ROBERT KOCH INSTITUT

JUNE 2021
ISSUE 2

FEDERAL HEALTH REPORTING
JOINT SERVICE BY RKI AND DESTATIS

Journal of **Health Monitoring**

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Communication and information in health care from the population's perspective

Journal of Health Monitoring · 2021 6(2)
DOI 10.25646/8325
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Submitted: 17.12.2020
Accepted: 01.04.2021
Published: 16.06.2021

Gestational diabetes in Germany: Development of screening participation and prevalence

Abstract

Gestational diabetes mellitus (GDM) is an important risk factor for pregnancy complications. Since 2012, the Federal Joint Committee's maternity directive recommends a two-step screening for GDM with a pre-test and subsequent diagnostic test if the pre-test is positive. This study analyses the implementation and development over time of GDM screening participation and prevalence in Germany. The data basis is the external inpatient obstetrics quality assurance documentation, which covers all births in hospital. Women with diabetes before pregnancy were excluded. The study defined women as GDM cases if the condition was documented in maternity records or if the ICD-10 diagnosis O24.4 was coded for inpatients at discharge and figures were determined for the years 2013 to 2018. As the documentation of screening tests has only been included in the data set since 2016, screening participation for the years 2016 to 2018 were estimated and evaluated based on the pre-test and/or diagnostic tests documented in maternity records. In 2018, the majority of all women who gave birth in hospitals had had a pre-test conducted (65.0%) or a pre-test and diagnostic test (18.2%) in line with the two-step procedure. A further 6.7% received a diagnostic test alone. GDM screening participation increased over time from 83.4% in 2016 to 89.9% in 2018. The prevalence of a documented GDM increased from 4.6% to 6.8% between 2013 and 2018. In 2018, this equates to 51,318 women with GDM. Reliably assessing the extent and causes of this development will require continuous analyses of screening implementation, documentation and changes in maternal risk factors.

GESTATIONAL DIABETES · EPIDEMIOLOGY · SCREENING · PRENATAL CARE · DIABETES MELLITUS

1. Introduction

Gestational diabetes mellitus (GDM) is defined as a disorder of glucose tolerance occurring for the first time during pregnancy (Info box 1). GDM is one of the most common pregnancy complications and can have acute and long-term consequences for mother and child [1]. During pregnancy, GDM increases the risk of pre-eclampsia (a serious disease of the second half of pregnancy associated with high blood pressure, increased protein excretion in the urine and water retention), premature birth and caesarean section [2, 3]. Newborns of mothers with GDM are more likely to show malformations and high birth weight (macrosomia) [2, 3], which is associated with an increased incidence of birth injuries and shoulder dystocia [4]. In the long term, mothers with GDM have a significantly elevated risk of developing

Info box 1
Gestational diabetes

Gestational diabetes mellitus belongs to the group of diabetes mellitus related metabolic diseases. Gestational diabetes is defined as a glucose intolerance occurring for the first time during pregnancy and typically returning to normal after birth. Gestational must be distinguished from manifest type 1 or type 2 diabetes diagnosed for the first time during pregnancy. Hormonal changes during pregnancy lead to changes in insulin requirement, especially from the second trimester of pregnancy onwards. The decreased sensitivity of body cells to the hormone insulin (insulin resistance) can lead to an increase in blood sugar levels. Early diagnosis and treatment can reduce the pregnancy and birth related risks for mother and child resulting from gestational diabetes [3].
For this reason, Germany introduced general screening for gestational diabetes in 2012. According to the maternity directive of the Federal Joint Committee, screening is carried out in a two-step procedure and must be offered to pregnant woman between the 24th and 28th week of pregnancy [17]. First, a pre-test with 50 g glucose (glucose challenge test, GCT) is carried out, which can be performed regardless of the time of day and recent food intake. If the blood glucose value in the preliminary test exceeds 135 mg/dL (7.5 mmol/L), a diagnostic test with 75 g glucose (oral glucose tolerance test, oGTT) follows, for which the pregnant woman has to fast. If the pretest exceeds the value of 200 mg/dL (11.1 mmol/L) then the woman has a manifest diabetes mellitus. In line with international guidelines, German guidelines for gestational diabetes nonetheless recommend a diagnostic test directly, which is not covered by statutory health insurance [18].

type 2 diabetes [5] and subsequently also increased mortality from cardiovascular disease [6].

According to estimates by the International Diabetes Federation, the prevalence of GDM ranges from 2% to over 30% worldwide [7]. Even within Germany, prevalence estimates of GDM vary considerably depending on the data source, study region and diagnostic criteria applied, and range between 5.1% and 13.2% [8–12]. International comparisons are complicated by diverging screening methods, diagnostic criteria and documentation systems [1, 13]. Consistently, an increase in the prevalence of GDM has been observed in most countries over the last decades [14]. Different factors have potentially contributed to this development, including changes to screening implementation and in the completeness of test result documentation [15] but also an increasing prevalence of important GDM risk factors such as obesity and advanced maternal age [1, 16].

Since 2012, pregnant women in Germany without pre-existing diabetes mellitus have been offered a two-step screening (Info box 2) for GDM based on the maternity directive of the Federal Joint Committee (G-BA) [17]. If gestational diabetes is diagnosed, the pregnant woman should make an appointment with a diabetologist, who will inform her about GDM and advise her on therapy options. The primary treatment consists of adjusting diet and exercise habits while regularly measuring blood glucose [18]. Insulin therapy is recommended for those women whose blood glucose levels do not return to normal with lifestyle changes.

In order to report the disease dynamics and determinants of diabetes mellitus in Germany on a recurring basis, a set of 40 indicators was defined within the framework of the diabetes surveillance at the Robert Koch Institute, which include risk factors, the disease frequency, care and the social impact of diabetes [19]. Within this framework GDM prevalence and screening participation are two core indicators, as GDM represents an important risk factor for developing type 2 diabetes later in life [20]. Since 2015, the Institute for Quality Assurance and Transparency in Health Care (Institut für Qualitätssicherung und Transparenz im Gesundheitswesen, IQTIG) administrates the inpatient quality assurance data for obstetrics, which are made available on request for research purposes within the framework of secondary data use since 2019. These contain the details from the maternity records of all women who gave birth in hospital and information on inpatient stay, including the diagnosis at discharge. Based on this data source, the present study estimates the development of screening participation and the prevalence of GDM in Germany over time. In addition, the implementation and results of two-step testing are evaluated in detail.

2. Methodology
2.1 Obstetrics data

Data from quality assurance procedures pursuant to Section 136 of the German Social Code (Sozialgesetzbuch, SGB) V of the Federal Joint Committee (Gemeinsamer Bundesausschuss, G-BA) were used for this study. According to the G-BA's directive on data-supported cross-facility quality assurance, all hospitals licensed under Section 108 of SGB V regularly submit measurement data on the quality of care with the aim of ensuring and promoting the quality of medical care [24]. In 2001, a corresponding quality assurance procedure was established for the field of

Info box 2
Screening

Screening is defined as the routine examination of persons without symptoms of disease for the presence of disease. The aim is to identify people at high risk of a particular disease and to diagnose the disease as early as possible [21]. The basic idea behind this is that starting treatment at an earlier stage of the disease improves the results of treatment. A well-known example is mammography screening, which aims to detect breast cancer as early as possible [22]. The disadvantages of screening that have been discussed are false positive findings and disease stages that do not necessarily require treatment, which in turn can lead to health burdens, unnecessary therapies and an unfavourable cost/benefit ratio [23].

obstetrics (becoming part of the quality assurance procedure perinatal medicine in 2021) covering all hospital births [11]. IQTIG currently compiles the data and ensures the quality assurance procedures. Secondary data use has been possible upon request and after approval by the G-BA for external applicants since 2019. Applicants receive the requested results in the form of aggregated data. The obstetrics dataset consists of two sub-datasets with information on mothers (16/1:M) and on newborn children (16/1:K). In addition to demographic information on pregnant women, the dataset includes information on the course of pregnancy, birth and the newborn child. Information on the course of pregnancy is mainly based on maternity record logs. Hospitals transmit the data to the IQTIG using a standardised documentation form with the data collected during birth at the hospital [25].

The present study relies on data collected during the reporting years 2013 to 2018. Women diagnosed with diabetes before becoming pregnant (pre-conceptional diabetes) and where this was documented in the maternity record at the first screening in catalogue A were excluded (Annex Figure 1). To assess completeness, the obstetric data were compared with the number of births published by the Federal Statistical Office [26]. Since the Federal Statistical Office only publishes the number of newborns, the total number of births was estimated using the number of live and stillborn children and the number of multiples for each year.

2.2 Definition of screening participation

The evaluation of screening tests was limited to the reporting years 2016 to 2018, as tests have only been included in the data set from 2016 onwards following a decision by the G-BA to document them in maternity records in April 2014 [27]. The information on pre-tests and the diagnostic tests is contained in catalogue B of the maternity record and registered under 'Special findings during pregnancy'. The physician attending the pregnant woman enters in the maternity record whether a preliminary test and a diagnostic test were carried out (yes/no) and whether the test was abnormal (yes/no).

2.3 Definition of gestational diabetes

Cases of GDM were defined as GDM documented in the maternity record or the coding of GDM in the discharge diagnoses of the hospital stay at birth. In the maternity record, GDM is documented in catalogue B under 'Special findings during pregnancy' by the physician who made the diagnosis of GDM. Discharge diagnoses are coded according to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, German Modification (ICD-10-GM [28]). GDM was assumed for the ICD-10 diagnosis O24.4.

2.4 Statistical analyses

All data used to calculate GDM screening participation and prevalence were provided in aggregated format by the IQTIG stratified by reporting year and maternal age using the following age groups: <20 years, 20 to 24 years, 25 to 29 years, 30 to 34 years, 35 to 39 years, 40 to 44 years and 45 years and older. To calculate GDM prevalence, a quotient was formed per age group and reporting year

Table 1
Description of the study population – women with hospital births (n=4,303,532)
Source: External inpatient quality assurance for obstetrics at IQTIG, own calculations

	2013		2014		2015		2016		2017		2018	
	n	%	n	%	n	%	n	%	n	%	n	%
Study population	**652,479**	**100**	**684,163**	**100**	**707,995**	**100**	**752,040**	**100**	**754,082**	**100**	**752,773**	
Age group												
<20 years	14,508	2.2	14,723	2.2	15,218	2.1	17,125	2.3	15,085	2.0	14,059	1.9
20–24 years	79,407	12.2	77,888	11.4	77,214	10.9	81,503	10.8	77,886	10.3	76,152	10.1
25–29 years	184,419	28.3	193,496	28.3	201,817	28.5	212,031	28.2	209,148	27.7	203,621	27.0
30–34 years	227,597	34.9	241,715	35.3	249,698	35.3	263,024	35.0	268,134	35.6	271,545	36.1
35–39 years	119,093	18.3	128,014	18.7	135,413	19.1	147,513	19.6	151,879	20.1	154,683	20.5
40–44 years	26,074	4.0	26,877	3.9	27,084	3.8	29,142	3.9	30,180	4.0	30,923	4.1
≥45 years	1,381	0.2	1,450	0.2	1,551	0.2	1,702	0.2	1,770	0.2	1,790	0.2

Maternity records show that the proportion of women who gave birth in hospital without a screening for gestational diabetes during pregnancy decreased from 16.6% in 2016 to 10.1% in 2018.

with the number of hospital births presenting maternal GDM according to the definition as numerator and all hospital births after excluding women with pre-conceptional diabetes as denominator. The screening participation was calculated analogously, excluding women with missing information on screening tests. For the screening participation, the results were analysed differentiated according to the test procedures performed (‘pre-test only’, ‘diagnostic test only’, ‘pre- and diagnostic test’ and ‘no test’). In addition, age-standardised values of GDM prevalence were calculated based on the mentioned age groups. The age distribution of the study population from the reporting year 2018 was used as the reference population (Table 1).

3. Results

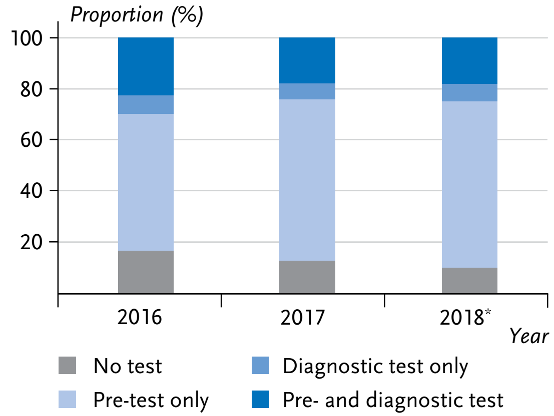
3.1 Description of the study population

A comparison of the number of hospital births with the birth figures of the Federal Statistical Office shows a high degree of completeness. Depending on the reporting year, figures deviated between 2.5% and 3.6% (Annex Table 1). Deviations are owed to births outside the hospital as well as to women with pre-conceptional diabetes, a condition found in around 1% of the women who gave birth in hospital each year (Annex Figure 1). Birth numbers have increased since 2013 to more than 750,000 births in 2018 (Table 1). Over a third of mothers gave birth between the ages of 30 and 34. While the proportion of births in the 20 to 24 age group has decreased, the proportions in the 30 to 34 and 35 to 39 age groups have increased over time.

3.2 Gestational diabetes screening participation

Figure 1 shows the proportion of women with a hospital birth for the years 2016 to 2018 who received a pre-test and diagnostic test, only a diagnostic test, only a pre-test or no test. For the reporting year 2018, no information was available for 2.0% of women (missings), with no differences in the age distribution of women with documented screenings. Over time, there was a decrease in the proportion of

Figure 1
Development of the proportion of women with hospital births according to the test procedure used during pregnancy (n=2,243,518)
Source: External inpatient quality assurance for obstetrics at IQTIG, own calculations

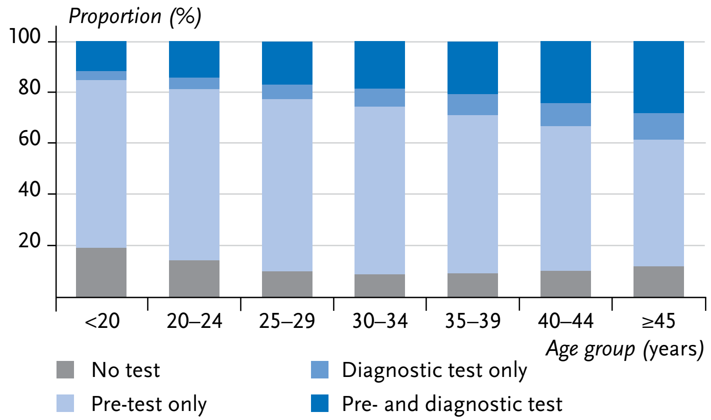


* In the reporting year 2018, 15,372 women with hospital births (2.0%) were excluded due to missing values (missings)

18.2% of women who gave birth in hospital had a pre-test and diagnostic test for gestational diabetes, 65.0% a pre-test only and 6.7% a diagnostic test only in 2018.

women who were not screened and a corresponding increase in the proportion with screening results to 89.9% in 2018. While the proportion of women who gave birth in hospital and had only a diagnostic test performed remained relatively constant, figures for women with only a pre-test increased over time.

Figure 2
Proportions of women with hospital births in 2018* by test procedure used in pregnancy and age at birth of child (n=737,401)
Source: External inpatient quality assurance for obstetrics at IQTIG, own calculations



* In the reporting year 2018, 15,372 women with hospital births (2.0%) were excluded due to missing values (missings)

By age group, the highest figure for women who were not tested (19.2%) is found in the age group under 25 (Figure 2). Between the ages of 25 and 44, the proportion is relatively constant at around 10% and then increases slightly for women aged 45 and older. In the age groups under 35, two thirds of women with a hospital birth receive only a pre-test, while only half of women aged 45 and older receive only a pre-test. The proportion of women who have both tests or only a diagnostic test increases significantly with age. Age-specific distribution patterns are constant over the reporting years (Annex Table 2), meaning that the decline in the proportion of women without a test cannot be attributed to a specific age group.

Maternity records document test procedures as well as test results. For the 'pre-test only' group, the pre-test result, for the other two tested groups the result of the diagnostic test was considered (Table 2). In the 'pre-test only' group, between 2016 and 2018, over 97% of the tested pregnant women consistently tested negative and thus were not affected by GDM. About 3% of the 'pre-test only' group were positive and just under a quarter of them were also diagnosed as GDM. For the groups of pregnant women who received pre-test plus diagnostic test or only a diagnostic test, the proportion of positive tests increased from 25.7% to 37.6% and from 13.9% to 17.6% respectively between 2016 and 2018. For all three tested groups, the proportion of positive tests increases significantly with age, and is highest (56.6%) for women in the 'pre-test plus diagnostic test' group aged 45 and older (Annex Table 3).

Table 2
Absolute and relative proportion of women who gave birth in hospitals and screening for gestational diabetes by test method, test result and reporting year (n=1,948,847)
Source: External inpatient quality assurance for obstetrics at IQTIG, own calculations

Screening GDM	2016		2017		2018[1]	
	n	%	n	%	n	%
Pre-test only[2]	403,086		476,489		479,277	
Positive	11,556	2.9	14,004	2.9	13,629	2.8
Negative	391,530	97.1	462,485	97.1	465,648	97.2
Diagnostic test only[3]	53,369		46,449		49,280	
Positive	7,443	13.9	7,926	17.1	8,694	17.6
Negative	45,926	86.1	38,523	82.9	40,586	82.4
Pre-test plus diagnostic test[3]	170,812		135,570		134,515	
Positive	43,955	25.7	46,488	34.3	50,535	37.6
Negative	126,857	74.3	89,082	65.7	83,980	62.4

GDM = Gestational diabetes
[1] In the reporting year 2018, 15,372 women with hospital births (2.0%) were excluded due to missing values (missings)
[2] Test result refers to pre-test with 50 g glucose (glucose challenge test)
[3] Test result refers to diagnostic test with 75 g glucose (oral glucose tolerance test, oGTT)

50,000 cases of gestational diabetes were documented in Germany among women with hospital births in 2018.

3.3 Prevalence of gestational diabetes

Documented GDM prevalence figures show a continuous increase from 4.6% in 2013 to 6.8% in 2018 (Table 3). Combined with the simultaneous increase in the total number of births, this translates to an increase from 29,735 to 51,318 women with GDM in the observation period. The increase in GDM prevalence affects all age groups meaning that the age-standardised prevalences are only slightly higher.

Most women diagnosed with GDM have had both a pre-test and a diagnostic test performed. Thus, in the reporting year 2018, 75.4% of the women with GDM were in the group 'pre-test and diagnostic test' and 12.3% in the 'diagnostic test only' group. The remaining women received either only a pre-test (10.3%) or no test (2.0%). Between 2016 and 2018, there was a slight decrease in the group without documented testing from 3.5% to 2.0%, which was accompanied by an increase in the group 'pre-test and diagnostic test'.

