagnosis of disease. To avoid inclusion of possible cases of Type 1 diabetes, individuals with an age at diagnosis of diabetes ≤ 30 years were excluded. Internal plausibility checks of the pooled data were performed and variables were recoded according to

DIAB-CORE standard to ensure a high degree of comparability. Out of a total of 23 598 non-diabetic and diabetic participants (Table 1), 15 071 were eligible for the present analyses.

Statistical analysis

Data were reported as the median (25th, 75th) for continuous variables and as percentages for categorical variables. Age- and sex-specific prevalence estimates were calculated and results for each age stratum were expressed as percentages with a 95% confidence interval (95% CI). Prevalence estimates of the five regional studies have been directly standardized to the German adult population (reference date 31 December 2007) [21]. Regional differences were estimated carrying out a logistic regression including region as independent variable and adjusting for age and sex with Type 2 diabetes mellitus (yes/no) as dependent variable and using the GNHIES 98 as reference study. The odds ratio (OR) was calculated with 95% confidence interval. Statistical analyses were performed with the SAS 9.1 software (SAS Institute Inc., Cary, NC, USA). Geodata used for Fig. 1 were provided by the German Federal Agency for Cartography and Geodesy and ©EuroGeographics for the administrative boundaries.

Results

After exclusion of participants with unclear diabetes status ($n = 1$) and possible cases of Type 1 diabetes ($n = 28$), the study population of the five regional and the nationwide studies comprised 15 071 subjects (7490 men, 7581 women) aged 45–74 years (Table 2). Among these, 1287 (706 men, 581 women) have prevalent Type 2 diabetes. Regarding the regional studies, out of 11 688 participants, 1008 have prevalent Type 2 diabetes mellitus, corresponding to a prevalence of 8.6% (8.1–9.1%) (Table 2). Nationwide data (GNHIES 98) (Table 2) reveals a higher prevalence for the east, with 10.7% (8.9–12.5%), compared with the west, with 6.9% (5.9–8.0%).

We estimated the highest regional standardized prevalence (Figs 1 and 2) in the East (CARLA) with 12.0% (10.3%–13.7%), followed by the northeast (SHIP) with 10.9% (9.6–12.3%). We estimated the lowest prevalence in the south (KORA S4) with 5.8% (4.9–6.7%).

We carried out a logistic regression adjusting for sex and age to estimate regional differences in Type 2 diabetes prevalence. In comparison with the GNHIES 98, the prevalence is lower in KORA (OR 0.6; 95% CI 0.5–0.8) and RECALL (OR 0.8; 95% CI 0.7–0.9), while the prevalence was higher in CARLA (OR 1.4; 95% CI 1.1–1.7) and SHIP (OR 1.3; 95% CI 1.1–1.6). No difference is found for the DHS (OR 1.0; 95% CI 0.8–1.3) in comparison with GNHIES 98.

Overall, the prevalence of Type 2 diabetes mellitus is higher in men than in women (Table 3). An age-dependent pattern was found for age-specific prevalence estimates in the Eastern studies (SHIP, CARLA) and in the nationwide study (GNIHES 98), .

The age at diagnosis of Type 2 diabetes mellitus is lower in men than in women (Table 4). We observed the earliest age at diagnosis of Type 2 diabetes mellitus in the northeast (SHIP) at 54 years compared with 59 years in the west (DHS), although the results of the DHS are based on a smaller number of cases.

Regarding regional patterns in antidiabetic treatment (Table 5), the medication with oral antidiabetic agents is more frequently reported in the south (KORA S4) and less frequently in the northeast (SHIP), whereas treatment with insulin alone is more often reported in the northeast (SHIP) than in the south (KORA S4). We found the lowest proportion of treatment with insulin alone in the nationwide study (GNHIES 98).

Data of the regional studies demonstrate that treatment with both oral antidiabetic agents and insulin is more frequent in the east (CARLA) than in the west (HNR) (Table 5). This is in line with data from the nationwide study (GNHIES 98), where treatment with a combination is also more often reported in the eastern than in the western part of Germany.

