Diabetes mellitus in Germany

Diabetes mellitus – a metabolic disorder that is now common all over the world – is characterized by elevated blood sugar concentrations. There are different types of diabetes, which are caused by insulin deficiency or impaired insulin action. Insufficient control of the blood sugar level can cause serious damage to the blood vessels and peripheral nerves.

The socio-economic importance of diabetes arises from the resultant severe long-term complications, the partial disability, the reduction in quality of life and life expectancy, and the need for medical treatment. The main complications of diabetes – which the St Vincent Declaration has targeted to reduce – are coronary heart disease, blindness, kidney failure and amputations of the lower limbs (WHO, IDF 1990).

The following overview focuses on diabetes mellitus in adults, which in 80% to 90% of cases occurs as type 2 diabetes. This type of diabetes usually develops among older adults, but is increasingly being observed in younger age groups. It is based on an interaction between genetic predisposition and environmental factors (particularly lack of exercise, unfavourable dietary habits and overweight). In cases of type 2 diabetes the effect of insulin is impaired and may be combined with an insufficient insulin secretion.

Type 1 diabetes, which is characterized by an autoimmune destruction of the insulin-producing cells, occurs predominantly in childhood and adolescence. It can also be found in adults as what is known as »latent autoimmune diabetes in adults« (LADA). Other types of diabetes include gestational diabetes – which occurs for the first time in pregnancy and usually regresses after birth – and specific, very rare types caused by genetic defects or specific diseases (Kerner, Brückel 2010).

The information provided below on the prevalence of diabetes in the German adult population is based on data from the »German Health Update« (GEDA), a telephone health survey conducted by the Robert Koch Institute (RKI) in 2009 (Kurth et al. 2009). The prevalence of diabetes complications is presented by including results from the RKI’s 2003 telephone health survey »GSTel03«. The article also tracks the trend in prevalence of diabetes and its complications since the 1990s. Finally, aspects of diabetes care are examined using data from various other sources.

A total of 9 percent of the adult population suffer from diabetes

In the 2009 GEDA study, the German population aged 18 years and older living in private households was asked whether a physician had ever diagnosed a diabetes (lifetime prevalence). A total of 8.8% of adults – 9.3% of the women and 8.2% of the men – stated a diagnosis of diabetes. Extrapolating these results to
the adult population in Germany (per 31 December 2007) suggests that 5.98 million adults have ever been diagnosed with diabetes.

High prevalence among adults aged over 50 years
In both sexes, the prevalence of diabetes is less than 5% among people aged up to 40–49 years, but strongly increases in the older age groups: diabetes was reported from one in eleven among the 50- to 59-year-olds, one in seven among the 60- to 69-year-olds, and as many as one in five people among the over-70s (Figure 1).

Regional differences in the prevalence of diabetes
In the 2009 GEDA study, 11.5% of the women and 9.5% of the men in eastern Germany (including Berlin) reported that they had ever been diagnosed with diabetes, reflecting that they were more frequently affected by diabetes than women and men in western Germany (excluding Berlin), where the figures were 8.7% and 7.9%, respectively. An analysis at the regional level also points to north-south differences in the prevalence of diabetes among the adult population (Figure 3).

Increase in diabetes prevalence
By including previous RKI health surveys it was feasible to trace the temporal development of the prevalence of diagnosed diabetes since 1990/92 among the population aged 25–69 years. Up until a few years ago (1990/92 to 2003/05), there was no statistically significant trend, at least not for this age group (Heidemann et al. 2009). When the latest data from the 2009 GEDA are included, however, a significant increase in diabetes prevalence among the 25- to 69-year-olds can be shown for the first time at the population level (RKI 2009a). The increase is even stronger when adults from the age of 18 years with no upper age limit are examined (Table 1). However, because of the different age

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**German Health Update (GEDA)**

**Data holder:** Robert Koch Institute

**Objectives:** To provide up-to-date data on health-related issues, to analyse temporal developments and trends

**Survey method:** Computer-assisted telephone interviews (CATI)

**Population:** Residential population of Germany aged 18 and over

**Sample:** 21,262 women and men

**Cooperation rate:** 51.2%

**Survey period:** July 2008 to June 2009
had ever had typical diabetes complications. Over 10% of
the participants with diabetes stated (acute) severe hypo-
glycaemia. The most commonly reported long-term com-
pliances were heart complications, followed by diabetic
eye disease, diabetic neuropathy, diabetic foot syndrome,
diabetic kidney disease and amputations (Table 2). In total,
about half of the people with diabetes stated that they had
not experienced any of these complications to date (Burger,
Tiemann 2005).