Comparing the proportion of women with a positive diagnostic test and with documented GDM shows that the proportion of women with a positive diagnostic test is higher. While 6.8% had a positive diagnostic test in 2016, this proportion increased to 7.9% in 2018, 1.5 and 1.1 percentage points higher than the proportion with documented GDM.

Table 3
Age-specific prevalence of documented gestational diabetes in women with hospital births by reporting year (n=4,303,532)
Source: External inpatient quality assurance for obstetrics at IQTIG, own calculations

	2013		2014		2015		2016		2017		2018	
	n	%	n	%	n	%	n	%	n	%	n	%
GDM diagnosis	**29,735**	**4.6**	**31,400**	**4.6**	**36,016**	**5.1**	**40,065**	**5.3**	**45,632**	**6.1**	**51,318**	**6.8**
Age group												
<20 years	238	1.6	232	1.6	265	1.7	310	1.8	373	2.5	358	2.5
20–24 years	2,232	2.8	2,182	2.8	2,232	2.9	2,673	3.3	2,915	3.7	3,275	4.3
25–29 years	7,119	3.9	7,336	3.8	8,490	4.2	9,459	4.5	10,300	4.9	11,581	5.7
30–34 years	10,865	4.8	11,330	4.7	13,098	5.2	14,427	5.5	16,501	6.2	18,518	6.8
35–39 years	7,164	6.0	7,941	6.2	9,231	6.8	10,409	7.1	12,131	8.0	13,584	8.8
40–44 years	1,981	7.6	2,215	8.2	2,511	9.3	2,608	8.9	3,161	10.5	3,718	12.0
≥45 years	136	9.8	164	11.3	189	12.2	179	10.5	251	14.2	284	15.9

GDM = Gestational diabetes

4. Discussion

This study is the first to estimate the development of the documented screening participation and prevalence of gestational diabetes in Germany using data from inpatient obstetric quality assurance. Most recently, 89.9% of pregnant women took part in screening and the proportion without testing has decreased significantly since 2016. Since the introduction of screening in 2012, there has been a steady increase in GDM prevalence and in 2018, 6.8% of women who gave birth in hospital had GDM documented in their maternity records.

Analyses of outpatient claims data from 2014/2015 already show that 80.8% of women were screened for GDM during pregnancy [12]. The present study suggests that this proportion has further increased over time and that screening also reaches women covered by private health insurance. In both studies, more than three quarters of pregnant women participated in the two-step screening. With age, the proportion of women who take both the pre-test and the diagnostic test increases significantly, which is because the age of the mother at birth is an important gestational diabetes risk factor. Only a small proportion of women receive a diagnostic test alone, which is somewhat higher in the present analysis (6.7% against 4.8%).

Estimates on the prevalence of gestational diabetes in Germany vary considerably depending on the data source,

In relation to all women who gave birth in hospital, the prevalence of documented gestational diabetes in Germany rose steadily from 4.6% in 2013 to 6.8% in 2018.

Table 4
Overview of selected publications on the prevalence of gestational diabetes in Germany
Source: Own table

Source	Data source	Study population	Definition GDM	Number of cases	Period	GDM prevalence
Bühling et al. [29]	Survey and examination data from the University Women's Hospital Berlin	Women giving birth at the University Women's Hospital without pre-existing diabetes	Two-step test procedure Screening with 50g CGT Diagnosis with 75g oGTT	N=1,416	1994–1996	8.2%
Festa et al. [30]	Survey and examination data of the Rudolfstiftung Hospital	Pregnant women in weeks 24 to 28 of gestation	Two-step test procedure Screening with 1h 75g Diagnosis with 75g oGTT	N=1,621	2001*	6.0%
Huy et al. [9]	Survey and examination data from the German Health Interview and Examination Survey for Children and Adolescents (KiGGS)	Mothers of participating children and young people	Information provided by mothers during the interview	N=2,970	2003–2006	5.3%
Domanski et al. [8]	Survey and examination data from the Survey of Neonates in Pomerania (SNiP) study	Mothers of newborns	Two-step test procedure Screening for glucosuria Diagnosis with 75g oGTT	N=5,801	2002–2008	5.1%
Reeske et al. [32]	AOK Berlin claims data	AOK-insured persons in Berlin with at least one year of insurance and pregnancy, excluding multiple pregnancies, multiple pregnancies within the study period, miscarriages and stillbirths, ectopic pregnancies and other diagnoses.	ICD-10 diagnosis: O24.4 without the presence of diabetes or O24.0–O24.3	N=3,338	2005–2007	16.0%
Beyerlein et al. [35]	Data of the inpatient quality assurance obstetrics in Bavaria	Women with hospital birth	Entry in the maternity record	N=81,129 N=92,589	2008 2014	3.4% 4.0%

Continued on next page

Table 4 *Continued*
Overview of selected publications on the prevalence of gestational diabetes in Germany
Source: Own table

Source	Data source	Study population	Definition GDM	Number of cases	Period	GDM prevalence
Tamayo et al. [10]	Outpatient claims data of KV Nordrhein	SHI-insured persons in KV Nordrhein with pregnancy in at least one quarter	ICD-10 diagnosis: O24.4 without presence of E10–E14 or O24.1–O24.3	N=153,302 N=158,839	2012–2013 2013–2014	6.0% 6.8%
Melchior et al. [12]	Outpatient claims data of all KVs in Germany	SHI-insured persons nationwide with pregnancy in at least three quarters and no diabetes in two quarters before (ICD-10 diagnosis: E10–E14 or O24.0–O24.3)	ICD-10 diagnosis: O24.4, O24.9	N=567,191	2014–2015	13.2%
KBV [34]	Outpatient claims data of all KVs in Germany	SHI-insured persons nationwide with pregnancy in at least three quarters and no diabetes in two quarters before (ICD-10 diagnosis: E10–E14 or O24.0–O24.3)	ICD-10 diagnosis: O24.4 or O24.9	N=555,778 N=575,699 N=594.438	2015 2016 2017	12.9% 13.5% 13.9%
Reinders et al. [33]	Techniker Krankenkasse claims data	TK-insured persons with childbirth in the reporting year and with continuous insurance one year before pregnancy. Pregnancy of at least 20 weeks and GDM test (EBM 01776 or 01777).	ICD-10 diagnosis: O24.4 without presence of diabetes in the previous year (ICD-10 diagnosis: E10, E11 or ATC code 10A)	N=74,433	2016	14.7%
AQUA Institute (until 2014); IQTIG (from 2015) [11, 31]	Data from the nationwide inpatient quality assurance in obstetrics at the AQUA Institute or IQTIG	Women giving birth in hospital	Entry in the maternity record	N~650,000 N~650,000 N~650,000 N~650,000 N=658,201 N=638,798 N=650,232 N=638,951 N=651,696 N=658,735 N=690,547 N=714,574 N=758,614 N=761,176	2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017	2.2% 2.3% 2.4% 2.7% 3.4% 3.4% 3.7% 4.4% 4.3% 4.4% 4.5% 5.0% 5.4% 5.9%
Present study	Data from the nationwide inpatient quality assurance of obstetrics at IQTIG	Women with hospital birth without pre-existing diabetes	Entry in the maternity record or ICD-10 diagnosis O24.4 at discharge of inpatient stay	N=652,479 N=684,163 N=707,995 N=752,040 N=754,082 N=752,773	2013 2014 2015 2016 2017 2018	4.6% 4.6% 5.1% 5.3% 6.1% 6.8%

* Year of publication, as observation period not specified
AQUA Institute = Institute for Applied Quality Improvement and Research in Health Care, AOK = Allgemeine Ortskrankenkasse, ATC = Anatomical Therapeutic Chemical Classification System, CGT = Glucose Challenge Test, EBM = Einheitlicher Bewertungsmaßstab, GDM = Gestational Diabetes, ICD = International Statistical Classification of Diseases and Related Health Problems, IQTIG = Institute for Quality Assurance and Transparency in Health Care, KV = Association of Statutory Health Insurance Physicians, KBV = National Association of Statutory Health Insurance Physicians, oGTT = oral glucose tolerance test, SHI = Statutory health insurance, TK = Techniker Krankenkasse

observation period and diagnostic criteria applied (Table 4). Population-based studies or cohort studies report a GDM prevalence of five to eight percent [8, 9, 29, 30] and are clearly above the estimates based on inpatient quality assurance data collected at the same time [11, 31]. However, the latter have increased significantly over the last few years. Analyses of statutory health insurance claims data provide higher GDM prevalence estimates [12, 32–34]. In line with this study, the available time series analyses show an increase in GDM prevalence over time. Reliable estimates of GDM prevalence are necessary to assess the extent and causes of this development and thus the potential for prevention.

For this reason, it is important to consider the influence of different data sources and diagnostic criteria with regard to an under- or overestimation of GDM prevalence. Except for the analysis of data from the Association of Statutory Health Insurance Physicians of Nordrhein (KV Nordrhein) [10], the study population of all estimates refers to women who have given birth and thus excludes pregnant women who have suffered miscarriages (Table 4). The study based on 2017 outpatient claims data examined the largest study population to date with 75% of all births, but this only included women covered by statutory health insurance that received continuous outpatient care [12]. Furthermore, case definitions in the studies also differed significantly. In claims data and inpatient quality assurance data, the prevalence of GDM is estimated on the basis of documented diagnoses [10, 12, 32, 33] or corresponding logs in maternity records [11, 31, 35] whereas survey and examination studies used measurement results to determine GDM prevalence [8, 9, 29, 30]. In claims data analyses, it is difficult to distinguish gestational diabetes from newly diagnosed manifest diabetes. For example, in approximately 1% of cases, in addition to gestational diabetes (ICD-10 diagnosis O24.4), manifest diabetes (ICD-10 diagnosis: O24.0–O24.3 or E10–E14) was also newly documented during pregnancy [10, 12]. These cases were only excluded in GDM prevalence estimate calculations in the analyses based on KV Nordrhein data [10]. Furthermore, in two studies that were based on claims data, a high proportion (44% and 33%, respectively) of women diagnosed with GDM received only a pre-test [12, 33], which only indicates GDM or diabetes if the result is highly abnormal [18, 36]. In the present study, this proportion is much lower at 10% to 11% (data not shown). This may have contributed to an overestimation of prevalence in claims data, leaving the magnitude of the discrepancy with the current analysis unexplained. An underestimation of prevalence by the present study cannot be ruled out either, as despite a documented positive diagnostic test result some women still did not receive a GDM diagnosis. The proportion of women with a positive diagnostic test result is 1 to 1.5 percentage points higher than GDM prevalence. More in-depth analyses should determine the extent to which this is due to incomplete documentation or also actually a diagnosis of new type 1 or type 2 diabetes.

Furthermore, subgroups of pregnant women with a particularly high or low GDM risk may not be being tested. An Austrian study concluded that women with a migration background took part in screening less frequently, but showed more frequent abnormal findings than women without a migration background [37]. The latter was also reported by a regional analysis of data from the AOK Berlin [32]. In addition, an analysis of hospital births in Bavaria showed that GDM prevalence is increased in socioeconomically deprived regions, characterised, for example, by higher unemployment and lower income [35]. The correlation was not evident before the introduction of general screening, so it can be assumed that especially women in regions with high social deprivation are reached by general screening. The inpatient quality assurance of obstetrics data set offers opportunities for further analyses regarding women who have not yet been reached by screening. In this case, regional differences and maternal risk factors for GDM can be specifically examined. A comparison between European countries is also difficult due to different diagnostic criteria [15, 38]. Countries with two-step GDM screening show lower prevalences than single test countries [39, 40]. Similar to the development in Germany, GDM prevalence over time is rising in Europe [14]. This raises the question as to the extent to which lifestyle factors such as obesity or severe weight gain, physical activity and diet before and during pregnancy [1, 41] play a role, irrespective of the methodological differences that exist between countries, as these could offer starting points for measures to prevent gestational diabetes. In Israel, for example, a nine-item questionnaire was developed using machine learning methods capable of assessing women's risk of developing gestational diabetes already in early pregnancy [42]. Since the data set of inpatient obstetric quality assurance also contains information on maternal risk factors such as body mass index, weight gain during pregnancy or smoking, it could in future, after confirming the reliability of the relevant information, enable the use of innovative methods to detect women at increased risk of gestational diabetes, in line with the aforementioned study. Furthermore, the data set also facilitates the analysis of complications during birth depending on the presence of GDM.

Limitations and strengths

The data basis of the present study includes all hospital births irrespective of the mothers' insurance status and covers 97% of all births in Germany. Births outside of hospitals are not included, although the 2018 estimates for the prevalence of GDM here are significantly lower (1.3%) [43]. The selection bias for this study can be assumed to be lower than in cohort studies and analyses of claims data. Maternity records are the central source of information and have not only been documenting diagnosed cases of GDM, but also information on the results of pre-tests and diagnostic tests in the two-step screening procedure for GDM since 2014. Screening examinations will also document when a person does not have a test, whereas GDM tests will only document a positive result. In the maternity records of 90% of women who gave birth in hospital, whether they have received at least one of the two tests and with a positive or negative result is recorded. However, inconsistent documentation such as a positive diagnostic test without the diagnosis of GDM indicates limitations in the completeness and accuracy of the documentation. Thus, the proportion of women with a positive diagnostic test is 1 to 1.5 percentage points higher than the proportion of women with documented GDM and so an underestimation of GDM is therefore possible.

Conclusion

The data of inpatient obstetric quality assurance appears to be a suitable source for continuous surveillance of the development of GDM screening participation and prevalence in Germany. Over time, there is an increase in the documented prevalence of GDM. In addition to the increase in the screening participation, changes in documentation behaviour, updates to diagnostic criteria implemented in 2012 and an increase in maternal risk factors may have contributed. More in-depth analyses should focus on the problems of incomplete documentation and inconclusive values found in two-step GDM screening. A further important question is whether women who have not yet been reached by screening differ with regard to important risk factors for GDM from women who have participated. This should allow validated assessments of the extent and causes of the increasing prevalence of GDM, which is observed in Germany as well as internationally. With regard to prevention measures, future analyses based on the described data set can, in addition to methodological differences, more strongly include maternal risk factors before and during pregnancy and take GDM-related complications into account.

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Please cite this publication as
Reitzle L, Schmidt C, Heidemann C, Icks A, Kaltheuner M et al. (2021) Gestational diabetes in Germany: Development of screening participation and prevalence.
Journal of Health Monitoring 6(2):3–18.
DOI 10.25646/8325

The German version of the article is available at:
www.rki.de/journalhealthmonitoring

Data protection and ethics

The analyses described in the study are based on anonymised aggregated data from external inpatient quality assurance for obstetrics. The underlying individual data are managed by the Institute for Quality Assurance and Transparency in Health Care (IQTIG) and made available in aggregated form to applicants within the framework of secondary data use.

Funding

The establishment and continuation of a National Diabetes Surveillance at the Robert Koch Institute is funded by the Federal Ministry of Health (funding codes: GE20150323 and GE20190305).

Conflicts of interest

The authors declared no conflicts of interest.

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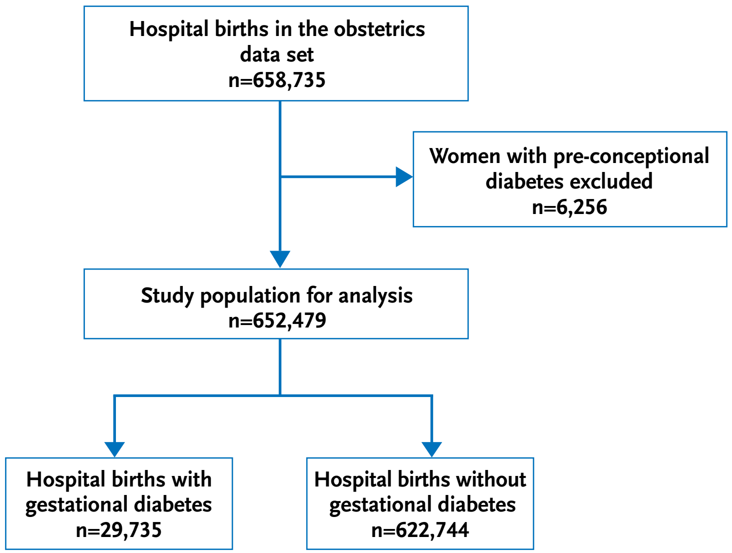
Annex Figure 1
Flowchart for the analysis of gestational diabetes and the screening participation as an example for 2013
Source: Own figure



Annex Table 1
Comparison of the number of births in the IQTIG inpatient obstetric quality assurance dataset and the Federal Statistical Office
Source: Federal Statistical Office – Statistics on births [26], External inpatient quality assurance for obstetrics at IQTIG, own calculations

	2013	2014	2015	2016	2017	2018
Federal Statistical Office						
Live-born	682,069	714,927	737,575	792,141	784,901	787,523
Stillborn	2,556	2,597	2,787	2,914	3,003	3,030
Multiples	12,355	13,270	13,637	14,635	14,712	14,365
Twins	12,119	12,977	13,368	14,371	14,415	14,099
Triplets	230	282	258	258	287	260
Higher grade multiples	6	11	11	6	10	6
Estimated births[1]	672,028	703,950	726,445	780,150	772,885	775,916
Inpatient quality assurance obstetrics						
Births[2]	652,479	684,163	707,995	752,040	754,082	752,773
Difference						
Absolutely	19,549	19,787	18,450	28,110	18,803	23,143
Relatively	2.9%	2.8%	2.5%	3.6%	2.4%	3.0%

IQTIG = Institute for Quality Assurance and Transparency in Health Care
[1] Total live births and stillbirths – (number of twins + twice number of triplets + three times number of higher-grade multiples)
[2] Women with pre-existing diabetes mellitus are excluded

Annex Table 2
Age-specific screening participation of pregnant women with hospital births by test procedure and reporting year (n=2,243,518)
Source: External inpatient quality assurance for obstetrics at IQTIG, own calculations

	2016		2017		2018*	
	n	%	n	%	n	%
Pre-test only	**403,086**	**53.6**	**476,489**	**63.2**	**479,277**	**65.0**
Age group						
<20 years	8,826	51.5	9,389	62.2	8,977	65.6
20–24 years	43,601	53.5	49,757	63.9	49,726	66.8
25–29 years	117,361	55.4	136,814	65.4	134,381	67.3
30–34 years	142,566	54.2	170,695	63.7	174,591	65.6
35–39 years	76,039	51.5	91,981	60.6	93,631	61.8
40–44 years	13,985	48.0	16,969	56.2	17,105	56.6
≥45 years	708	41.6	884	50.0	866	49.5
Diagnostic test only	**53,369**	**7.1**	**46,449**	**6.2**	**49,280**	**6.7**
Age group						
<20 years	813	4.7	532	3.5	483	3.5
20–24 years	4,538	5.6	3,458	4.4	3,437	4.6
25–29 years	13,909	6.6	11,045	5.3	11,313	5.7
30–34 years	19,554	7.4	17,469	6.5	18,711	7.0
35–39 years	11,944	8.1	11,324	7.5	12,419	8.2
40–44 years	2,462	8.4	2,473	8.2	2,736	9.1
≥45 years	149	8.8	148	8.4	181	10.3