We compared the frequency of insulin monotherapy with combination therapy and found different patterns between the regional studies in the west. Insulin monotherapy is more frequently reported in the DHS than the HNR but the combination therapy is similar in both studies, whereas more exclusively dietary treatment is reported in the HNR.

Discussion

Within the studies of DIAB-CORE the regional prevalence estimates of known Type 2 diabetes mellitus show a Southwest-Northeast gradient in Germany resulting in the lowest standardized prevalence in the South and the highest prevalence in the East, followed by the Northeast. The overall regional estimates with a higher prevalence in the East than in the West are in line with the estimates in the nationwide study.

In agreement with our results from south Germany, similar low prevalence estimates for Type 2 diabetes mellitus from health insurance data are reported for the Federal State of Hesse in central Germany [9]. However, comparisons of practice-based or health insurance data with population-based data on the prevalence of Type 2 diabetes are limited because of methodological differences.

For Germany, results for self-reported known diabetes were similar in the GEDA study 2009, a nationwide telephone survey [22]. This study also reported considerable regional differences with a lower prevalence in the south. However, in contrast to our study, the proportion of self-reported diabetes was higher in women than in men. For Europe, the overall prevalence of self-reported diabetes in Greece is higher in urban areas (8.2%) [4] than in rural areas (5.3%) [3]. For the USA, the prevalence of Type 2 diabetes by county level was assessed by the Behavioural Risk Factor Surveillance System 2007–2008 [23]. In line with our findings, the geographic differences in the USA are characterized as a diabetes belt following an inverse pattern with a north-to-south gradient with the highest prevalence of self-reported diabetes in the south with 11.7% compared with the rest of the USA with 8.5%. In the USA, the regional differences are associated with sedentary lifestyle and obesity [23]. These international data addressing regional prevalence of Type 2 diabetes so far differ in methods, such as age range, assessment of diabetes or time-periods, which should be taken into account when comparing these data.

The regional differences in the prevalence of Type 2 diabetes in Germany found in the present analyses are in agreement with recently reported regional differences in cardio-metabolic risk factors such as obesity and lifestyle habits, which might explain the variation in diabetes prevalence across study regions. For example, the prevalence of obesity is higher in the northeast than in the southwest of Germany [24]. Also, there are regional differences in fat distribution with the highest waist circumference in East Germany (13). Further, the prevalence of hypertension is higher in the northeast, with 60.1% for men and 38.5% for women, than in the south of Germany, with 41.4% for men and 28.6% for women [14]. In addition, there is a higher smoking prevalence in the northeast than in the south and west of Germany, especially in younger individuals [25] and in younger men with Type 2 diabetes [26]. Additional analyses of potential explanatory factors for such differences will be addressed in future analyses in DIAB-CORE, focusing on individual social factors and on regional indicators of deprivation.

The present analyses reveal regional sex-specific differences in the prevalence of Type 2 diabetes mellitus. For the east German studies, the prevalence of Type 2 diabetes mellitus for men in the youngest age group is higher compared than in women, whereas in the oldest age-group the prevalence is higher in women. Similar sex-specific differences are found in the nationwide practice-based German Metabolic and Cardiovascular Risk Project [24]. Possible explanations for these sex differences include the higher prevalence of the metabolic syndrome and its components in men compared with women [12].

Regarding treatment with antidiabetic agents, on the one hand, the regional patterns might be explained by differences in health care within the 16 Federal States of Germany. The structures in diabetes care have changed between 1998 and 2004 with a clear tendency towards the concentration of outpatient diabetes centres showing regional differences [27] which might have influenced the prescription patterns. In addition, in 2002, guidelines of the German Diabetic Association recommended the early combination of both insulin and oral antidiabetic agents [28]. Between 1998 and 2001 it has been observed that insulin monotherapy especially increased in patients with Type 2 diabetes, whereas the prescriptions for oral antidiabetic agents increased only marginally [29]. We found regional differences with the highest proportion of insulin monotherapy reported in the north and the lowest in the south whereas the highest proportion with oral antidiabetics was reported in the south and the lowest in the north. However, different times of data collection for the studies included may have influenced the results. The earliest studies include SHIP, KORA S4 and GNHIES 98, for which data collection was performed between 1997 and 2001.