Partial success in achieving the St Vincent objectives
Analyses of regional disease data and health insurance
data indicate that there has been at least a partial reduction
in the occurrence of some serious diabetes complications
over time, as envisaged by the 1989 St Vincent Declaration.
Although people with diabetes still suffer blindness,
amputations, kidney failure, heart disease and pregnancy
complications much more frequently than non-diabetics,
the incidence rates of blindness (Genz et al. 2010) and
amputations (Icks et al. 2009a) and the frequency of seve-
re pregnancy complications (Beyerlein et al. 2010) have
dropped since the 1990s – to a greater extent among dia-
betics than non-diabetics. This observation was not made
regarding renal failure (Icks et al. 2011) or heart disease
(Icks et al. 2009b).

Heart disease is most common long-term complication
In the »GSTel03« telephone health survey, participants
with physician-diagnosed diabetes were asked whether they

Table 2
Prevalence of complications among adults aged 18 years and older who
have been diagnosed with diabetes, as a percentage
Data basis: GSTel03 (Burger, Tiemann 2005)

<table>
<thead>
<tr>
<th>Diabetes complications</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe hypoglycaemia</td>
<td>14.7%</td>
<td>11.6%</td>
</tr>
<tr>
<td>Heart complications</td>
<td>26.0%</td>
<td>20.6%</td>
</tr>
<tr>
<td>Diabetic eye disease</td>
<td>15.5%</td>
<td>13.9%</td>
</tr>
<tr>
<td>Diabetic neuropathy</td>
<td>11.8%</td>
<td>9.2%</td>
</tr>
<tr>
<td>Diabetic foot syndrome</td>
<td>6.5%</td>
<td>7.4%</td>
</tr>
<tr>
<td>Diabetic kidney disease</td>
<td>4.6%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Amputation</td>
<td>1.4%</td>
<td>2.6%</td>
</tr>
</tbody>
</table>

* as formulated in the GSTel03 interview

Growing efforts to improve the quality of diabetes care
To date there are no nationwide data available assessing
the extent to which the St Vincent Declaration targets have
been met in diabetes care. The results of various studies
described above, however, indicate that some progress has
been made. This is probably due in part to the considere-
able efforts made in recent years to structure diabetes
care and to integrate diabetes care into a comprehensi-
ve system of quality management. The disease-manage-
ment programmes (DMPs) for type 2 and type 1 diabetes introduced in 2003 and 2004 are essential components in this context. By February 2011 a total of 3.43 million people were enrolled in a DMP for type 2 diabetes and 138,000 people in a DMP for type 1 diabetes. In addition, the National Disease Management Guidelines Programme for type 2 diabetes (DM-CPG Programme) was revised into the form of modules aimed at diagnosing and treating specific diabetes complications and encouraging patients to become actively involved in their diabetes care (http://www.diabetes.versorgungsleitlinien.de).

Further, indicators are currently being developed in Germany to describe the quality of care in line with central recommendations of the DM-CPG Programme to facilitate to put the guidelines into practice and to evaluate their effect on the quality of diabetes care (Nothacker et al. 2011). However, this does not mean that the development of the quality indicators for diabetes care is complete (http://www.aqua-institut.de).

Improvement in the implementation of services for diabetes care possible
The GSTel03 data are the most recent available nationwide survey data providing information on the extent to which treatment and care services are actually received by people with diabetes. All participants who had reported a diagnosis of diabetes were asked about the type of treatment they were currently receiving. Altogether, only one in seven (14%) stated a treatment based on changes in diet and/or physical activity only (Burger, Tiemann, 2005) – although lifestyle modifications should be a main focus in the treatment of persons with type 2 diabetes (which represent the largest portion among all persons with diabetes). For almost half of the participants with diabetes the treatment was based on a combination of lifestyle modification and drug treatment, either using tablets (26%) or insulin (14%) or both tablets and insulin (5%). 14% of the participants with diabetes were treated exclusively with medication. According to self-reports, about one in ten (1%) were not treated at all.