	2016		2017		2018*	
	n	%	n	%	n	%
Pre- and diagnostic test	**170,812**	**22.7**	**135,570**	**18.0**	**134,515**	**18.2**
Age group						
<20 years	2,686	15.7	1,724	11.4	1,594	11.6
20–24 years	15,545	19.1	11,186	14.4	10,555	14.2
25–29 years	45,749	21.6	35,084	16.8	33,941	17.0
30–34 years	61,083	23.2	49,137	18.3	49,215	18.5
35–39 years	37,101	25.2	31,000	20.4	31,398	20.7
40–44 years	8,117	27.9	6,946	23.0	7,319	24.2
≥45 years	531	31.2	493	27.9	493	28.2
No test	**124,772**	**16.6**	**95,570**	**12.7**	**74,329**	**10.1**
Age group						
<20 years	4,800	28.0	3,439	22.8	2,630	19.2
20–24 years	17,819	21.9	13,485	17.3	10,676	14.4
25–29 years	35,012	16.5	26,205	12.5	19,984	10.0
30–34 years	39,821	15.1	30,833	11.5	23,806	8.9
35–39 years	22,429	15.2	17,574	11.6	13,960	9.2
40–44 years	4,578	15.7	3,792	12.6	3,062	10.1
≥45 years	313	18.4	242	13.7	211	12.1

* In the reporting year 2018, 15,372 women with hospital births (2.0%) were excluded due to missing values (missings)

Annex Table 3
Proportion of positive screening tests by testing method used, reporting year and age of women at birth (n=1,948,847)
Source: External inpatient quality assurance for obstetrics at IQTIG, own calculations

	Pre-test only[1]			Diagnostic test only[2]			Pre- and diagnostic test[2]		
	2016	2017	2018*	2016	2017	2018*	2016	2017	2018*
Age group									**in percent**
<20 years	2.1	2.0	2.2	7.9	11.4	9.9	14.7	21.7	23.4
20–24 years	2.5	2.7	2.3	10.4	13.5	13.8	19.3	26.9	30.0
25–29 years	2.6	2.6	2.6	11.7	14.9	15.8	22.6	30.3	33.6
30–34 years	2.8	2.9	2.8	13.6	16.5	16.6	25.4	33.7	36.9
35–39 years	3.4	3.5	3.3	17.2	19.8	20.5	31.0	40.0	43.1
40–44 years	4.2	4.4	4.7	21.7	24.1	25.6	36.9	46.7	50.0
≥45 years	4.4	6.1	6.7	26.0	25.8	26.5	44.4	51.7	56.6
Total	**2.9**	**2.9**	**2.8**	**13.9**	**17.1**	**17.6**	**25.7**	**34.3**	**37.6**

1 Test result refers to pre-test with 50g glucose (glucose challenge test, GCT)
2 Test result refers to diagnostic test with 75g glucose (oral glucose tolerance test, oGTT)
* In the reporting year 2018, 15,372 women with hospital births (2.0%) were excluded due to missing values (missings)

Imprint

Journal of Health Monitoring

Publisher
Robert Koch Institute
Nordufer 20
13353 Berlin, Germany

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Typesetting
Kerstin Möllerke, Alexander Krönke

Translation
Simon Phillips/Tim Jack

ISSN 2511-2708

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

Journal of Health Monitoring · 2021 6(2)
DOI 10.25646/8327
Robert Koch Institute, Berlin

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Submitted: 18.12.2020
Accepted: 21.04.2021
Published: 16.06.2021

Diabetes mellitus and comorbidities – A cross-sectional study with control group based on nationwide ambulatory claims data

Abstract

As a condition, diabetes mellitus is associated with risk factors and diseases such as obesity. At the same time, cardiovascular diseases are a frequent consequence of diabetes. There have yet to be any findings on the Germany-wide prevalence of diabetes and diabetes comorbidities based on statutory health insurance data. This study estimates the documented prevalence of diabetes in 2019 on the basis of all ambulatory physicians' claims data of German statutory health insurance. In addition, the prevalence of obesity, high blood pressure, coronary heart disease, heart failure, stroke and depression is calculated for diabetes and non-diabetes patients, and the prevalence ratio (PR) is determined as a quotient. The approach used was a case-control design, which assigns a control person without diabetes to each diabetes patient who is similar in terms of age, region and sex.

In diabetes patients, a PR greater than 1 was observed for all examined diseases across all age groups, thus demonstrating a higher prevalence compared to persons without diabetes. The highest PR across all age groups for women (3.8) and men (3.7) was found for obesity. In a comparison over time, documented prevalence figures of diabetes in Germany stagnate. With the exception of depression, the documented prevalences of comorbidities correspond well with the prevalences found in population-wide examination surveys.

DIABETES MELLITUS · AMBULATORY CLAIMS DATA · COMORBIDITY · DIABETES SURVEILLANCE

1. Introduction

Over recent decades, type 2 diabetes has gained in public health relevance both in Germany and worldwide. On the basis of various data sources, studies on the development of diabetes prevalence show a tenfold increase in Europe and Germany since the 1960s [1]. Population-wide results for Germany also show an increase in prevalence over the last two decades, and at the same time, there is evidence of a high potential for diabetes prevention [2, 3]. Advanced age and a family history of the disease, as well as behavioural risk factors such as a lack of physical activity, smoking and poor diet resulting in obesity have been shown to be the main risk factors of type 2 diabetes [4]. In addition, settings-based risk factors for type 2 diabetes are also being discussed. In particular, living environments with few opportunities for physical activity, an oversupply of energy-rich food or living in a neighbourhood where many people have formally low levels of education have been studied as settings-based risk factors [5, 6]. In contrast to type 2 diabetes, the other types of diabetes, type 1 and type 3 diabetes, are relatively rare and have other causes.

Long-term elevated blood glucose levels in people with diabetes damage the small blood vessels (microangiopathy) and nerves (diabetic polyneuropathy) and can typically lead to secondary diseases of the kidneys, eyes or feet [7]. In addition, diabetes is an independent risk factor, specifically for cardiovascular diseases such as coronary heart disease (CHD) and stroke [8].

For Germany, survey data from the Robert Koch Institute (RKI) for persons aged 50 and older show that the age- and sex-adjusted odds of having high blood pressure or a cardiovascular disease is 3.60 and 2.35 times higher respectively in persons with diabetes compared to persons without diabetes [9]. In addition, diabetes patients are also more likely to suffer mental disorders and, in particular, depressive disorders [10]. Irrespective of whether a disease such as CHD is to be regarded as a secondary disease of diabetes or, like depression, as a common concomitant disease, the simultaneous presence of at least one other additional disease is referred to as comorbidity.

Increasingly, statutory health insurance (SHI) claims data are being used to assess the frequency of common diseases such as diabetes [11–17]. There are also occasional analyses of claims data on the frequency of risk factors or comorbidities in persons with diabetes compared with persons without diabetes in insurants of single SHI funds. As these analyses are based on data from a single health insurance fund [18, 19], their results are not, however, readily transferable to the totality of all persons insured by SHI [20].

In diabetes surveillance at the RKI, in addition to diabetes prevalence, relevant risk factors as well as secondary and concomitant diseases of diabetes are presented and recurrently reported [21]. Data from the population representative RKI surveys and claims data are used to populate indicators [22]. This study aims to examine the prevalence of diabetes by age and sex and the frequency of secondary and concomitant diseases based on 2019 Germany-wide SHI claims data. The selection of diseases is based on an expert-consented list that was developed within the framework of diabetes surveillance. The data basis of the analysis is the full sample of ambulatory claims data for the year 2019 [23]. A cross-sectional study was conducted with a control group in order to compare prevalence values between persons with and without diabetes. In addition to age group-specific observations, the focus is on comparing the sex-related outcomes of diabetes comorbidity burdens. The study results are compared with those of the German Health Interview and Examination Survey for Adults (DEGS1) [24], which was conducted between 2008 and 2011 as an interview and examination survey by the RKI.

2. Methodology

2.1 Study data

The analysis was based on the pseudonymised Germany-wide ambulatory claims data from all health insurance funds in accordance with article 295 of the German Social Code (SGB) V for 2019 for all patients with SHI, provided they had at least one encounter in ambulatory care in the year of study. In total, the 2019 data contain information on the ambulatory SHI-accredited physician medical care

Info box
Diabetes comorbidities: Case definition and description

Obesity
ICD-10 codes: E66.–
- Obesity due to excessive calorie intake, obesity due to medication and other or unspecified forms of obesity

High blood pressure
ICD-10 codes: I10.–, I11.–, I12.–, I13.–, I15.–
- Essential hypertension, secondary hypertension and diseases of the heart or kidney caused by hypertension

Coronary heart disease (CHD)
ICD-10 codes: I20.–, I21.–, I22.–, I23.–, I24.–, I25.–
- Angina pectoris, heart attack and chronic ischaemic heart disease

Heart failure
ICD-10 codes: I50.–, I11.–, I13.0, I13.2
- Heart failure, also as a result of high blood pressure

Stroke
ICD-10 codes: I63.–, I64.–, I69.3.–, I69.4.–
- Cerebral infarction, stroke and their consequences

Depression
ICD-10 codes: F32.–, F33.–, F34.1.–
- Depressive disorders and long-lasting depressive mood

provided to 56,648,639 patients of adult age. In addition to sociodemographic data, e.g. on a patient's age, sex and district of residence, these data also include information on the billed ambulatory medical services and diagnoses, type of physician, e.g. specialists, or the regional Association of Statutory Health Insurance Physicians at which the practice is licensed by the SHI. The data are kept at the Central Research Institute of Ambulatory Health Care in Germany (Zi). To avoid the re-identification of individuals, all information was transmitted in aggregated form and with a minimum of 30 persons per group set.

2.2 Definition of diabetes and its comorbidities

The definition of diabetes was based on the code provided by the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) used in billing claims data. Insured persons who were diagnosed with diabetes mellitus (ICD-10: E10–E14) documented as confirmed in at least two quarters of 2019 (M2Q criterion) were counted as having diabetes in accordance with existing definitions [15] and recommendations [25, 26]. The selection of diagnoses for the definition of comorbidities (Info box) was made according to existing case definitions used for the analyses of claims data [11–14] and the M2Q criterion was applied throughout.

The documented prevalence of diabetes in 2019 was calculated as the number of persons with diabetes as a percentage of the total population of SHI-insured persons as of 1 July 2019 according to the official statutory health insurance member statistics (KM 6 statistics) [27] across the age groups 18 to 29, 30 to 59, 60 to 79 and 80 and older. The KM 6 statistics provide the absolute numbers of insured persons in the lower age segment exclusively for the age groups 0 to 14 years and 15 to 19 years. Since the absolute number of insured persons aged 18 and 19 cannot be taken directly from the KM 6 statistics, this figure was estimated as a basis for determining the size of the insured population 18 years and older in 2019. This was done under the assumption that the distribution of the number of insured persons by age within the 15 to 19 age group corresponded to that of the 2019 German population figures for this age group.

2.3 Sample design and study implementation

To compare the prevalence of cardiovascular diseases, high blood pressure, depression and obesity in people with and without diabetes in 2019, the study applied a case-control design. The design randomly assigned each insured person with diabetes (case) to an insured person as a control who had encounters in ambulatory care in at least two quarters in 2019 and did not have a documented diabetes diagnosis in 2019 or in any previous years. Matching was done by age group (5-year age groups), sex and place of residence (17 regions representing the different Associations of SHI-accredited physicians in Germany in order to control for the occurrence of these known influencing factors between the study groups.

In addition to prevalence estimates of comorbidities in both groups, relative differences between groups were assessed by the prevalence ratios (PR) which were calculated as the ratio between the prevalence in the group with diabetes and the prevalence in the group without diabetes.

The prevalence in persons with diabetes and persons without diabetes as well as the calculated PR value are presented for each disease according to age group (18- to 29-year-olds, 30- to 59-year-olds, 60- to 79-year-olds, and 80-year-olds and older) for the total estimator and separately for women and men.

Data extraction and analysis were carried out using SAS 9.4 software and results visualised with the freely available R version 3.6.1 program using the tidyverse program package [29].

3. Results

3.1 Sociodemographic factors and health care use

Table 1 provides an overview of sociodemographic factors and SHI-accredited physician appointments and compares the two groups studied. In total, more than seven million people with diabetes, as per the definition provided, were identified and compared with an equal number of controls. Based on the study design, the proportion of women was the same in both groups (49.79%). The age in the two groups showed an almost identical mean (cases: 68.99 years, controls: 68.93 years) and only slight differences in the mean spread (standard deviation; cases: 13.71, controls: 13.84). The utilisation of ambulatory services and the number of treatment cases was considerably higher in diabetics than in controls (Table 1).

3.2 Prevalence of documented diabetes

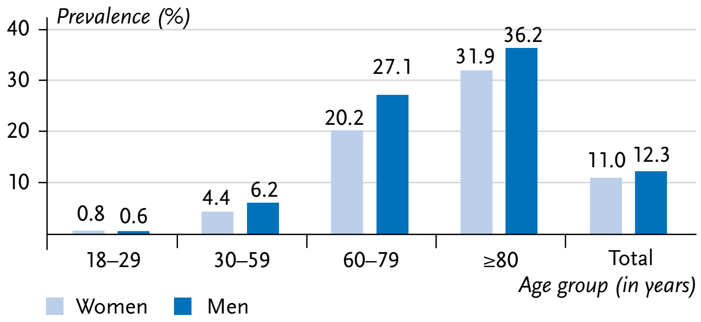
Figure 1 shows the prevalence of diabetes according to claims data for the year 2019 across the four age groups as well as the overall estimate for persons aged 18 and older (shown separately for women and men). Overall, the prevalence of diabetes increases considerably with age. Whereas the documented diabetes prevalence in women is 4.4% in the 30 to 59 age group, this rises to 20.2% in the 60 to 79 age group and is 31.9% in the age group 80 years and older. In men, the prevalence is 6.2%, 27.1% and 36.2% for the three age groups mentioned. Only in the 18 to 29 age group is the prevalence higher for women (0.76%) than men (0.64%). Across all age groups, prevalence for women is lower (11.0%) compared to men (12.3%).

Table 1
Features of the two groups analysed (case and control group)
Source: Germany-wide claims data from SHI-accredited physicians for adults covered by statutory health insurance, own calculations

	Case group with diabetes	Control group without diabetes
Number of persons	7,068,249	7,068,249
Proportion of women in %	49.79	49.79
Average age (SD)	68.99 (13.71)	68.93 (13.84)
Treatment cases[1] per person and year (mean value)	14.21	10.98
Services[2] per person and year (mean value)	126.75	83.57
Value of services in euros (mean value)	1,147.98	815.50

SD = standard deviation
[1] Treatment cases are defined in §21 Para. 1 of the Bundesmantelvertrag-Ärzte (BMV-Ä) as treatment of the same insured person by the same medical practice in a calendar quarter at the expense of the same health insurance fund [28].
[2] This indicator records the number of invoiced fee schedule items for individual medical services, such as home visits or specific diagnostic and therapeutic services, but also invoiced fee schedule items that represent flat rates for service complexes, such as primary care or specialist care.

Figure 1
Documented prevalence of diabetes by age group and sex in 2019 (n = 3,518,968 women, n = 3,549,281 men)
Source: Germany-wide claims data from SHI-accredited physicians for adults covered by statutory health insurance, own calculations



3.3 Prevalence and prevalence ratios of diabetes comorbidities

Figure 2 and Figure 3 show prevalence estimates of comorbidities in women and men with diabetes and without diabetes. A PR greater than 1 indicates that the prevalence of the respective condition is higher in the group with diabetes than in the group without diabetes. No values are shown in cells where the number of persons included in either study group is less than 30. This applies to the 18 to 29 age group for heart failure, CHD and stroke in women and men.

3.4 Results by age group for women

Across all age groups, obesity prevalence (34.2%) is 3.8 times higher in the group of women with diabetes compared to those without documented diabetes (9.1%). Hence, of all the diseases analysed here, obesity has the strongest association with diabetes in women. In the age group of 18- to 29-year-old women with diabetes, the prevalence of obesity is 7.6 times higher (30.7%) compared to those without diabetes (4.0%), the highest relative difference in prevalence between the two groups studied. The PR for obesity decreases with age: it is still 5.6 in the 30 to 59 age group, falling to 3.6 in the 60 to 79 age group and 2.8 in the age group 80 years and older. The decrease in PR across age groups is due to the prevalence of obesity in women, with diabetes decreasing earlier and more with age. While the highest prevalence of obesity (46.3%) among women with diabetes is found in the 30 to 59 age group, the highest prevalence among women without diabetes (10.1%) is found in the 60 to 79 age group. In this age group, the prevalence for women with diabetes is 36.6% and thus already considerably lower compared to younger age groups.

Across all age groups, the prevalence of hypertension in women with diabetes is 80.7%, 1.4 times higher than in women without diabetes (56.0%). Women with diabetes are eight times more likely to have documented high blood pressure in the youngest age group of 18- to 29-year-olds, with a prevalence of 12.6%, than women without diabetes (1.6%). With increasing age, the differences in prevalence between the study groups decrease, a fact due to a higher relative increase in prevalence in the group of women without diabetes. In the group of women aged 80 years and older, the prevalence in the group with diabetes is 1.2 times higher at 90.0% compared to the group without diabetes (76.7%). A similar picture can also be seen for heart failure, stroke and CHD. All these cardiovascular diseases show large relative differences in prevalence between the study groups, especially in the young age groups (30- to 59-year-olds), which decrease with rising age. Across all age groups, women with diabetes show a 1.7- to 1.9-fold higher prevalence for heart failure (20.2%), CHD (20.7%) and stroke (6.8%) compared to women without diabetes.

Across all age groups, the prevalence of depression is around 1.4 times higher in women with diabetes than in women without diabetes (26.9% vs. 19.8%). Here, too, women with diabetes in the youngest age group of 18- to 29-year-olds show the highest relative difference, with a PR of 2.1, compared to women without diabetes (6.9%). Depression prevalence (29.5%) is highest among women with diabetes in the 30 to 59 age group, whereas the highest prevalence in women without diabetes (22.9%) is found in the age group 80 years and older.