Some limitations of the present study should be noted. First, we assessed the diabetes by self-report only which demonstrates a relative low sensitivity. Therefore, the prevalence of Type 2 diabetes mellitus may be underestimated because of undetected cases [11]. Results of several studies indicate that for diabetes the accuracy of self-reports is generally high [30–32]. Confirmations of self-reported diabetes (sensitivity) have ranged from 66% to 99% (specificity 97% to 99%). Using self-reported Type 2 diabetes only vs. self report, clinical and laboratory evaluations in addition to self-reported Type 2 diabetes to define prevalent cases revealed similar results [33]. Adding information about diabetes treatment to the self-reported definition of Type 2 diabetes mellitus yields a satisfactory validity [34,35]. Our definition of Type 2 diabetes mellitus, based on self-reported diabetes, is internally validated to determine cases with prevalent diabetes by adding information on self-reported treatment and self-reported age at diagnosis. However, prevalence of undiagnosed cases of Type 2 diabetes in the general population is considered to be high (30–50%) in most European countries and Germany [11]. Second, data collection for the studies included was done in different time-periods. It cannot be assessed to what extent the prevalence estimates may be biased in these analyses. Third, non-response is a common reason for bias in epidemiological studies. Even though the overall response rates between 56% and 69% achieved in the present studies can be regarded as satisfactory for population-based studies (Table 1) [36–38], differences in response proportions between studies could have biased the results.

The strengths of the present study include the large sample size of the pooled data and the high comparability of the studies in DIAB-CORE. Overall, all available population-based studies in Germany with comparable study design, response rates and similar assessment tools agreed to participate. Most studies (CARLA, KORA S4 and SHIP) used assessment methods derived from the World Health Organization MONICA project [39], and the remaining studies (DHS and HNR) used methods from the nationwide GNHIES 98. Further strengths are the population representativeness, and the high level of quality assurance and data management.

In conclusion, there are relevant regional differences in the prevalence and treatment of Type 2 diabetes within Germany. Our results give rise to the hypothesis that the differences observed may at least partly be caused by differences in common risk factors for Type 2 diabetes. The results are important for health-care planning, for the identification of high-risk groups and for the development of regionally tailored preventive measures.

Competing interests

Nothing to declare.

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Supporting Information

Additional Supporting Information may be found in the online version of this article.
Appendix S1.
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FIGURE 1 Regional prevalence estimates of Type 2 diabetes (age 45–74 years) standardized to the German population (31 December 2007). Map Scale 1:3 500 000; Based on VG250 (GK3), German Federal Agency for Cartography and Geodesy and NUTS 0, Eurostat, ©EuroGeographics for the administrative boundaries. By Werner Maier, Helmholtz Zentrum München, 2011. SHIP, Study of Health in Pomerania; CARLA, Cardiovascular Disease, Living and Ageing in Halle; DHS, Dortmund Health Study; HNR, Heinz Nixdorf Recall Study; KORA, Cooperative Research in the Region of Augsburg.

FIGURE 2 Regional prevalence estimates of Type 2 diabetes (age 45–74 years) standardized to the German population (31 December 2007). SHIP, Study of Health in Pomerania; CARLA, Cardiovascular Disease, Living and Ageing in Halle; DHS, Dortmund Health Study; HNR, Heinz Nixdorf Recall Study; KORA, Cooperative Research in the Region of Augsburg.

Table 1 Studies in the Diabetes Collaborative Research of Epidemiologic Studies (DIAB-CORE)

Study	Region	*N*	Response (%)	Sampling	Study period	Age range
SHIP	Northeast	4308	69	Two-stage cluster-sample	1997–2001	20–79
CARLA	East	1779	64	Stratified random sample	2002–2006	45–83
HNR	West	4814	56	Stratified by city, random sample	2000–2003	45–74
DHS	West	1312	67	Stratified random sample	2003–2004	25–74
KORA S4	South	4261	67	Two-stage cluster-sample	1999–2001	25–74
GNHIES 98	Nationwide	7124	61	Stratified random sample	1997–1999	18–79

SHIP, Study of Health in Pomerania; CARLA, Cardiovascular Disease, Living and Ageing in Halle; DHS, Dortmund Health Study; HNR, Heinz Nixdorf Recall Study; KORA S4, Cooperative Research in the Region of Augsburg S4; GNHIES 98, German National Health Interview and Examination Survey 1998.