In the GSTel03 survey, participants diagnosed with diabetes were also asked about the frequency of important healthcare measures. On average, more than half reported that their HbA1c was measured less frequently than once a quarter; about 10% stated that it had not been measured at all in the last 12 months. About 70% of the participants with diabetes reported that their eye-ground had been measured during the last 12 months, but only just under half reported a medical foot examination. Only about one in four (28%) received all three services.

Diabetes is one of the most frequent primary diagnoses in hospitals
According to hospital statistics, the total number of diabetes cases treated as inpatients remained relatively constant at about 210,000 per annum between 2000 and 2009. It is believed, however, that these data underestimate the importance of diabetes as the underlying disease for hospitalization. Often not the diabetes, but one of its complications is entered in official statistics as the responsible primary diagnosis. Furthermore, when assessing time series, it must also be kept in mind that changes made for technical, invoicing reasons can have an effect on the number of cases via the Diagnosis Related Group (DRG) system.

Diabetes is one of Germany’s most expensive chronic diseases
The Federal Statistical Office estimates that the direct costs for caring for diabetes patients in Germany (outpatient and inpatient treatment, nursing, rehabilitation services and drugs) totalled €63.4 billion in 2008. This corresponds to a 2.5% of health expenditure for all diseases (Federal Statistical Office 2010b). Over time, the direct costs of diabetes gradually increased. For example, diabetes-related costs in 2008 were 28% higher than in 2002 – while the costs of all diseases had increased by only 16%. Expenditures on the treatment of diabetic complications and secondary diseases were not included in these estimates.

When these expenditures are also taken into account, the direct costs – in accordance with the Costs of Diabetes Mellitus (CoDiM) study – are probably about three times higher (for 2007: €91 billion) (Köster et al. 2011). Further, when the indirect costs resulting from diabetes (loss of resources through disability or early retirement) are also included, total costs could be as much as four times higher (Hauner 2006).

Conclusion and outlook
The presented data show that the prevalence of diagnosed diabetes in the adult population of Germany increased between 2003 and 2009. This increase can be partly explained by the »ageing« of the population. The role played by additional factors (such as an increasing prevalence of diabetes risk factors, improved measures for early diagnosis and improved treatment) needs to be investigated.

Moreover, there are signs of improvement in diabetes care in terms of both care processes and care outcomes. At the same time, however, there are indications that diabetic patients with a high risk of complications are not being reached via the structured DMP care service (Schafer et al. 2010).

When interpreting the diabetes prevalence estimates given above, it should be noted that the available data do not allow an estimation that includes the prevalence of undiagnosed diabetes. Yet this would be necessary to assess the overall disease burden associated with diabetes mellitus. An increase in the prevalence of diagnosed diabetes in Germany could largely be the result of improved health education and earlier diagnosis. The prevalence
of undiagnosed diabetes would correspondingly tend to remain constant or even decline – a trend that has been observed in the USA and the UK, for example (Gregg et al. 2004, Pierce et al. 2009).

To date, estimates on the prevalence of undiagnosed diabetes in Germany have only been available from regional studies in the Augsburg area. On the basis of a standardized glucose tolerance test, a prevalence of undiagnosed diabetes was observed in subsamples of the KORA cohort that was just as high as the prevalence of diagnosed diabetes (Rathmann et al. 2003, Meisinger et al. 2010). The Robert Koch Institute’s ongoing »Adult Health in Germany« (DEGS) study, which includes at least measurements of fasting glucose in a subsample of the study participants, will be able to contribute nationwide data for the first time (RKI 2009b).

In the context of continuous health monitoring, the RKI’s recurring, population-representative cross-sectional surveys will also be able to contribute important data on diabetes prevalence and the utilization of diabetes-specific care services in the future. In addition, regularly available data on the incidence of type 2 diabetes, and its organ complications and on regional care processes and structures will be needed for a comprehensive surveillance of the disease and the quality of care in Germany. This would facilitate to identify special needs at the regional level in a much more differentiated way and meet them by allocating resources accordingly.

As long as the corresponding data are only partially available, it will be necessary to resort to other data sources. For example the Organization for Economic Cooperation and Development (OECD) has proposed estimating the quality of care of chronic diseases with a high care potential via the rate of avoidable hospital admissions, which are defined in the Development (OECD) has proposed estimating the quality of care of chronic diseases with a high care potential via the rate of avoidable hospital admissions, which are defined in the

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