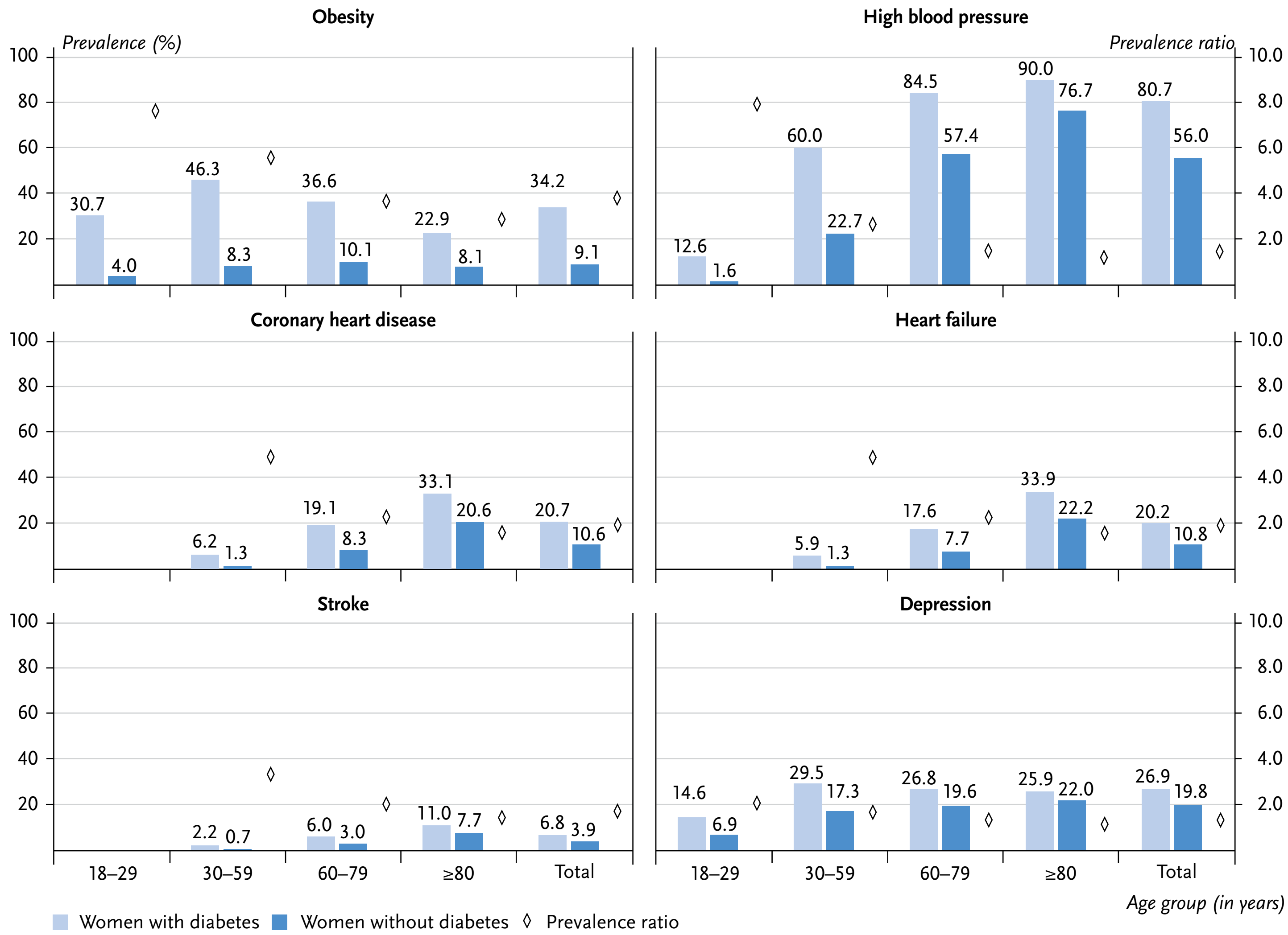
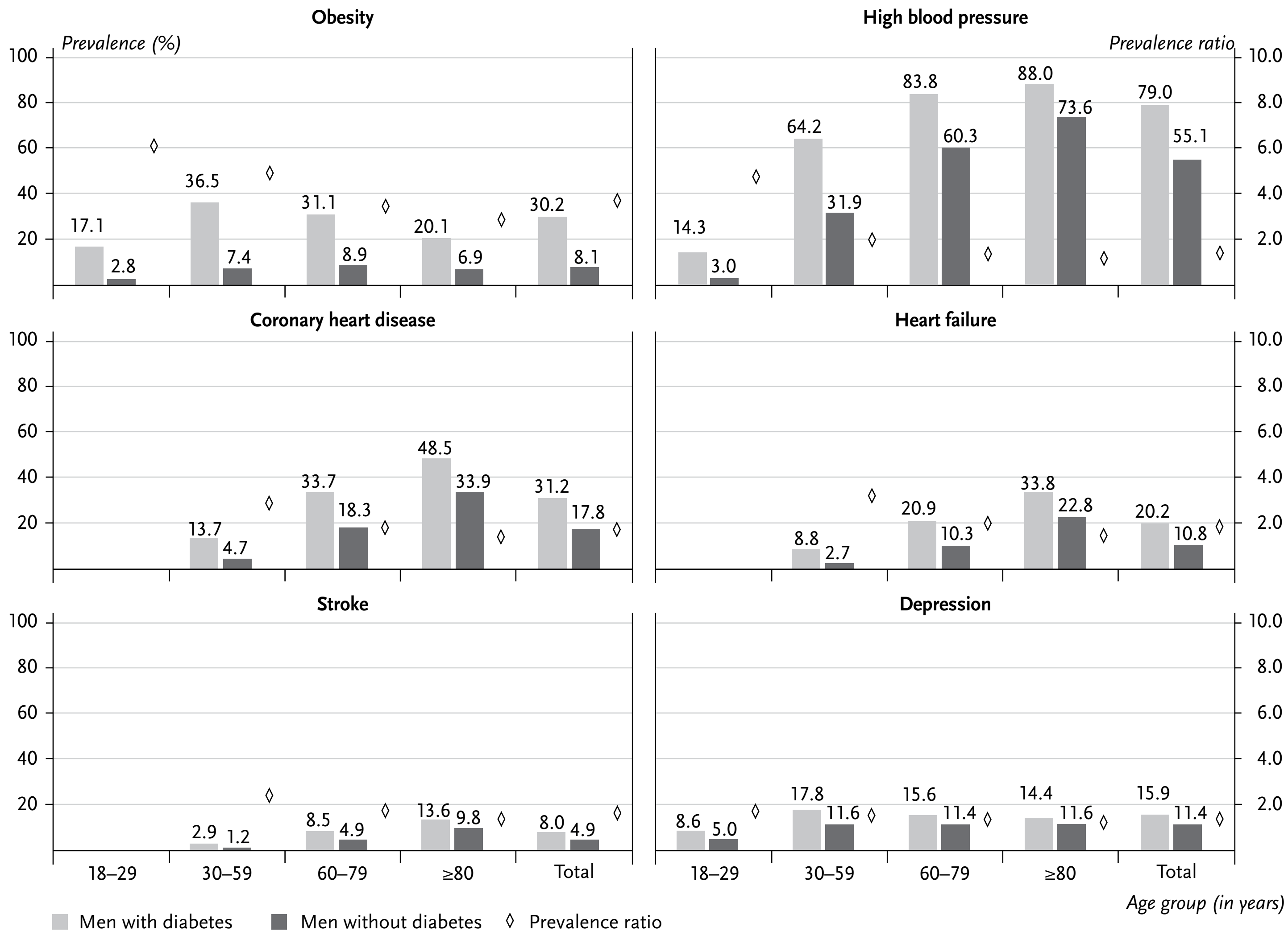


Figure 2
Documented prevalence and prevalence ratio for selected diseases in women with and without diabetes by age group (n = 3,518,968 women with diabetes, n = 3,518,968 women without diabetes)
Source: Germany-wide claims data from SHI-accredited physicians for adults covered by statutory health insurance, own calculations

Figure 3
Documented prevalence and prevalence ratio for selected diseases in men with and without diabetes by age group (n=3,548,968 men with diabetes, n=3,548,968 men without diabetes)
Source: Germany-wide claims data from SHI-accredited physicians for adults covered by statutory health insurance, own calculations



3.5 Results by age group for men

Obesity prevalence among men with documented diabetes (30.2%) is 3.7 times higher compared to men without diabetes (8.1%). As in women, obesity is therefore most strongly associated with diabetes in men. Figures across age groups for men are also similar to those found for women. Prevalence for men with diabetes (17.1%) is already 6.1 times higher in the younger age group of 18- to 29-year-olds compared to men without diabetes (2.8%). The

Women and men with diabetes show a higher prevalence for all studied comorbidities and across all age groups compared to women and men without diabetes.

highest prevalence of obesity in men with diabetes (36.5%) is found in the 30 to 59 age group; for men without diabetes, it is found in the 60 to 79 age group (8.9%). With age, the differences in prevalence become relatively smaller, which – as in women – coincides with a faster and relatively greater decrease in the prevalence of obesity in the group with diabetes compared to the group without diabetes.

Across all age groups, the prevalence of high blood pressure in men with diabetes is 79.0% and is 1.4 times higher than in men without diabetes (55.1%). With regard to high blood pressure, the picture is similar to that of women across all age groups. For men, too, the relative difference is highest in the 18 to 29 age group, with a 4.8 times higher prevalence (14.3%) in the group with diabetes compared to the group without diabetes (3.0%). With age, prevalence in the groups gradually equalises and the PR factor decreases to 1.2 in the age group 80 years and older. The highest prevalence of high blood pressure is reached in the age group 80 years and older (persons with diabetes: 88%, persons without diabetes: 72.6%).

The prevalence of heart failure and stroke are identical or slightly higher across all age groups with values between 20.2% and 8.0% for men with diabetes and 10.8% and 4.9% for men without diabetes compared to the figures for women. Progressively, for all age groups, the prevalence for men with diabetes is higher compared to men without diabetes. The highest prevalence in both study groups is again found in the age group 80 years and older.

In spite of a similar PR, men are significantly more likely to be affected by CHD. CHD prevalence across all age groups is 33.0% in men with diabetes and 1.8 times higher compared to men without diabetes (17.6%).

In contrast to the figures for CHD, the prevalence of depression is lower in men in both groups compared to women. For men with diabetes, the prevalence of depression across all age groups is 15.9%, 1.4 times higher than for men without diabetes (11.4%). The highest prevalence of depression (17.6%) is found in men with diabetes in the 30 to 59 age group and in men without diabetes in the 30 to 59 age group (11.6%) but there are only minor differences to the higher age groups.

4. Discussion

Based on the full sample of ambulatory claims data of SHI-accredited physicians, the current study assessed the prevalence of important comorbidities of diabetes compared to persons without diabetes. In line with a study based on data from the AOK Baden-Württemberg [18], which specifically analysed the case of type 2 diabetes and was based on a comparable methodology, this study also shows a higher prevalence for persons with diabetes for each disease. In contrast to the aforementioned study [18], the results in this study are based on data from all SHI-accredited physicians in Germany and therefore allow conclusions to be drawn that apply to all diabetes patients covered by SHI. The results highlight both the importance of diabetes as a frequent consequence of behavioural risk factors and the strong links of diabetes with other diseases, especially cardiovascular disease. The study design provides insights into the specific age- and sex-related factors of frequent concomitant diseases of diabetes. Compared to people without diabetes, women and men with diabetes are considerably more likely to be severe overweight and

In comparison over time, the documented prevalence of diabetes in 2019 stagnates at a high level.

have elevated blood pressure, even at a younger age. As a result, the burden of disease due to cardiovascular diseases, but also depression, is greatly increased across all age groups, but especially in people under 60 years of age.

4.1 Prevalence of documented diabetes

To estimate the development of the documented prevalence, the diabetes prevalence figures derived from Germany-wide 2019 claims data were compared to the 2013 diabetes surveillance figures. The documented prevalence in the earlier study was calculated using the data set provided according to Germany's Data Transparency Ordinance (DaTraV data), which in addition to the ambulatory claims data used here includes inpatient claims data of all patients covered by SHI [7]. Across all adult age groups the prevalence found in DaTraV data in 2013 was 11.2% for women and 12.6% for men [29]. In comparison with the rates this study found for 2019 (11.0% for women and 12.3% for men), the prevalence is slightly lower below the 2013 figures. The small difference of prevalence estimates derived from DaTraV data and the present analysis indicate that the documented prevalence has stabilised at a high level, an interpretation also corroborated by another analyses of SHI claims data [19]. A further indication that the documented prevalence has stagnated at a high level is found when comparing the 2015 figures for people with diabetes, which were based on the same data source and case definition [30]. While the 2015 study identified 6,955,865 people with diabetes, this study counted 7,068,249 persons with diabetes in 2019, in spite of excluding persons younger than 18, who are, however, rarely affected by diabetes.

If we limit the analysis in this study to the age range covered by the population representative DEGS1 survey (2008–2011, 18- to 79-year-olds), the documented prevalence for women was 8.5% and 10.5% for men. According to DEGS1, the prevalence of known diabetes in relation to persons covered by SHI is 7.8% for women and 7.2% for men, with gestational diabetes accounting for 1.2% of the population-wide prevalence in women [3]. Assuming there is strong correlation between the prevalence of known diabetes in claims data and the diagnosis prevalence found by DEGS1 collected by physician interviews, the comparison of prevalence figures by sex of DEGS1 with the results of this study indicate a considerable increase in documented diabetes between the years when data for DEGS1 were collected and 2019. With regard to the documented prevalence, an earlier analysis of the nationwide ambulatory claims data of people covered by SHI [30] already showed an increase across all age groups from 9.00% to 9.96% between 2010 and 2015, which means a relative increase of around 11% or, in absolute terms, of around 700,000. Much of this increase (around 8%, or roughly 500,000) occurred between 2010 and 2013. A comparison of the years 2015 and 2019 shows that the case numbers for documented diabetes mentioned above stagnated. The higher documented prevalence in 2019 compared to DEGS1 is therefore presumably partly owed to a strong increase in prevalence in the years up to 2015. A further decrease in the proportion of undiagnosed diabetes since 2010 could very well account for a part of this difference, as its decrease would simultaneously mean an increase in documented cases of diabetes. In DEGS1, the proportion of undiagnosed diabetes was still 1.2% for women and 2.9% for men, and

The highest relative difference in prevalence between people with and without diabetes in women and men is found for obesity.

was thus already considerably lower than in the previous German National Health Interview and Examination Survey 1998 (GNHIES98) [1]. Clarification of the time trend will be provided by future population-wide examination surveys conducted by the RKI. In principle, the guidelines for diabetes diagnostics and in particular the threshold values used for measured parameters, such as long-term blood glucose levels (HbA1c value), incorporate new findings, which could also have an influence on the development of prevalence over time [31].

4.2 Obesity and high blood pressure prevalence in diabetes patients

The strongest association with diabetes, both in women and men, is seen for obesity and high blood pressure. This result is consistent with the biological mechanisms described, according to which people with obesity are more likely to develop diabetes, whereby obesity and diabetes are likewise considerable risk factors for developing high blood pressure [32]. As shown in DEGS1, the population representative prevalence of obesity (Body Mass Index $\geq 30\,kg/m^2$) for people with type 2 diabetes (aged 45 to 79) was 54.4% [33] and thus higher than the prevalence determined in this study: in the 30 to 59 age group, the prevalence of obesity was 46.1% for women and 36.6% for men; in the 60 to 79 age group, the figures stood at 36.5% for women and 31.1% for men.

For the total population of 18- to 79-year-olds, DEGS1 shows an increased prevalence of obesity in women, especially of more severe forms, which is in line with the results from this study [34]. The pronounced decrease in prevalence for persons with diabetes shown in this paper from the 60 to 79 age group cannot be confirmed with the DEGS1 data published, as here the total population is considered. However, more severe forms of obesity, which are also more strongly associated with diabetes [35], already begin to decrease in the 60 to 69 age group in DEGS1 [34]. As there are published study results showing that accounting data predominantly document severe forms of obesity [36] and that persons suffering obesity and diabetes have an increased mortality [37], the results presented here indicating a high prevalence in young age groups combined with a decline occurring early in life are epidemiologically highly plausible.

DEGS1 shows a prevalence of drug-treated or measured high blood pressure of 76.4% for 45- to 79-year-old type 2 diabetes patients [38]. Notably, both the values for individuals in the 65- to 79-year-old age group in DEGS1 (85.5% for women and 80.3% for men) and for the 60- to 79-year-old age group in this study (women 84.5%, men 83.8%) are similarly high. Thus, the documented prevalence of high blood pressure in persons with documented diabetes in this study is comparable to that of DEGS1 – a result that is supported by the high validity of documented billing diagnoses for high blood pressure [36, 39].

Unlike high blood pressure prevalence, the prevalence of obesity in people with diabetes did not decline between the RKI surveys [33, 40]. Since obesity already becomes apparent at a young age and its development and course can be strongly influenced by behavioural and settings-based factors, there is considerable potential for prevention here with regard to the burden of disease and premature mortality.

With the exception of depression, the documented prevalence of the examined diseases shows good agreement with population representative prevalence.

4.3 Cardiovascular disease prevalence in diabetes patients

For persons with type 2 diabetes 45- to 79-years-old, DEGS1 estimates the prevalence of at least one cardiovascular disease to be at 37.1% [33]. Comparing this value with available study data is difficult due to the more detailed presentation of analysis for individual diseases from the larger group of cardiovascular diseases chosen here. However, if one assumes, for the purpose of comparison, that heart failure develops on the basis of CHD and that stroke, which occurs in older age groups, also overlaps with CHD, an estimate based on CHD alone is possible. According to this assumption, the prevalence found by DEGS1 is higher than the prevalence documented in the claims data in the 30 to 59 and 60 to 79 age groups in women (6.2%, 19.1%) and men (13.7%, 33.7%) as part of this analysis. This confirms the result of a recent study [11], which, based on the same data and case definition, shows a moderately lower prevalence for the documented prevalence of CHD compared to DEGS1. The strong association between the documented and population representative prevalence for CHD is also supported by the fact that the sex-specific characteristics of a considerably higher population representative raw disease prevalence for women are also reflected by claims data prevalences [11, 41].

4.4 Depression prevalence in diabetes patients

Compared to the diseases discussed so far, depression and diabetes differ in their biological mechanisms, as well as their risk and influencing factors. Nevertheless, an analysis of diabetes surveillance shows that 19.1% of women and 12.3% of men with diabetes show depression symptoms in adulthood [42]. Between the groups with and without diabetes, the analysis, moreover, shows that the age-adjusted likelihood for a person to develop depression symptoms is twice as high for people with diabetes compared to people without the disease [42]. International findings corroborate this [10]. In accordance with these results, this analysis shows a higher prevalence of depression for the group with diabetes and for women. For women aged 18 years and older with diabetes, this analysis shows a documented prevalence of 26.9% and 15.9% for men. The considerably higher figures found in the documented diagnoses relative to those found in survey data are known and have been discussed in detail elsewhere [14]. The main reason for this discrepancy is likely to be the specific definition of depression in clinical interviews, which determines the condition at a level of detail not possible using solely claims data [14, 43].