Table 2 Characteristics of the total study populations and of participants with Type 2 diabetes by study

	Total population (age 45–74 years)			Type 2 diabetes (age 45–74 years)			
Study	*N*	Men (%)	Age, median (25th, 75th)	*N*	Men (%)	Crude prevalence, % (95%CI)	Standardized prevalence*, % (95%CI)
SHIP	2.247	49.8	59 (52; 66)	251	51.0	11.2 (9.9–12.5†)	10.9 (9.6–12.3)
CARLA	1.382	52.9	61 (53; 67)	174	55.2	12.6 (10.8–14.3)†	12.0 (10.3–13.7)
DHS	883	49.4	61 (53;68)	87	59.8	9.9 (7.9–11.8)	9.3 (7.4–11.3)
HNR	4.734	49.8	60 (53; 66)	350	60.0	7.4 (6.5–8.1)†	7.2 (6.4–7.9)
KORA S4	2.442	49.8	59 (52; 66)	146	54.8	6.0 (5.0–6.9)†	5.8 (4.9–6.7)
Total (regional studies)	11.688	50.1	60 (53; 66)	1.008	56.2	8.6 (8.1–9.1)	–
GNHIES 98	3.383	48.3	58 (51; 64)	279	50.2	8.2 (7.3–9.2)	–
East	1.188	46.3	58 (52; 64)	127	48.0	10.7 (8.9–12.5)	–
West	2.195	49.4	58 (51; 64)	152	52.0	6.9 (5.9–8.0)	–
Total	15.071	49.7	59 (52; 66)	1.287	54.9	8.5 (8.1–9.0)	–

SHIP, Study of Health in Pomerania; CARLA, Cardiovascular Disease, Living and Ageing in Halle; DHS, Dortmund Health Study; HNR, Heinz Nixdorf Recall Study; KORA S4, Cooperative Research in the Region of Augsburg S4; GNHIES 98, German National Health Interview and Examination Survey 1998; GNHIES 98 East, east Germany; GNHIES 98 Wes, west Germany.
*Regional prevalence estimates standardized to the German population (31 December 2007).
†Differences in prevalence of Type 2 diabetes between study regions were estimated using a binary logistic regression model including region as independent variable and adjusting for age and sex with GNHIES 98 as the reference group.