4.5 Strengths and limitations of the study

This study is based on all the ambulatory diagnoses of patients covered by SHI using claims data from SHI-accredited physicians. This avoids a distortion of the calculated Germany-wide documented prevalence that could result from different compositions regarding age structure and other risk factors among members of individual health insurance funds or SHI-accredited physician associations.

Compared to survey data, the inclusion of all age groups is a particular strength of claims data and thus of the study presented here. In particular, the old and very old were not

Claims data of all ambulatory statutory health insurance physicians are well suited for the regular analysis of diabetes comorbidity in diabetes surveillance.

included in the previous nationwide survey data, where the age range was limited to a maximum of 79. In addition, claims data are routinely collected regardless of a patient's willingness to participate. Consequently, the data covers large swathes of the population. Ultimately, the scope of information made available through claims data also allows for deeply stratified analyses by age, region and sex. Overall, the fast availability of SHI-accredited physician claims data within less than one year is advantageous. These data thus make it possible to show changes in morbidity quickly. A fundamental disadvantage of SHI claims data is that patients with private health insurance are not included and that services provided outside the statutory claims system are not documented. Although the majority of the German population is covered by SHI, it is estimated that information about the illness history of 12.2% of the population is not recorded in these data, and they are therefore not representative of the population [44].

Especially in comparison with the population representative DEGS1 study, the prevalences calculated in this study for 2019 correspond well with the epidemiological results by sex and age group. In particular regarding diseases where billing diagnoses and clinical diagnoses are known to show a strong correlation, such as diabetes, high blood pressure and cardiovascular diseases, the study results are robust. However, compared to the prevalences found in examination surveys such as DEGS1, risk factors such as being overweight and obesity appear to be under-coded or not recorded. The documented prevalence of depression calculated in our study, which is considerably higher compared to the prevalence found by DEGS1, is difficult to classify. Studies show that depression, in particular, is coded considerably more often in claims data than in clinical diagnosis data [14, 43, 45]. This study does not operationalise patients' social situation as the corresponding indicators often used, such as income, occupational status or educational status, are not present in the data. For this reason, the prevalence ratios presented here are not adjusted for differences in educational attainment between people with and without diabetes. In particular, as results show diabetes prevalence reflects social inequalities [46], the prevalence ratios presented here are skewed to a degree that depends on the unknown distribution of social situation indicators between persons with and without diabetes.

In general, it must be assumed that risk factors and concomitant diseases are also coded more frequently in persons with a documented chronic disease such as diabetes [36, 39, 47]. To mitigate this effect, in this analysis the persons with diabetes were compared to a control group of persons with an appointment at a SHI-accredited physician in at least two quarters.

In contrast to the data from SHI providers, the data in this study do not include inpatient diagnoses, drug prescriptions or, in particular, persons without ambulatory encounter. Due to the lack of people with SHI without ambulatory encounter, prevalence cannot be calculated on the basis of the data alone, as the total population of people with SHI cannot be determined directly. This study addressed this limitation by using the official member statistics of SHI providers – called the KM 6 statistics – to estimate the total SHI population. For the other limitations, i.e. absence of inpatient diagnoses and drug prescriptions, the comparison of the study's documented prevalence with the results of the literature considered in this article shows that for common chronic diseases, the ambulatory SHI-accredited physician care of all persons covered by SHI captures the disease situation well.

5. Conclusion

Using current and Germany-wide ambulatory claims data, this study underscores that, on the whole, persons with diabetes, but especially those at younger adult age, have a considerably increased disease burden due to severe overweight, elevated blood pressure and cardiovascular disease. The claims data of all ambulatory services provided by SHI-accredited physicians are suited to continuously assess diseases of high public health relevance. In particular, diabetes surveillance at the RKI could benefit from a regular assessment of diabetes prevalence and diabetes comorbidities as documented in claims data. If repeated, the chosen study approach would also enable estimates of changes in the comorbidity burden in a comparison of persons with and without diabetes.

Lastly, the ongoing COVID-19 pandemic underlines the importance of systematically monitoring and assessing the development of diabetes and diabetes comorbidities. Analyses show that persons with diabetes, obesity, cardiovascular as well as other chronic diseases also suffer greater complications when they develop COVID-19, such as hospital admission, ventilation or death, regardless of age and are more likely to die from the disease [48]. Similar effects have also been documented for other viral infections such as seasonal influenza [49]. An improved health situation and care of the population would likely also lead to a decrease in the number of severe courses of the disease [50].

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Please cite this publication as
Schmidt C, Reitzle L, Paprott R, Bätzing J, Holstiege J (2021)
Diabetes mellitus and comorbidities – A cross-sectional study with
control group based on nationwide ambulatory claims data.
Journal of Health Monitoring 6(2):19–35.
DOI 10.25646/8327

The German version of the article is available at:
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Data protection and ethics

The analyses conducted in this study are based on anonymised and summarised data. The individual data are kept at the Central Research Institute of Ambulatory Health Care in Germany (Zentralinstitut für die kassenärztliche Versorgung in der Bundesrepublik Deutschland, Zi) and are only accessible to authorised staff.

Funding

The establishment and continuation of a National Diabetes Surveillance at the Robert Koch Institute is funded by the Federal Ministry of Health (funding codes: GE20150323 and GE20190305).

Conflicts of interest

The authors declared no conflicts of interest.

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Imprint

Journal of Health Monitoring

Publisher
Robert Koch Institute
Nordufer 20
13353 Berlin, Germany

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ISSN 2511-2708

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

Journal of Health Monitoring · 2021 6(2)
DOI 10.25646/8329
Robert Koch Institute, Berlin

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Submitted: 18.12.2021
Accepted: 30.04.2021
Published: 16.06.2021

Self-assessed quality of care among adults with diagnosed diabetes in Germany

Abstract

People who have diabetes require regular medical care. The views of patients about the quality of their care are becoming increasingly relevant when it comes to chronic diseases such as diabetes. As part of the nationwide study Disease Knowledge and Information Needs – Diabetes mellitus (2017), data on self-assessed quality of care by people with diagnosed diabetes was collected using the Patient Assessment of Chronic Illness Care – DAWN short form (PACIC-DSF, scale 1 to 5) and analysed for respondents aged 45 years or above. The average score for quality of care was 2.47 and was lower for women than for men (2.33 vs 2.58). The respondents assessed the quality of their care as being worse with rising age and size of the population in their residential area. No significant differences were observed by education group. Overall, people with diabetes in Germany consider the quality of their care to be moderate, which indicates a need for improvement in care.

DIABETES · QUALITY OF CARE · SUBJECTIVE ASSESSMENT · POPULATION · DIABETES SURVEILLANCE

Introduction

Diabetes mellitus is a metabolic disease resulting from disorders in the regulation of blood sugar levels [1] and belongs to the chronic diseases with a high frequency (prevalence) [2]. Diabetes is associated with an increased risk of serious comorbidities and secondary diseases [3] as well as increased mortality [4]. Consequently, people with diabetes need regular, well-coordinated medical care in addition to good self-management [5].

These needs have led to the establishment of evidence-based national guidelines and structured care programmes (disease management programmes) in various countries, including Germany, to ensure that people with diabetes receive a high quality of care [6, 7]. These guidelines and programmes are widely used in practice and include recommendations on medicinal treatment (such as when insulin is necessary), therapy goals (such as controlling blood sugar levels and additional cardiovascular risk factors), self-management (such as self-monitoring of blood sugar levels) and follow-up checks for the early detection of diabetes-related complications. Since its establishment at the Robert Koch Institute (RKI) in 2015, the diabetes surveillance system has been using selected core indicators denoting the quality of care [8] to analyse both the extent to which guideline-based recommendations on the quality of care for people with diabetes are being implemented in Germany, and whether it is changing over time. To this end, data collected from the ongoing DMP docu-

Info box

Studying self-assessed quality of care using the Patient Assessment of Chronic Illness Care – DAWN short form

Introductory question:
What kind of help have you received from your health care team for diabetes management in the past twelve months?

Individual questions:
1. I was asked how diabetes affects my life.
2. I was asked about the effectiveness of my medication and any problems and side effects that may have occurred.
3. I was asked for my wishes and goals when the treatment plan for my diabetes was being drawn up.
4. I was supported in setting specific goals to improve my diabetes management.
5. I was supported in developing plans to meet my diabetes treatment goals.
6. I was supported in developing plans for how I could get support from friends, family or people around me.
7. I was encouraged to attend a specific group or class that will help me manage my diabetes.
8. I was contacted after my visit to the practice to see how I was doing.
9. I was satisfied that my treatment was well organised.

Possible answers:
1 = never, 2 = rarely, 3 = sometimes,
4 = often, 5 = always

mentation compiled by the Central Research Institute of Ambulatory Health Care in Germany (Zi) [9] and from nationwide health surveys are used [10].

In addition to this objective assessment of the quality of care using data on the implementation of the guidelines, the subjective assessment of the quality of care from the perspective of the people affected by diabetes is becoming increasingly important [11]. Self-assessed quality of care is one of the ten supplementary indicators comprising the indicator set of the diabetes surveillance in Germany. Epidemiological studies on self-assessed quality of care in adults with diabetes have not been available for Germany to date. The aim of this study, therefore, is to examine how people with diabetes in Germany assess the quality of the care they receive.

Indicator

The indicator self-assessed quality of care was examined within the framework of the diabetes surveillance as part of the study Disease Knowledge and Information Needs – Diabetes mellitus (2017) conducted by the RKI [12]. In this nationwide health study, adults from the German-speaking resident population in Germany were assigned to two survey sections (representative sample or diabetes sample) using an established procedure. Data was obtained based on a telephone interview, which means that information from the study is self-reported. A detailed description of the study and the instruments used has been published elsewhere [12, 13].

The study enrolled 1,396 people with diagnosed diabetes in the past twelve months. People under 45 years of age were excluded from the analyses due to a small number of cases, as were those without complete information on self-assessed quality of care. The study population then comprised 1,254 participants (597 women, 657 men).

Data for the self-assessed quality of care indicator was collected using a German version of the Patient Assessment of Chronic Illness Care – DAWN short form (PACIC-DSF), which was adapted for diabetes [14]. The instrument comprises nine single questions, eight of which relate to central aspects of patient-oriented care such as patient's wishes and goals in the treatment process and the impact of treatment on their daily life. The last question gathers data on satisfaction with the organisation of treatment overall (Info box). The questions relate to experiences made in the past twelve months and each could be answered with one of five possible answers. The sum of the numerical answer categories from the nine single questions divided by nine forms the PACIC-DSF score. The results are placed on a scale of 1 to 5, with higher values indicating better self-assessed quality of care.

The mean PACIC-DSF score, together with the corresponding 95% confidence interval (95% CI), serves as a measure of the level of self-assessed quality of care in the past twelve months. The results were calculated for the entire group and stratified by sex, age group, education level, population size of residential area and region. Differences with p values <0.05 were considered statistically significant.

A weighting factor was used to correct deviations from the underlying reference population caused by different participation or selection probabilities. This adapted the study sample to the population structure of the reference population (December 31, 2016) in terms of the distribu-

People with diabetes in Germany assess the quality of their care as moderate.

Women with diabetes provide a lower rating of their care than men with diabetes.

tion of sex, age and level of education. The distribution structure of people with diagnosed diabetes from the RKI's German Health Update 2012 (GEDA 2012) was used for adjustment, since the data from the population statistics of the Federal Statistical Office do not facilitate conclusions to be drawn about the German-speaking population aged 18 years or above who are diagnosed with diabetes.

Results and discussion

The mean self-assessed PACIC-DSF score (scale from 1 to 5) for quality of care in people with diagnosed diabetes in the past twelve months in the survey year 2017 was 2.45 (Figure 1). The mean value was 2.33 among women, significantly higher than that among men (2.58), which means that women provided a significantly poorer rating of the quality of the care they received than men. Figure 1 also demonstrates that significantly poorer self-assessments of care are associated with increasing age: the mean PACIC-DSF score in the age group 45 to 64 years is 2.68 compared to 2.13 among people aged 80 years or above. These patterns can be observed in both sexes.

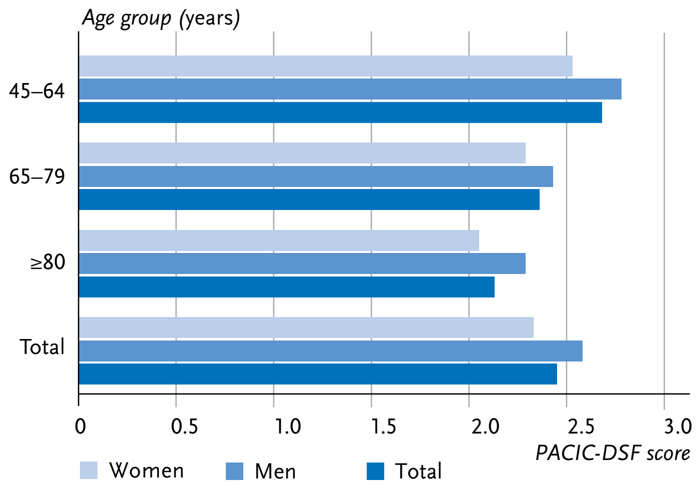
In contrast, only few differences were identified in self-assessed quality of care by education level (Table 1). The mean values of the PACIC-DSF scores for the low, medium and high education group are all similar at 2.42, 2.49 and 2.43, respectively.

A poorer rating of quality of care was also associated with increasing population size of the residential area. The mean PACIC-DSF score is 2.62 for respondents living in a rural area or small town, but drops significantly to 2.33 for those living in a large city. A significant difference in self-assessed quality of care can also be seen between women and men by size of residential area. This pattern is observed among both women and men and is still present even if age has been taken into account (linear regression, data not shown).

The regional distribution of the PACIC-DSF score demonstrates a better self-assessment of quality of care in the central eastern region (Saxony, Saxony-Anhalt and Thuringia) with a mean score of 2.59 compared to 2.34 in the north-eastern region (Berlin, Brandenburg and Mecklenburg-Western Pomerania) and 2.37 in the central western region (Hesse, North Rhine-Westphalia, Rhineland-Palatinate and Saarland). The PACIC-DSF scores for the north-west (Bremen, Hamburg, Lower Saxony and Schleswig-Holstein) and south (Baden-Württemberg and Bavaria) are in between these figures (2.53 and 2.49 respectively, data not shown).

The results of this population-based study show that people with a diagnosed diabetes in the past twelve months

Figure 1
Mean PACIC-DSF score as a measure of the self-assessed quality of care in people aged 45 years or above and with diagnosed diabetes, both in the past twelve months, by sex and age (n=597 women, n=657 men)
Source: Disease Knowledge and Information Needs – Diabetes mellitus (2017)



PACIC-DSF = Patient Assessment of Chronic Illness Care – DAWN short form

Table 1
Mean PACIC-DSF score as a measure of self-assessed quality of care among people aged 45 years or above and with diagnosed diabetes, both in the past twelve months, by education level, size of residential area and sex (n=597 women, n=657 men)
Source: Disease Knowledge and Information Needs – Diabetes mellitus (2017)

Education level	PACIC-DSF score Mean	PACIC-DSF score (95% CI)
Women		
Low education group	2.33	(2.18–2.48)
Medium education group	2.30	(2.18–2.43)
High education group	2.39	(2.16–2.62)
Men		
Low education group	2.53	(2.37–2.70)
Medium education group	2.67	(2.54–2.80)
High education group	2.45	(2.31–2.59)
Total		
Low education group	2.42	(2.31–2.53)
Medium education group	2.49	(2.40–2.59)
High education group	2.43	(2.31–2.55)

Size of residential area	PACIC-DSF score Mean	PACIC-DSF score (95% CI)
Women		
Rural/small town	2.55	(2.38–2.73)
Middle-sized town	2.28	(2.07–2.49)
Metropolitan area	2.27	(2.08–2.47)
Men		
Rural/small town	2.68	(2.53–2.82)
Middle-sized town	2.55	(2.33–2.76)
Metropolitan area	2.38	(2.25–2.52)
Total		
Rural/small town	2.62	(2.51–2.73)
Middle-sized town	2.42	(2.27–2.57)
Metropolitan area	2.33	(2.22–2.45)

PACIC-DSF = Patient Assessment of Chronic Illness Care – DAWN short form, CI = confidence interval

Older people with diabetes tend to assess their care as poorer than younger people.

assess the quality of the care they receive as moderate. Previous studies examining this indicator carried out in Germany have been based on clinical and regional study populations [15–18]; they found a similar or slightly better rating of quality of care than in the present study. Differences in the study design and the version of the PACIC questionnaire used mean that these results are only comparable to a limited extent. The values for quality of care determined by this study were calculated using a complex score derived from the results gained from nine single questions; the scores, therefore, were strongly influenced by the results from the questions about patient involvement in the treatment process. As such, they are not indicative of a general dissatisfaction with medical care, but rather illustrate an inadequate achievement of targets with regard to the patient-centred design of health care processes. In line with patient-centred health care provision to people with chronic illnesses, the PACIC questionnaire focuses on the questions that highlight the views of the people affected in treatment planning and communication with their doctors [17]. It is crucial that people with diabetes are asked how they are coping, how their illness affects their everyday life, how well they react to their medication, and what kind of supports they might need for self-management and towards achieving their treatment goals. Participation in training courses plays an important role here.

Until now, there is hardly any information available on self-assessed quality of care that could be aligned with sociodemographic factors. The sex-difference in self-assessed quality of care could be because women tend to find fault with care issues and expect more consideration from the treatment team. Various other instruments that have studied subjective perceptions have often shown that women tend to provide lower ratings than men. This has

There are slight regional but no educational differences in self-assessed quality of care.

People with diabetes assess the quality of their care as poorer with increasing size of the population in their residential area.

been the case with depressive symptoms [19] and self-assessed health [20] and variation in response behaviours may contribute towards this difference. In addition, it is also possible that a greater need for care and higher levels of psychosocial stress due to increasing health problems contribute to the lower ratings of quality of care that are generally provided by older people compared to younger people.

In summary, the PACIC-DSF score shows that people with diabetes in Germany tend to view the quality of their care as moderate. These results send a clear signal that improvements are needed in medical care provision, particularly in terms of a stronger focus on the needs of patients with diabetes, for example, in implementing treatment plans and treatment goals in their everyday life. The identification of population groups who assess their quality of care as poor highlights areas in which measures need to be put in place to improve the health care provided to people with diabetes. There is a great need for health services research in this area.