Table 3 Regional prevalence estimates of Type 2 diabetes by sex and age

	Age (years)	SHIP, % (95% CI)	CARLA, % (95% CI)	DHS, % (95% CI)	HNR, % (95% CI)	KORA S4, % (95% CI)	GNHIES 98, % (95% CI)	GNHIES 98 East, % (95% CI)	GNHIES 98 West, % (95% CI)
Men	45–54	6.5 (3.9–9.2)	9.5 (5.5–13.5)	5.0 (1.0–8.9)	5.0 (3.4–6.6)	2.2 (0.8–3.6)	3.2 (1.8–4.6)	3.1 (0.6–5.6)	3.2 (1.5–5.0)
	55–64	12.5 (9.3–15.7)	11.8 (7.9–15.7)	13.9 (8.5–19.2)	9.2 (7.3–11.0)	7.3 (4.8–9.8)	12.0 (9.5–14.4)	15.6 (11.0–20.3)	10.0 (7.2–12.8)
	65–74	14.8 (11.2–18.4)	17.5 (12.8–22.2)	15.4 (9.6–21.3)	12.7 (10.2–15.2)	10.7 (7.6–13.9)	11.1 (7.8–14.3)	15.0 (8.5–21.5)	9.1 (5.4–12.7)
	45–74	11.4 (9.6–13.3)	13.1 (10.7–15.6)	11.9 (8.9–15.0)	8.9 (7.8–10.1)	6.6 (5.2–8.0)	8.6 (7.2–9.9)	11.1 (8.5–13.7)	7.3 (5.7–8.8)
Women	45–54	4.5 (2.5–6.5)	5.0 (1.9–8.0)	3.9 (0.8–6.9)	2.4 (1.3–3.5)	2.0 (0.7–3.3)	2.5 (1.2–3.7)	3.3 (0.9–5.8)	2.0 (0.6–3.4)
	55–64	11.2 (8.2–14.2)	11.5 (7.5–15.5)	5.6 (2.0–9.1)	5.0 (3.7–6.5)	5.5 (3.3–7.6)	7.2 (5.3–9.1)	8.4 (5.0–11.8)	6.6 (4.3–8.8)
	65–74	19.1 (14.6–23.6)	19.4 (14.0–24.9)	15.4 (9.1–21.7)	10.8 (8.4–13.1)	9.5 (6.5–12.5)	16.9 (13.3–20.5)	22.3 (15.9–28.7)	13.5 (9.3–17.6)
	45–74	10.9 (9.1–12.7)	12.0 (9.5–14.5)	7.8 (5.3–10.3)	5.9 (4.9–6.8)	5.4 (4.1–6.6)	7.9 (6.7–9.2)	10.3 (8.0–12.7)	6.6 (5.1–8.0)
Total	45–54	5.4 (3.8–7.0)	7.2 (4.8–9.8)	4.4 (1.9–6.8)	3.7 (2.8–4.7)	2.1 (1.1–3.0)	2.8 (1.9–3.8)	3.2 (1.5–5.0)	2.6 (1.5–3.8)
	55–64	11.8 (9.6–14.0)	11.6 (8.8–14.4)	9.8 (6.5–13.0)	7.1 (5.9–8.3)	6.3 (4.7–8.0)	9.5 (8.0–11.1)	11.8 (8.9–14.7)	8.2 (6.4–10.0)
	65–74	16.7 (13.9–19.5)	18.4 (14.8–21.9)	15.4 (11.2–19.7)	11.8 (10.1–13.5)	10.1 (7.9–12.3)	14.2 (11.8–16.7)	19.2 (14.6–23.8)	11.4 (8.6–14.1)
	45–74	11.2 (9.9–12.5)	12.6 (10.8–14.3)	9.9 (7.9–11.8)	7.4 (6.5–8.1)	6.0 (5.0–6.9)	8.2 (7.3–9.2)	10.7 (8.9–12.5)	6.9 (5.9–8.0)

SHIP, Study of Health in Pomerania; CARLA, Cardiovascular Disease, Living and Ageing in Halle; DHS, Dortmund Health Study; HNR, Heinz Nixdorf Recall Study; KORA S4, Cooperative Research in the Region of Augsburg S4; GNHIES 98, German National Health Interview and Examination Survey 1998; GNHIES 98 East, east Germany; GNHIES 98 Wes, west Germany.

Table 4 Regional age at diagnosis for Type 2 diabetes by age and sex

	SHIP	CARLA	DHS	HNR	KORA S4	GNHIES 98	GNHIES 98 East	GNHIES 98 West
Men	51 (45; 59)	54 (49; 62)	58 (49; 64)	55 (46; 62)	55 (46; 62)	54 (49; 60)	55 (50; 59)	54 (46; 60)
Women	55 (50; 61)	56 (48; 63)	62 (50; 68)	57 (50; 63)	56 (50; 63)	55 (49; 62)	55 (49; 63)	55 (49; 60)
Total	54 (46; 60)	55 (48; 62)	59 (49; 65)	55 (48; 62)	55 (48; 62)	55 (49; 60)	55 (49; 61)	55 (48; 60)

SHIP, Study of Health in Pomerania; CARLA, Cardiovascular Disease, Living and Ageing in Halle; DHS, Dortmund Health Study; HNR, Heinz Nixdorf Recall Study; KORA S4, Cooperative Research in the Region of Augsburg S4; GNHIES 98, German National Health Interview and Examination Survey 1998; GNHIES 98 East, east Germany; GNHIES 98 Wes, west Germany.
Data are median (25th; 75th).