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Please cite this publication as
Baumert J, Paprott R, Du Y, Heidemann C, Scheidt-Nave C (2021)
Self-assessed quality of care among adults with diagnosed diabetes in Germany.
Journal of Health Monitoring 6(2):36–42.
DOI 10.25646/8329

The German version of the article is available at:
www.rki.de/journalhealthmonitoring

Data protection and ethics

The ethics committee of the Berlin Chamber of Physicians (Number Eth-23/17) and the Federal Commissioner for Data Protection and Freedom of Information provided ethical approval of this study. At the beginning of the telephone interview, all participants were informed about the voluntary nature of participation, the objectives of the survey and data protection and gave verbal consent to participate.

Funding

The study Disease Knowledge and Information Needs – Diabetes mellitus (2017) is funded by the Federal Ministry of Health (funding code: GE20160358). The establishment and continuation of a National Diabetes Surveillance at the Robert Koch Institute is funded by the Federal Ministry of Health (funding codes: GE20150323 and GE20190305). In addition, this contribution was made possible by a research grant from the German Center for Diabetes Research (DZD), funded by the Federal Ministry of Education and Research (funding code: HMGU2018Z3).

Conflicts of interest

The authors declared no conflicts of interest.

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Imprint

Journal of Health Monitoring

Publisher
Robert Koch Institute
Nordufer 20
13353 Berlin, Germany

Editors
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Typesetting
Kerstin Möllerke, Alexander Krönke

Translation
Simon Phillips/Tim Jack

ISSN 2511-2708

Note
External contributions do not necessarily reflect the opinions of the
Robert Koch Institute.

The Robert Koch Institute is a Federal Institute within
the portfolio of the German Federal Ministry of Health

Journal of Health Monitoring · 2021 6(2)
DOI 10.25646/8331
Robert Koch Institute, Berlin

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Submitted: 21.01.2021
Accepted: 05.05.2021
Published: 16.06.2021

Healthy life years among people with and without diabetes in Germany

Abstract

In addition to life expectancy, the length of time a person can expect to remain free of health-related functional impairments is becoming increasingly important both for the individuals concerned and for society at large. The indicator healthy life years used for this purpose is a key figure for mapping mortality and morbidity. Diabetes is one of the most common chronic diseases and can be associated with health-related functional impairments. In 2014, women and men with diabetes could expect to have significantly fewer healthy life years than people without diabetes; this particularly applies to younger and middle-aged groups. Among 30- to 34-year-olds, for example, women and men with diabetes could expect eleven and twelve fewer healthy life years respectively than people without diabetes. These differences narrow with increasing age. Ensuring that people with and without diabetes have a similar length of lifetime free of health impairments is an important task for public health.

DIABETES · HEALTH IMPAIRMENTS · HEALTHY LIFE YEARS · BURDEN OF DISEASE · DIABETES SURVEILLANCE

Introduction

Diabetes mellitus is one of the most common chronic diseases and its prevalence is increasing throughout the world [1]. Diabetes and its often serious comorbidities and secondary diseases [2], which both are associated with increased mortality [3], require lifelong medical treatment and care. In the past few decades, improvements in health care have contributed to lower mortality among people with diabetes [4, 5] and in turn, to an increasing life expectancy [6, 7]. Nevertheless, people with diabetes still have a lower life expectancy than people without diabetes [6, 8].

The positive developments in life expectancy in Germany have also contributed to an increase in the number of years spent with diabetes [7] and in a higher prevalence of health-related functional impairments [9]. These impairments can result from the comorbidities and secondary diseases associated with diabetes which are often serious [10]. Although people with diabetes now live longer than in previous decades, they also have health problems for longer periods of their life. Increasing life expectancy is making the length of time spent without health-related impairments more important at both an individual and societal level. Health impairments primarily involve difficulties in performing everyday activities (e.g. getting dressed, washing or moving, eating and drinking and taking medication). Considerable impairments here contribute to a significantly reduced health-related quality of life [11].

The European Statistical Office (Eurostat) has defined the “Healthy Life Years” (HLY) indicator as a European structural indicator and as a key figure in studying mortality and morbidity [12]. A central goal for public health in dealing with diabetes, therefore, is ensuring that people with diabetes have a similar number of healthy life years than people without diabetes.

Data on healthy life years among younger and middle-aged people with diabetes have not been available for Germany so far. This gap could be closed within the framework of the diabetes surveillance which has been established at the Robert Koch Institute since 2015. The aim of this article is to compare the figures for healthy life years for people with and without diabetes over a broad age spectrum and for both sexes.

Indicator

The indicator “Healthy Life Years” is defined here as the number of years of life that a person with diabetes can expect to have without health-related functional impairments compared to people without diabetes. For the calculation of this indicator, the prevalences of known diabetes and of health-related functional impairments are taken from the German Health Update (GEDA) 2009, 2010 and 2012 (n=52,112), nationwide telephone health surveys carried out by the Robert Koch Institute. Mortality rates among the general population in 2014, which are also used for the calculation, were provided by the Federal Statistical Office (full survey). The 2014 relative diabetes-related mortality risks are based on health care data from all statutory health insurers (provided in accordance with Germany’s Data Transparency Ordinance, DaTraV, n=47.3 million, population aged 30 years or above). The figures set out in the following are for people aged 30 years or above.

Information about the prevalence of known diabetes was assessed in the GEDA surveys using the question, ‘Have you ever been diagnosed with diabetes by a doctor?’; known diabetes is assumed when respondents answer, ‘Yes’. Data on the prevalence of health impairments is gathered using the question, ‘To what extent do you face permanent restrictions to your daily activities by illness? By permanent we mean for at least six months’; a health impairment is assumed when respondents answer ‘severely limited’. The other possible answers ‘limited but not severely’ and ‘not limited’ form the complementary group. Calculations of the prevalence of diabetes and health impairments were undertaken using summarised data from three GEDA surveys (2009–2012). Weighting factors were used to correct the sample for different selection probabilities and for deviations from the population structure (as of 31 December 2011) with regard to sex, age, education and region. A detailed description of the methodology used in the GEDA surveys 2009, 2010 and 2012 is available in earlier publications [13–15].

The relative diabetes-related mortality risks were calculated using the ratio of the mortality of people with documented diabetes to that of people without documented diabetes. Documented diabetes is defined as a confirmed inpatient diagnosis in at least one quarter or a confirmed documented outpatient diagnosis (E10 to E14) in at least two quarters of one year among people with statutory health insurance. A detailed description of the methodology and preparation of the health care data from statutory

People who have diabetes can expect to have significantly fewer healthy life years than people without diabetes; this particularly applies to younger and middle-aged people.

health insurers can be found online and in an earlier publication [16, 17].

The estimates of healthy life years were calculated in three steps: first, age-specific mortality rates for people with and without diabetes were calculated using age-specific data on mortality rates among the general population, diabetes prevalence and diabetes-related relative mortality risks. Second, diabetes-specific mortality rates were used to calculate the life expectancies of people with and without diabetes. Finally, the Sullivan method [18] was used to estimate healthy life years using data on age-specific life expectancy and the age-specific prevalence of health impairments.

Results and discussion

Between 2009 and 2012, the prevalence of diabetes among women and men aged 30 years or above was 10.4%; the prevalence of health impairments was 13.5% among women and 12.3% among men. These prevalences increase significantly with age. The highest prevalence of diabetes is found among 80- to 84-year-olds at 22.0% in women and 24.6% in men. Women and men aged 90 years or above have the highest prevalence of health impairments (33.8% and 32.5%).

In 2014, women with diabetes (Figure 1) aged 30 to 34 years could expect 36.4 additional healthy life years; men in this age group could expect a further 32.4 healthy life years. Women aged 50 to 54 years could expect 20.3 healthy life years and men 18.7. Women aged 70 to 74 years could expect 9.2 healthy life years and men 8.5. People with diabetes can expect significantly fewer healthy life years than people without diabetes, and this particularly applies to younger and middle-aged groups (Table 1). The difference between the two groups is 11.2 years for women and 11.7 years for men aged 30 to 34 years; 8.8 and 7.4 years among 50- to 54-year-olds, and 4.3 and 3.4 years among people aged 70 to 74 years. Women can expect more healthy life years than men in all age groups, irrespective of their diabetes status. Among people aged 30 to 34 years, a 4.0-year

Figure 1
Remaining healthy life years and life expectancy among women aged 30 years or above without and with diabetes by age group in 2014
Source: GEDA 2009, GEDA 2010, GEDA 2012, Causes of Death Statistics from the Federal Statistical Office 2014, DaTraV data 2013/2014

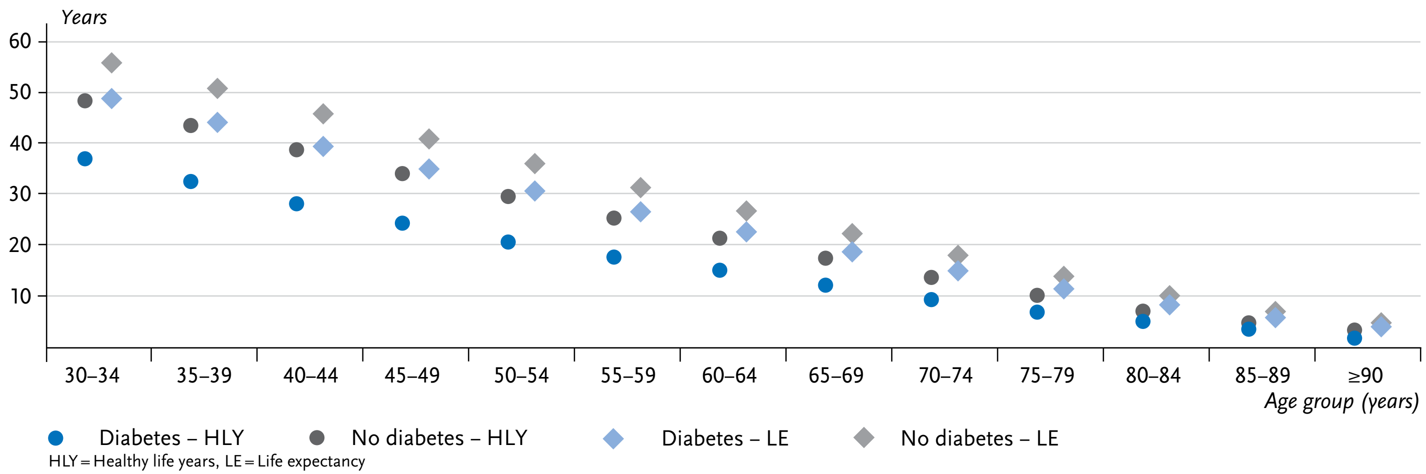
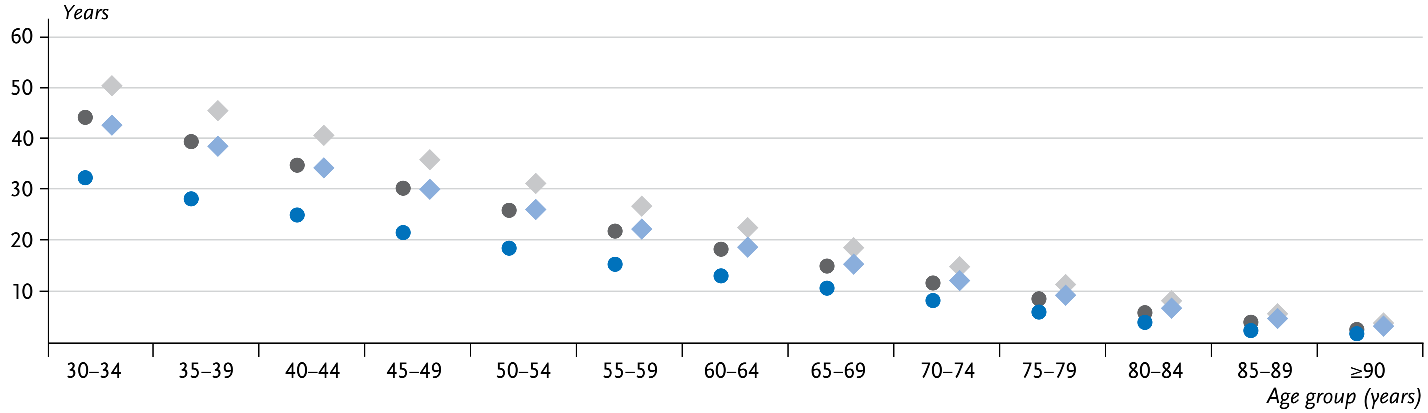


Figure 2
Remaining healthy life years and life expectancy among men aged 30 years or above without and with diabetes by age group in 2014
Source: GEDA 2009, GEDA 2010, GEDA 2012, Causes of Death Statistics from the Federal Statistical Office 2014, DaTraV data 2013/2014



HLY = Healthy life years, LE = Life expectancy

The number of healthy life years that people with and without diabetes can expect to have becomes similar with increasing age.

difference in healthy life years was identified between women and men with diabetes and 3.5 for those without diabetes. This difference decreases with age and is lower than twelve months as of 80 years-of-age.

Women aged 30 to 34 years with diabetes have a remaining life expectancy of 48.0 years (Figure 1), whereas the life expectancy among men is 42.6 years (Figure 2). However, women with diabetes in this age group still have around twelve fewer healthy life years, and men with diabetes around ten fewer healthy life years than their peers without diabetes. Healthy life years make up 75.8% of the remaining life expectancy for women with diabetes aged 30 to 34 years and 86.7% of the remaining life expectancy for women without diabetes; the figures are similar for men at 76.0% and 87.8%. These figures decrease equally for both sexes with rising age, irrespective of diabetes status.

Diabetes can be associated with serious comorbidities and secondary diseases [2] that can result in significant health-related functional impairments [8], premature mortality [19] and fewer healthy life years. The present study indicates that women and men with diabetes in Germany can expect significantly fewer healthy life years than those without diabetes, and that this finding particularly applies

Table 1
Difference between healthy life years for people without and with diabetes aged 30 years or above
Source: GEDA 2009, GEDA 2010, GEDA 2012, Causes of Death Statistics from the Federal Statistical Office 2014, DaTraV data 2013/2014

	Women		Men	
Age group	Difference	(95% CI)	Difference	(95% CI)
30–34 years	11.2	(10.3–12.1)	11.7	(10.6–12.9)
35–39 years	10.8	(9.9–11.7)	11.1	(10.1–12.2)
40–44 years	10.4	(9.6–11.3)	9.7	(8.9–10.5)
45–49 years	9.6	(8.8–10.4)	8.6	(7.9–9.4)
50–54 years	8.8	(8.0–9.5)	7.4	(6.7–8.0)
55–59 years	7.5	(6.8–8.2)	6.5	(5.8–7.1)
60–64 years	6.2	(5.5–6.8)	5.2	(4.6–5.7)
65–69 years	5.2	(4.6–5.8)	4.3	(3.7–4.9)
70–74 years	4.3	(3.7–4.9)	3.4	(2.9–4.0)
75–79 years	3.2	(2.6–3.9)	2.6	(2.0–3.2)
80–84 years	2.0	(1.3–2.6)	1.9	(1.2–2.6)
85–89 years	1.2	(0.5–2.0)	1.6	(0.7–2.6)
≥90 years	1.6	(0.4–2.8)	0.8	(-0.7–2.3)

CI = confidence interval

Women can expect to have more healthy life years than men; this applies to women with and without diabetes.

to younger and middle-aged groups. An earlier study of people aged 65 years or above using relative diabetes-related mortality risks from the 12-year mortality follow-up of the German National Health Interview and Examination Survey 1998 (GNHIES98) in place of DaTraV data but also using prevalences of health impairments from the GEDA surveys 2009 to 2012, as is the case with the present study, reported similar results [19].

When discussing the results presented here in the context of the literature, it should be noted that the instruments used for assessing health impairments and definitions of the construct 'health impairment' can differ significantly. This means that a direct comparison of the figures on healthy life years is often only possible to a limited extent. With respect to differences in healthy life years between people with and without diabetes, similar figures to those differences presented here have been identified by other studies [8, 20, 21], even though they used other instruments (e.g. Activities of Daily Living, ADL, and Instrumental Activities of Daily Living, iADL) and observation periods and different prevalences of health-related impairments. Irrespective of their diabetes status, women can expect to have a higher life expectancy as well as to have more life years free of health impairments than men. These differences between the sexes have been observed worldwide for a long time and are mainly explained by biological and behavioural factors [22]. With increasing age, the remaining length of time that people with or without diabetes can expect to remain free from health impairments becomes similar. This is to be expected, due to people's limited lifespan.

In summary, the figures for healthy life years and life expectancy are significantly lower for women and men with diabetes than those without diabetes, and this finding particularly applies to younger and middle-aged groups. Women can expect more healthy life years and a longer life expectancy than men, regardless as to whether they have diabetes or not. Improvements in diabetes care will be necessary in order to reduce the severity of health-related functional impairments.

Within the framework of the diabetes surveillance, future analyses of healthy life years should also focus on identifying particularly disadvantaged groups and regions so as to determine where effective health policy measures need to be put in place to reduce these differences.

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Please cite this publication as
Baumert J, Heidemann C, Reitzle L, Schmidt C (2021)
Healthy life years among people with and without diabetes in Germany.
Journal of Health Monitoring 6(2): 43–50.
DOI 10.25646/8331

The German version of the article is available at:
www.rki.de/journalhealthmonitoring

Data protection and ethics

GEDA 2009, 2010 and 2012 were approved by the Federal Commissioner for Data Protection and Freedom of Information (BfDI). Verbal consent to participate was obtained from all respondents at the beginning of the telephone interview.

Funding

The establishment and continuation of a National Diabetes Surveillance at the Robert Koch Institute is funded by the Federal Ministry of Health (funding codes: GE20150323 and GE20190305).

Conflicts of interest

The authors declared no conflicts of interest.

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Imprint

Journal of Health Monitoring

Publisher
Robert Koch Institute
Nordufer 20
13353 Berlin, Germany

Editors
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Typesetting
Kerstin Möllerke, Alexander Krönke

Translation
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ISSN 2511-2708

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

Journal of Health Monitoring · 2021 6(2)
DOI 10.25646/8333
Robert Koch Institute, Berlin

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Submitted: 15.02.2021
Accepted: 29.04.2021
Published: 16.06.2021

Utilisation of outpatient medical services by people with diagnosed diabetes during the COVID-19 pandemic in Germany

Abstract
People with diabetes regularly need outpatient medical care due to their disease and possible concomitant and secondary illnesses. Using data from the nationwide GEDA 2019/2020-EHIS survey conducted from April 2019 to September 2020, the present study examines developments in outpatient utilisation behaviour during the measures put in place to contain the SARS-CoV-2 pandemic. During the observation period, people with diabetes had a significantly higher rate of utilisation of medical services provided by general practitioners (GPs) and specialists than the population as a whole. In the spring of 2020, when the restrictions were put in place, utilisation of specialist medical services by people with diabetes decreased temporarily by 46% compared to the 2019 reference period. In contrast, no relevant decline in the utilisation of medical services provided by GPs was observed, but this could be related to adaptations of care provision through telephone consultations for people with regularly requiring GP office visits. The issue examined here requires further observations in view of the renewed containment measures.