Table 5 Antidiabetic treatment for type 2 diabetes (age 45–74 years) by study

	Antidiabetic treatment			
Study	No treatment or dietary treatment only, % (95% CI)	Insulin only, % (95% CI)	Oral antidiabetics and insulin (combination), % (95% CI)	Oral antidiabetics only, % (95% CI)
SHIP*	24.0 (18.7–29.3)	21.6 (16.5–26.7)	8.4 (5.0–11.9)	46.0 (39.8–52.2)
CARLA	18.4 (12.6–24.2)	16.1 (10.6–21.6)	16.1 (10.6–21.6)	49.4 (41.9–56.9)
DHS	17.2 (9.1–25.3)	24.1 (15.0–33.3)	9.2 (3.0–15.4)	49.4 (38.7–60.1)
HNR	24.6 (20.0–29.1)	16.9 (12.9–20.8)	7.4 (4.7–10.2)	51.1 (45.9–56.4)
KORA S4	13.7 (8.1–19.3)	16.4 (10.4–22.5)	13.0 (7.5–18.5)	56.9 (48.7–65.9)
Regional total	21.2 (18.6–23.7)	18.5 (16.1–20.9)	10.1 (8.3–12.0)	50.3 (47.2–53.3)
GNHIES 98	28.3 (23.0–33.6)	11.5 (7.7–15.2)	10.4 (6.8–14.0)	49.8 (43.9–55.7)
East	24.4 (16.8–32.0)	10.2 (4.9–15.6)	15.0 (8.7–21.5)	50.4 (41.6–59.2)
West	31.6 (24.1–39.1)	12.5 (7.1–17.8)	6.6 (2.6–10.6)	49.3 (41.3–57.4)
Total	22.7 (20.4–25.0)	17.0 (14.9–19.0)	10.2 (8.5–11.8)	50.2 (47.4–52.9)

SHIP, Study of Health in Pomerania; CARLA, Cardiovascular Disease, Living and Ageing in Halle; DHS, Dortmund Health Study; HNR, Heinz Nixdorf Recall Study; KORA S4, Cooperative Research in the Region of Augsburg S4; GNHIES 98, German National Health Interview and Examination Survey 1998; GNHIES 98 East, east Germany; GNHIES 98 Wes, west Germany.
*One Type 2 diabetes subject (SHIP) is missing because of unknown medication status