UTILISATION · MEDICAL SERVICES · DIABETES · SARS-COV-2 · COVID-19 · GEDA

Introduction
Since the beginning of 2020, SARS-CoV-2 has also been spreading in Germany. In addition to general hygiene measures, observing social distancing rules and wearing a mouth and nose cover, certain phases of stricter contact restrictions have been put in place during the pandemic as part of the non-pharmaceutical measures aiming at containing SARS-CoV-2 infection. In March 2020, the German government in agreement with the federal states decided to implement comprehensive measures for infection control and capacity redistribution for outpatient and inpatient care in addition to general contact restrictions. These measures were gradually phased out between the end of April 2020 and the end of October 2020, but were put in place again in November 2020 [1]. Accounting data from the statutory health insurance (SHI) and the Associations of SHI Physicians (Kassenärztliche Vereinigungen) show that these measures have had an impact on the provision of outpatient and inpatient care [2–4]. However, until now, very limited information has been available on utilisation behaviour by people with chronic illnesses [4, 5]. Results from the closely conducted telephone-based COSMO (COVID-19 Snapshot Monitoring) survey indicate that the majority of adults with chronic illnesses were able to attend necessary doctor's appointments and receive necessary medications largely without restrictions during the first stage of the containment measures [5].

GEDA 2019/2020-EHIS

Fifth follow-up survey of the German Health Update

Data holder: Robert Koch Institute

Objectives: Provision of reliable information on the health status, health behaviour and health care of the population living in Germany, with the possibility of European comparisons

Study design: Cross-sectional telephone survey

Population: German-speaking population aged 15 and older living in private households that can be reached via landline or mobile phone

Sampling: Random sample of landline and mobile telephone numbers (dual-frame method) from the ADM sampling system (Arbeitskreis Deutscher Markt- und Sozialforschungsinstitute e.V.)

Sample size: 23,001 respondents

Study period: April 2019 to September 2020

GEDA survey waves:
- GEDA 2009
- GEDA 2010
- GEDA 2012
- GEDA 2014/2015-EHIS
- GEDA 2019/2020-EHIS

Further information in German is available at www.geda-studie.de

People with diabetes mellitus belong to the group of chronically ill people and need continuous medical care. They also belong to the risk group for severe courses of COVID-19 [6–9]. This particularly applies to those who have poor control of their blood sugar levels or complications, regardless of whether they have type 1 or type 2 diabetes [6]. Fear of being infected with SARS-CoV-2 and changes in the health care delivery may have led people with diabetes to avoid visiting a doctor's office. Further, it is important to understand how long such changes in health care utilisation have lasted.

The present study uses data from the nationwide, population-based GEDA 2019/2020-EHIS study to help answer the following questions: (1) How has the use of general practitioner (GP) and specialist services developed among people with diabetes during the observation period from April 2019 to September 2020? and (2) Was there a reduction in health care utilisation among people with diabetes during the containment measure period in the spring of 2020 compared to the corresponding period in 2019?

Indicator

Definition of the indicators on the utilisation of outpatient GP and specialist services was based on the answers of participants to the questions about visits to GPs and specialists in the four weeks prior to the interview. Information on the utilisation of medical services provided by GPs was collected using the question 'How often have you consulted a GP in the last 4 weeks for advice, an examination or treatment?'; this question was accompanied by the following note: 'Please include visits to medical practices, home visits and consultations provided over the telephone'. Data on the utilisation of specialist medical services was collected using an adapted version of the same question and was accompanied by the following note: 'This does not include visits to a dentist or general practitioner'. The answers provided were used to establish two dichotomous variables which differentiated between people who had or had not used medical services provided by a GP or specialist. Diabetes status was determined using answers from the question 'Have you had any of the following illnesses or complaints in the last 12 months?'. The answer categories provided a list of diseases and conditions, one of which was 'diabetes (not including gestational diabetes)'. The survey did not collect any data about diabetes type, duration of illness, treatment (insulin, tablets and combinations) or diabetes-specific complications.

The following analyses are based on data from GEDA 2019/2020-EHIS, which was carried out as a telephone survey of the resident population in Germany aged 15 years or above [10]. The sample comprised 23,001 individuals who participated in the survey during the period of April 2019 to September 2020. No information was available for 192 participants on diabetes status or utilisation of medical services provided by GPs or specialists. Of the remaining 22,809 participants, a total of 2,044 (938 women, 1,106 men) who reported diabetes in the last twelve months were included in this analysis. A period of the twelve calendar weeks (CW) from CW 15 to CW 26 (i.e. beginning of April through end of June) in 2020 was considered as the time period of containment measures. Since utilisation of medical services can be affected by the seasons, the same period from CW 15 to CW 26 in 2019 was used as comparison

The utilisation of specialist medical services by people with diabetes significantly declined during the containment period.

period to examine the potential impact of the pandemic on the utilisation of medical services [10]. The analysis for health care utilisation from CW 15 to CW 26 are based on the responses of 256 people with diabetes in 2019 and 351 people with diabetes in 2020.

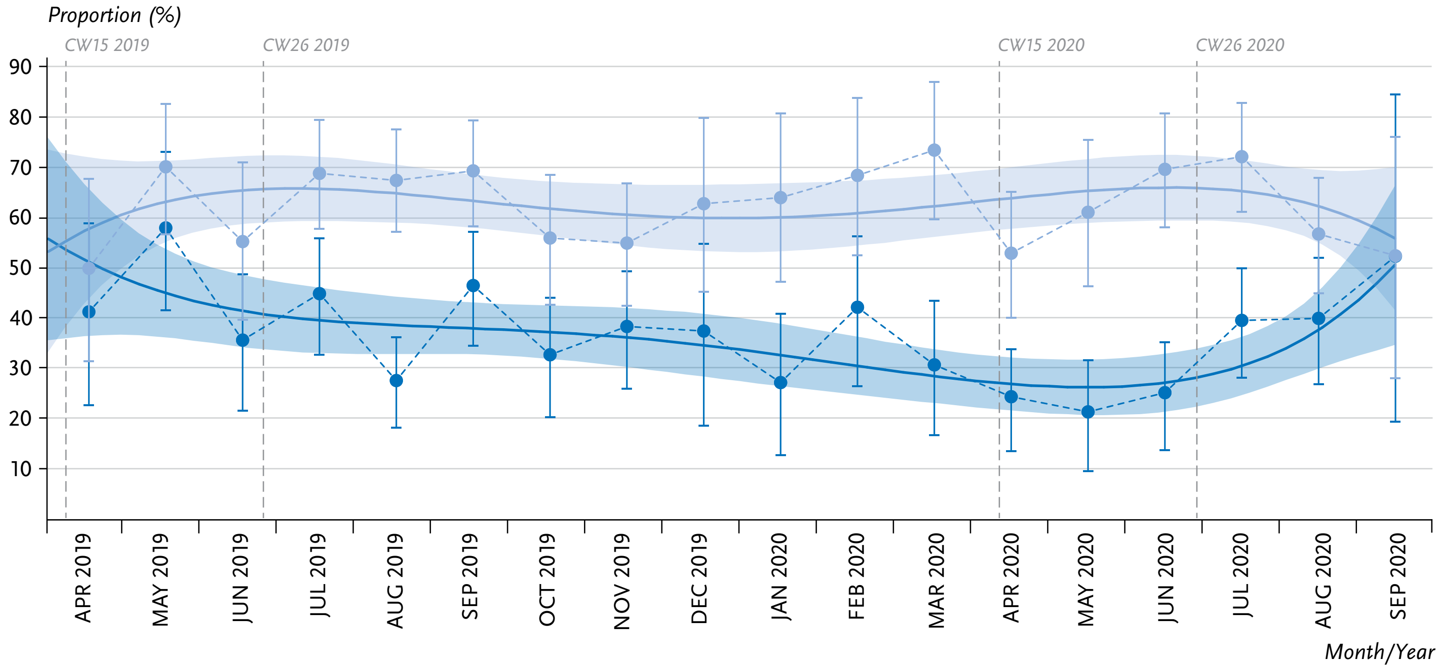
In order to map possible changes in the utilisation of outpatient GP and specialist medical services during the observation period from April 2019 to September 2020, three logistic regression models were fitted each with age, sex, education and federal state as independent control variables (adjustment). A detailed description of the modelling undertaken and the software used has been published elsewhere [10]. The models allow estimation of adjusted proportions and 95% confidence intervals (CI) for the utilisation of GP and specialists medical services monthly (model 1) and weekly (smoothed, i.e. weekly fluctuations adjusted in proportions, model 2) for the entire observation period from April (CW 14) 2019 to September (CW 36) 2020 as well as for the comparison periods from CW 15 to 26 in 2019 and 2020 (model 3). A significant difference between the comparison periods is assumed if the p-value of the binary variable used to differentiate between the periods is <0.05. The analysis was done using survey procedures. A weighting factor was used throughout the analysis, which corrected deviations from the population structure in terms of the distribution of age, sex, federal state and district type as of 31 December 2018 as well as the distribution of education according to the International Standard Classification of Education (ISCED classification) in the 2018 microcensus; the survey dates before and after the containment measures came into force were also taken into account here [10].

Results and discussion

During the observation period of April 2019 to September 2020, a total of 58.1% (95% CI 54.5%–61.7%) of respondents who had diabetes in the last twelve months used medical services provided by a GP in the last four weeks prior to their interview, 32.9% (95% CI 29.8%–36.1%) used medical services provided by a specialist.

Figure 1 demonstrates fluctuations in the monthly figures on the utilisation of medical services provided by GPs and specialists for people with diabetes. In addition to the seasonal fluctuations that are also seen among the general population [10], the monthly fluctuations are at least partly due to the relatively low number of cases available for this study. In terms of the utilisation of medical services provided by GPs, one of the highest monthly values can be seen in March 2020; this is followed by a clear, short-term decline in April 2020 to one of the lowest monthly values, before an equally clear, rapid increase in utilisation from May 2020. This results in an overall relatively horizontal smoothed curve for the period from CW 15 to 26 of 2020. In contrast, a very low monthly value in April 2020 is followed by similarly low monthly values in May and June 2020 for the utilisation of specialist medical services; then it increases again from July 2020. This is reflected in the lowest point of the smoothed curve for the period from CW 15 to 26 of 2020. A comparison of CW 15 to 26 in 2019 and 2020 found no statistically significant difference in the adjusted proportions of utilisation of medical services provided by GPs (58.8%, 95% CI 50.3%–67.3% vs. 62.0%, 95% CI 54.8%–69.3%). However, it did highlight a significant reduction in the utilisation of specialist services, which dropped by 46% from 43.4% (95% CI 34.4%–52, 3%) to 23.6% (95% CI 17.6%–29.7%).

Figure 1
Outpatient medical services utilisation in the last four weeks by people with diabetes in the observation period between April 2019 and September 2020 (adjusted proportions*)
Source: GEDA 2019/2020-EHIS



Points with vertical lines = monthly percentages with 95% CI, lines with tunnel = smoothed weekly percentages with 95% CI
CW = calendar week, CI = confidence interval
* adjusted for age, sex, education and federal state

The utilisation of specialist medical services by people with diabetes began to increase again once the measures were relaxed.

In a previous, comparable study conducted among the general population, the proportion for the utilisation of medical services provided by GPs or specialists in the period from April 2019 to September 2020 was consistently lower [10] than that among people with diabetes in the present study. In addition, a comparison of CW 15 to 26 in 2019 and 2020 based on the general population observed a temporary reduction in the utilisation of medical services provided by GPs (38.4% vs. 29.7%) and specialists (30.0% vs. 17.7%) [10]. The overall significantly higher rate of utilisation by people with diabetes than by the population as a whole is plausible due to their continuous need for health care. Further, people with diabetes also tend to be older, and thus have more health problems. In the general population, the smoothed curves for GP and specialist service utilisation run almost parallel to one another throughout almost the entire observation period with each curve reaching its lowest point within the period of containment measures. Among people with diabetes, with the exception of the ends of the smoothed curves (as these values are difficult to interpret due to small number of cases and resulting broad confidence

No significant decline in the utilisation of medical services provided by GPs among people with diabetes was observed during the containment period.

People with diabetes have a much higher proportion of utilising medical services provided by GPs and specialists than the general population – this also applied during the containment period.

intervals), few changes were observed in the utilisation of medical services provided by GPs, whereas marked changes are identifiable in the case of specialist medical services utilisation. One possible explanation for this is that necessary visits to GP office for the immediate care of diabetes were also largely made during the pandemic [11] or could have been replaced by telephone consultations (and this was also specifically mentioned in the question used for data collection). This is consistent with the observations in the COSMO study that most people with chronic diseases were still able to make the necessary visits to doctors and received the necessary medication [5]. Additional specialist visits are more likely to be occasion-based, such as if complications occur or to carry out guideline-based preventive measures (e.g. examinations of the ocular fundus every one or two years as part of the diabetes disease management programmes that have been operating in Germany since 2003/2004 [12]). Even if the results of this analysis need to be interpreted with caution due to the moderate number of cases available for each month, accounting data from the Associations of SHI Physicians (Kassenärztliche Vereinigungen) also demonstrate that the sharpest decreases occurred at the beginning of the pandemic compared to the corresponding period of the previous year, especially in terms of specialist medical care that required direct contact with patients [3]. Alongside the decrease in treatment involving direct contact until the end of May 2020, these data also indicate a rise in telephone and video consultations, which was interpreted by the authors as an adaption in the provision of care [3]. However, specialist medical examinations (e.g. of the ocular fundus and neurological examinations) cannot be carried out in this manner [13]. From the end of May 2020, therefore, accounting data also indicates that direct face-to-face contacts to patients increased again across all medical specialty groups.

In summary, during the first phase of the measures put in place to contain the SARS-CoV-2 pandemic (spring 2020), utilisation of medical services provided by GPs and specialists to the general population temporarily decreased compared to the same period in 2019. In contrast, utilisation of medical services provided by GPs to people with diabetes remained at a similar level to 2019, and this may be due to fewer patients forgoing their regular treatment, or the use of telephone consultations. In the spring of 2020, utilisation of medical services provided by specialists to people with diabetes decreased by 46% compared to the corresponding period in 2019; however, it rose again quickly from July 2020, which may indicate that patients began to visit practices again. Further observation of utilisation-related behaviour, but also of the self-assessed quality of care of diabetes and other chronic diseases, will be required during the further course of the pandemic. This is important in order to identify recurring interruption in health care utilisation, health-related and subjectively-perceived impairments, and to provide appropriate needs-based care for people with chronic illnesses.

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Please cite this publication as
Du Y, Baumert J, Damerow S, Rommel A, Scheidt-Nave C et al. (2021) Utilisation of outpatient medical services by people with diagnosed diabetes during the COVID-19 pandemic in Germany. Journal of Health Monitoring 6(2): 51–58.
DOI 10.25646/8333

The German version of the article is available at:
www.rki.de/journalhealthmonitoring

Data protection and ethics

GEDA 2019/2020-EHIS is subject to strict compliance with the data protection provisions set out in the EU General Data Protection Regulation (GDPR) and the Federal Data Protection Act (BDSG). The Ethics Committee of the Charité – Universitätsmedizin Berlin assessed the ethics of the study and approved the implementation of the study (application number EA2/070/19). Participation in the study was voluntary. The participants were informed about the aims and contents of the study and about data protection and provided written informed consent.

Funding

GEDA 2019/2020-EHIS was funded by the Robert Koch Institute and the German Federal Ministry of Health.

Conflicts of interest

The authors declared no conflicts of interest.

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Imprint

Journal of Health Monitoring

Publisher
Robert Koch Institute
Nordufer 20
13353 Berlin, Germany

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ISSN 2511-2708

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

Journal of Health Monitoring · 2021 6(2)
DOI 10.25646/7146
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Submitted: 01.07.2020
Accepted: 11.09.2020
Published: 16.06.2021

Needs of the population in Germany for information about health-related topics – Results from the KomPaS study

Abstract
Very few investigations have been conducted in Germany into the areas in which the population, including patients, lacks information about health-related issues. However, data from these areas provide crucial supplements to the descriptions and scientific analyses of health information behaviour that are more often available. Data on gaps in the population's knowledge about health-related issues provide indications of health policy challenges. The Alliance for Health Competence, the German National Health Targets and the German National Health Portal, which was commissioned by the German Federal Ministry of Health, have all taken up this issue. The 2017 study 'KomPaS: survey on communication and patient-safety' was conducted by the Robert Koch Institute (RKI). The KomPaS study used the response categories 'fairly well' informed and 'fairly poorly' informed to assess how well-informed people feel when it comes to health-related issues. A comparison of the results from the supplementary survey conducted as part of the German Health Update (GEDA) 2009 and those of the KomPas study demonstrate varying degrees of improvement in the population's level of health information in all areas over a period of almost ten years.

HEALTH INFORMATION NEEDS · HEALTH CARE · PATIENT-FOCUSED · KOMPAS STUDY

Introduction

The population is very interested in health-related issues. This is also clear from the Fact sheet Searching for health information on the Internet – Results from the KomPaS study, which is published in this issue of the Journal of Health Monitoring. The Internet is an essential source of information and people are increasingly turning to it. However, traditional media such as television, radio and newspapers as well as conversations with doctors, family and friends are still important sources of information about health and illness. The relevance of the topic 'searching for health information' is, inter alia, reflected by other factors, increased levels of research and the rise in activities undertaken in this area. In addition to the large number of scientific studies published in recent years [1–5], health policy initiatives are also taking up this issue and its associated challenges [6–8]. These initiatives include the Alliance for Health Competence, the German National Heath Targets and the German National Health Portal, with the latter set up on behalf of the German Federal Ministry of Health. The National Action Plan for Health Literacy also discusses key aspects of this area and draws up a number of relevant measures.

Although a large number of descriptions and analyses focus on health information behaviour in different contexts,

KomPaS study

KomPaS: survey on communication and patient-safety

Data holder: Robert Koch Institute

Objectives: Describe informational needs, health literacy, patient safety, informed decision-making and physician's counselling from the population's point of view as part of patients' information, decision-making and communication-related behaviour and the doctor-patient relationship.

Survey method: Computer-assisted telephone interview survey

Study design: Cross-sectional study

Population: German-speaking resident population in private households in Germany aged 18 or over

Sampling: Telephone sample comprising 60% landline and 40% mobile phone numbers

Survey period: May to September 2017

Response rate: 17.2%

Sample size: 5,053 participants

far fewer studies analyse gaps in the population's (including the patient's) knowledge and, therefore their information needs. However, studies that have investigated this issue, such as the German Health Update (GEDA) 2009 supplementary survey, which was conducted by the Robert Koch Institute (RKI), have identified a considerable need for information. This particularly applies to practical advice, and the information needed to make health care-related decisions. The study found that there are especially lacks of information in the population about the quality of health care services [2], about people's satisfaction with various aspects of medical care (e.g. time, information, communication) [2], about exercising their rights and making complaints [2].