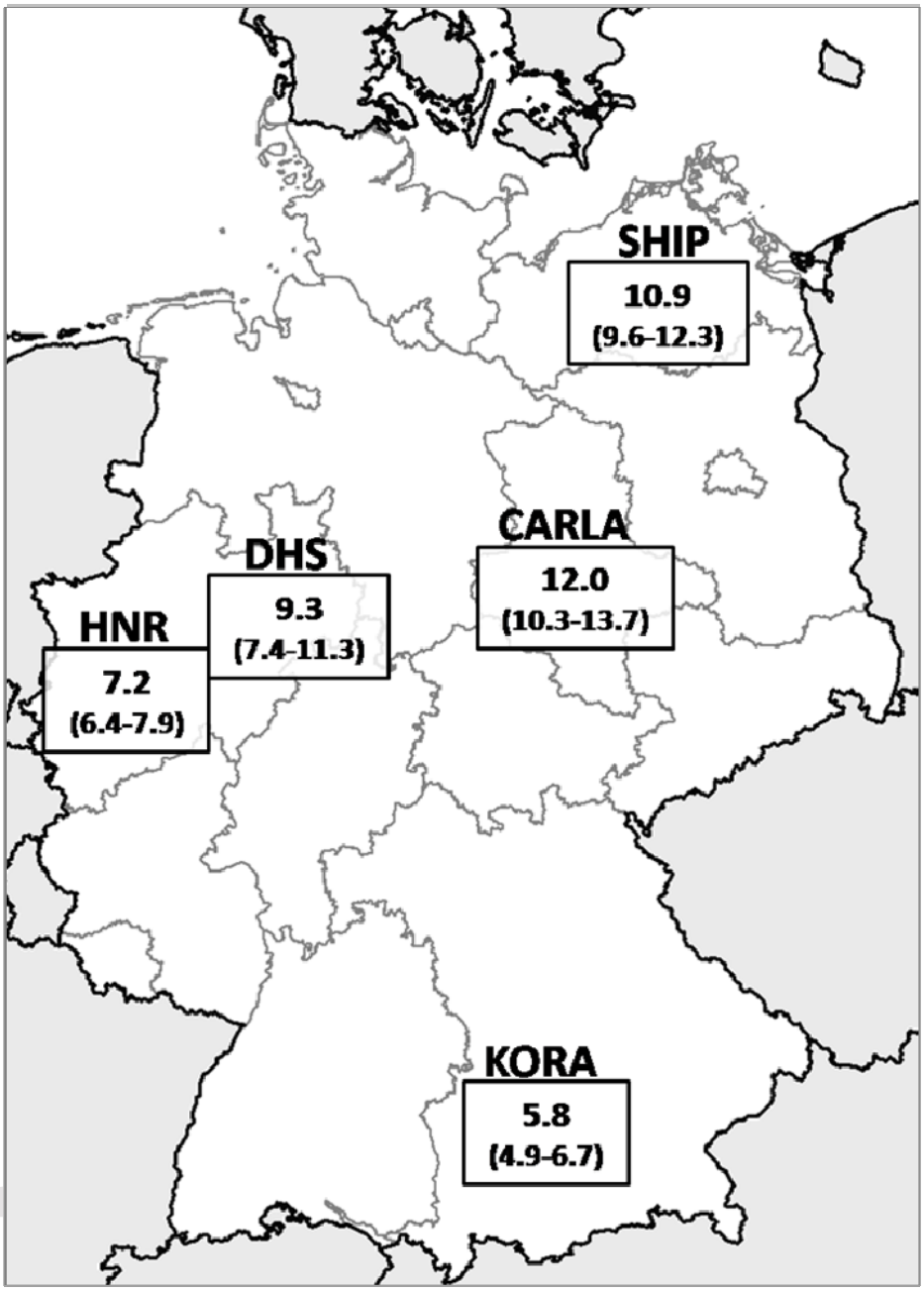

Figure 1: Regional prevalence estimates of type 2 diabetes

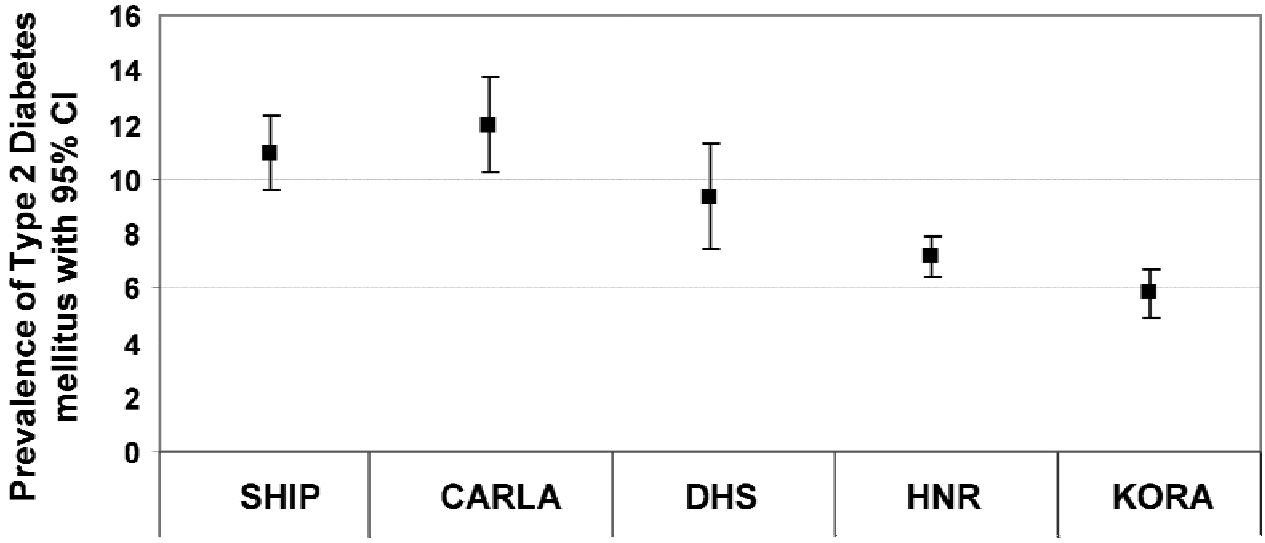

Figure 2: Regional prevalence estimates of Type 2 diabetes