The RKI's study 'KomPaS: survey on communication and patient-safety' took up this public health challenge with a number of specific questions. The aim was to determine the current information needs of the population in Germany. The study also compared its results with those of the GEDA 2009 supplementary survey in order to investigate trends.

Indicator

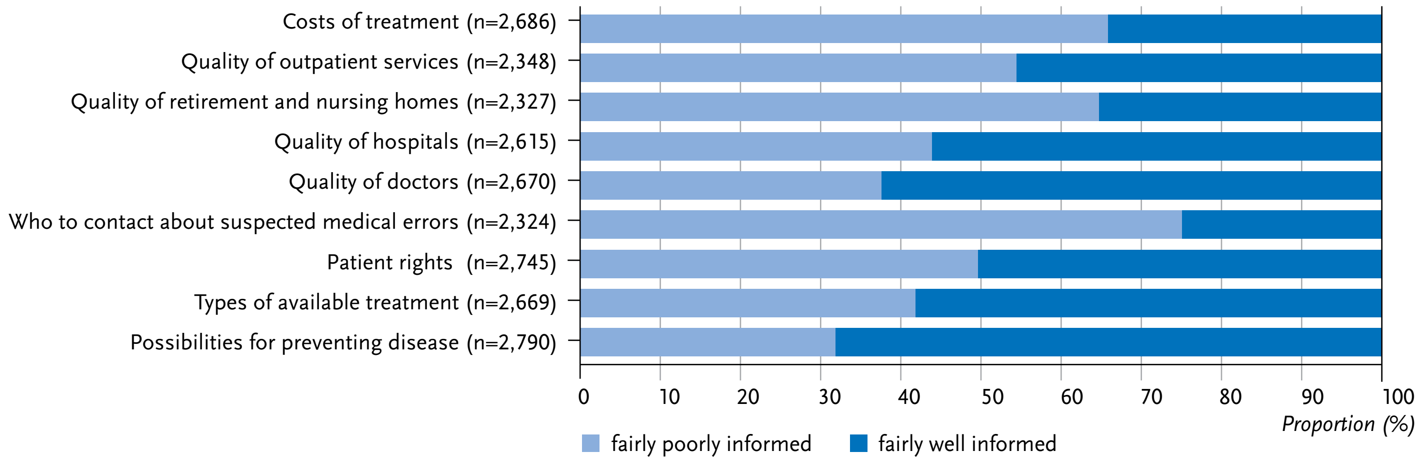
The KomPaS study and the GEDA 2009 supplementary survey asked participants to provide a self-assessment of how well informed they felt about various health-related issues (response categories: 'fairly well' informed and 'fairly poorly' informed). Data for the 'health information needs' indicator was collected using nine items: a set of questions about information on disease prevention and the different types of treatment available in the event of illness, two items about information issues relevant to patient-oriented health care (patient rights and who to contact about suspected medical errors) and items about their level of information concerning quality aspects in four health care areas.

The results (prevalences) of the KomPaS study are reported by sex, age group and socioeconomic status (hereinafter also referred to as social status) with 95% confidence intervals (95% CI). An indicator is used for social status that was developed using information provided by the respondents about their level of education, occupation and income. Statistical methods were used to test whether differences identified between groups were statistically significant. A statistically significant difference between groups is assumed if the corresponding p-value is less than 0.05. Statistically significant differences are explicitly stated. All analyses were carried out descriptively using the survey procedures provided by STATA SE 15.1 [9]. The analyses are based on data from a total of 5,053 participants aged 18 or older (56.7% women, 43.3% men). In order to ensure that the results can be viewed as representative, all calculations were carried out using a weighting factor that corrects deviations within the sample from the population structure (as of 31 December 2016).

Results and discussion

As Figure 1 and Figure 2 demonstrate, a large percentage of the population feels well informed about health information concerning disease prevention (68.4% overall). This applies equally to women and men (68.2% vs 68.6%). Evaluations undertaken by the KomPaS study demonstrate that older people feel better informed about health-related issues than younger people (this difference is statistically

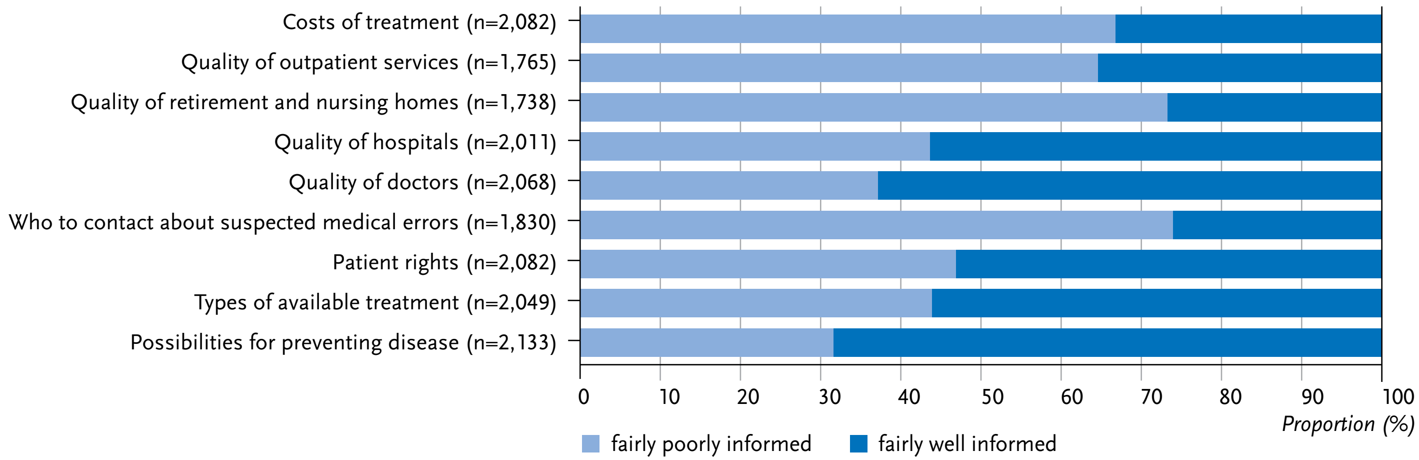
Figure 1
Percentage of women who feel 'fairly poorly' or 'fairly well' informed about selected health issues
Source: KomPaS study (2017)



People have an urgent need for practical advice and information that can be used to make health care-related decisions.

significant). This could be explained by the fact that people's health tends to deteriorate with age and thus older people are presumably more interested in this topic. Although 58.2% of women and 56.3% of men surveyed report that they are 'fairly well' informed about the various forms of treatment available in case of illness, 42.8% of the overall population feels 'fairly poorly' informed about this issue. A relatively large percentage of the population articulates a need for information that would enable them to make their own decisions about health care (74.5% item 'who to contact about suspected medical errors', and 48.2% item 'patient rights'). The desire for information about the quality of health care institutions should also be interpreted in this context: as sovereign users of health

Figure 2
Percentage of men who feel 'fairly poorly' or 'fairly well' informed about selected health issues
Source: KomPaS study (2017)



People particularly lack information about patient rights, who to contact in cases of suspected medical errors and about quality aspects and costs. However, this situation has improved since 2009.

care services, people want to be able to make informed decisions for or against a particular health care provider. Women and men feel least well informed about the quality of retirement and nursing homes (68.8% in total) and about the quality of outpatient care services (59.2% in total). Women feel better informed (35.3% and 45.6%) about these quality aspects than men (26.9% and 35.6%). This difference is statistically significant. However, men feel somewhat better informed than women (52.5% and 56.2%) about the quality of doctors (63.1%) and the quality of hospitals (56.6%).

The analyses undertaken for the KomPaS study show a rise in the percentage of people who feel 'fairly well' informed about all items surveyed in 2009 (Table 1).

The subject areas in which the majority of the population felt 'fairly poorly' informed when the GEDA supplementary survey was carried out (2009) include who to contact about suspected medical errors, the quality of retirement and nursing homes and outpatient care services, as well as the cost of treatment. The results of the 2017 KomPaS study show that these issues are still the most relevant in terms of women's and men's greatest information needs in Germany.

Table 2 sets out results from the KomPas study with regard to the population's information about the quality of health care services. Stratification by sex, age group, social status and health insurance (statutory/private) provides indications about population group-specific differences in information needs.

For many years, discussions have been ongoing about the lack of information on quality available to the population [10–13]. The introduction of the Hospital Report, the 'White List' and other measures [12] should improve the transparency of this type of information. In-depth analyses of whether this approach has been successful are currently lacking. However, various studies [11–15] demonstrate a significant need among users of the health care system and patients for information about quality. 81% of those surveyed in a study by the Bertelsmann Stiftung in 2018 [16] stated that more information about quality in the health care sector would help them to find a suitable service provider. At the same time, the respondents viewed the value of such data for quality development in the health care system as very high. One in four individuals is concerned that a lack of information might prevent them from finding the right doctor. Analyses of data from the KomPaS study supplement these results and indicate that quality-related information should take the needs of target groups into account (Table 2).

Figure 1 and Figure 2 demonstrate women's and men's levels of information about health-related issues. The significant differences between the sexes (see quality of retirement and nursing homes as well as outpatient care services) probably indicates the existence of sex-related differences due to the assumption of specific roles. Women are far more likely to take on the role of carer in the family than men [17, 18]. As such, they may also obtain information more frequently, and, consequently, be more likely to

Table 1
Percentage of people who feel 'fairly well' informed about various health-related issues (GEDA 2009 supplementary survey n=2,998 women and men; KomPaS study 2017 n=5,053 women and men)
Source: GEDA supplementary survey (2009), KomPaS study (2017)

	GEDA 2009 supplementary survey	KomPaS 2017
Possibilities for preventing disease	63.0%	69.0%
Types of available treatment	54.5%	57.0%
Who to contact about suspected medical errors	12.0%	25.5%
Quality (doctors, hospitals, nursing homes, outpatient care services)	20%–35%	30%–60%
Treatment costs	20.0%	34.0%

Table 2
Percentage of the population that feels 'fairly poorly' informed about the quality of health care services by sex, age, socioeconomic status and health insurance
Source: KomPaS (2017)

68.4% of the population feels 'fairly well' informed when it comes to disease prevention; 57.2% feels 'fairly well' informed concerning information about the various forms of treatment available in cases of illness.

	Quality of doctors (N=4,738)		Quality of hospitals (N=4,626)		Quality of retirement and nursing homes (N=4,065)		Quality of outpatient nursing services (N=4,113)	
	% (n)	(95% CI)	% (n)	(95% CI)	% (n)	(95% CI)	% (n)	(95% CI)
Sex					***		***	
Women	37.5 (2,670)	(34.9–40.1)	43.8 (2,615)	(41.2–46.6)	64.7 (2,327)	(61.9–67.5)	54.4 (2,348)	(51.5–57.2)
Men	36.9 (2,068)	(34.2–39.7)	43.4 (2,011)	(40.5–46.3)	73.1 (1,738)	(70.2–75.8)	64.4 (1,765)	(61.2–67.4)
Total	37.2 (4,738)	(35.3–39.1)	43.6 (4,626)	(41.6–45.6)	68.8 (4,065)	(66.8–70.7)	59.2 (4,113)	(57.1–61.3)
Age group	***		***		***		***	
18–29 years	36.2	(30.4–42.4)	41.9	(35.7–48.2)	71.4	(64.2–77.6)	59.2	(52.3–65.8)
30–44 years	46.5	(41.8–51.2)	51.1	(46.2–55.9)	74.9	(70.3–79.1)	68.2	(63.1–72.9)
45–64 years	40.7	(38.0–43.4)	48.7	(45.9–51.6)	70.9	(68.0–73.6)	62.2	(59.2–65.1)
≥65 years	24.5	(22.0–27.1)	30.4	(27.7–33.2)	58.3	(55.0–61.6)	46.6	(43.4–49.9)
Socioeconomic status	***		***		***		***	
Low	30.0	(24.4–36.2)	36.9	(30.8–43.5)	64.1	(57.3–70.4)	48.3	(41.5–55.1)
Medium	35.1	(32.7–37.6)	42.3	(39.7–44.9)	66.9	(64.2–69.5)	57.7	(54.9–60.4)
High	46.3	(43.2–49.5)	50.5	(47.4–53.6)	76.0	(73.2–78.6)	70.9	(67.8–73.7)
Health insurance					*		***	
Statutory	36.6	(34.5–38.6)	43.0	(40.9–45.2)	68.2	(66.0–70.4)	57.1	(54.7–59.4)
Private	40.5	(35.7–45.4)	46.9	(42.1–51.7)	73.5	(68.7–77.8)	71.1	(66.1–75.6)

CI = confidence interval, *$p < 0.05$, ***$p < 0.001$

rate themselves as better informed. The differences between the age groups considered here are significant for all quality-related items and predominantly result in the expected picture of a lower level of information among younger age groups than among older ones. However, the very high proportion of older women and men who feel 'fairly poorly' informed about the quality of retirement and nursing homes is particularly striking. This difference is associated with social status: people in the higher social status group feel 'fairly poorly' informed about the quality areas considered compared with the medium and lower status groups. This result presumably reflects different expectations about the quality of care providers and the corresponding provision of information. This might also explain the differences between the information needs of people with statutory and private health care as it is likely that various socioeconomic differences exist between these two groups.

In summary, the results of the KomPaS study presented here show that there is still a great need for information among women and men about transparency in the health care system (e.g. information about quality and who to contact about suspected medical errors) and patients' rights. However, the gaps in the other areas listed here also need to be filled by further improving health literacy and

Differences were identified by age, sex and socioeconomic status in terms of how well-informed people feel about health-related issues.

patient sovereignty. The results of the KomPaS study strengthen knowledge about the population's information needs, and can contribute to shaping and developing the German National Health Portal.

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Please cite this publication as
Horch K (2021)
Needs of the population in Germany for information about health-related topics – Results from the KomPaS study.
Journal of Health Monitoring 6(2): 59–66.
DOI 10.25646/7146

The German version of the article is available at:
www.rki.de/journalhealthmonitoring

Data protection and ethics

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The participants were informed about the aims and content of the study as well as about data protection, and provided their informed consent to participate. Participation in the study was voluntary.

Funding

The study 'KomPaS: survey on communication and patient-safety' was funded by the German Federal Ministry of Health (funding code: ZMVI1-2516FSB410).

Conflicts of interest

The author declared no conflicts of interest.

Acknowledgement

The author would like to thank Professor Marie-Luise Dierks, who provided valuable suggestions about the RKI's GEDA 2009 supplementary survey with regard to the issues addressed here. The KomPaS study meant that these issues could be revisited.

The author would also like to thank the study participants. She is also very grateful to their colleagues at the Robert Koch Institute who provided support during the implementation of the study. Furthermore, the author thanks Dr Julia Truthmann (University of Greifswald).

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Imprint

Journal of Health Monitoring

Publisher
Robert Koch Institute
Nordufer 20
13353 Berlin, Germany

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Typesetting
Kerstin Möllerke, Alexander Krönke

Translation
Simon Phillips/Tim Jack

ISSN 2511-2708

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

Journal of Health Monitoring · 2021 6(2)
DOI 10.25646/7147
Robert Koch Institute, Berlin

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Submitted: 01.07.2020
Accepted: 11.09.2020
Published: 16.06.2021

Searching for health information on the Internet – Results from the KomPaS study

Abstract
Searching for information about health is a key component of health behaviour. It is important because information generally has a significant impact on the outcome of decision-making processes, and this also applies to informed decisions about health-related issues. Representative results from the study 'KomPaS: survey on communication and patient-safety', which was conducted by the Robert Koch Institute, demonstrate that the Internet is the most popular choice for women and men who use media to search for health information. However, the results also demonstrate statistically significant differences by sex and socioeconomic status. People in the low socioeconomic status group search less frequently for health information on the Internet than people in the medium and high status groups. Furthermore, women up to the age of 65 use the Internet to search for information about health more frequently than men of the same age do. These differences reverse from the age of 65 onwards.

SEARCH FOR HEALTH INFORMATION · INTERNET · SEX · SOCIAL STATUS · KOMPAS STUDY

Introduction
The Act to Improve the Rights of Patients affords patients and the wider German population the right to have comprehensive health information provided in a manner in which they can understand. Better levels of information and transparency are essential for strengthening the role of health-system users, both to choosing health care services and sharing the responsibility for maintaining and regaining health [1]. These points are particularly relevant in light of the fact that information generally has a significant impact on the outcome of decision-making processes [2], and this also applies to informed decisions about health-related issues. From a public health point of view, the search, contextualisation, evaluation and implementation of health information by users as part of their health-related practices are essential aspects of health literacy. Therefore, people need to be provided with suitable information but also to be in a position to make decisions that meet their objective (evidence-based) and subjective (preference-based) needs for health care services. Since 2001, reports by the Advisory Council on the Assessment of Developments in the Health Care Sector have repeatedly emphasised this relation and the relevance of this topic in attempts to reduce over, under and incorrect provision of care [3].

In this context, the development and establishment of standards, prerequisites and structures that guarantee quality-assured, evidence- and needs-based health information are becoming increasingly important. Examples include the website informedhealth.org, and the German National Health Portal.

Trend analyses demonstrate that the Internet is becoming an increasingly important source of health information [4–6]. While the Robert Koch Institute's (RKI) German Health Update (GEDA) 2009 [7] found that just 36.2% of the German population used the Internet to find health information, the study 'KomPaS: survey on communication and patient-safety', also conducted by the RKI, found that the figure had risen to 68.9% by 2017. At the same time, a wider range of health-related content became available on the internet [2]. Online health information-seeking behaviour is now a widespread health-related form of behaviour and is viewed as essential to empowerment and health literacy. Quality-assured, user-friendly, gender-appropriate informational strategies are required to improve the potential of the Internet for health literacy and patient empowerment [8–11].

In summary, the results from the analysis of German and English-language overviews and a comprehensive literature review demonstrate the need for regular, standardised representative surveys. These surveys should assess the population's health information-seeking behaviour and take into account traditional and digital information channels as well as key determinants such as age, gender and socioeconomic status. This is the only way to observe changes in information-seeking behaviour across different forms of media. Moreover, studying these changes is essential if we are to ensure that health information is drawn up appropriately, and that it is properly targeted and tailored to people's particular needs.

Indicator

The KomPaS study (Info box) was conducted within the RKI's health monitoring framework. Data on searching for health information was gathered using questions about how often seven types of media (radio/television, the Internet, health apps, booklets or brochures from health insurers, booklets or brochures from chemists, health topics in other magazines or newspapers, and medical hotlines provided by health insurers) were used to search for health information. The respondents could choose from the following response categories: 'often', 'sometimes', 'rarely' and 'never'. The respondents also had the option to use a free text field to report any other sources they had used to gain health information (such as information from doctors, relatives and friends).

This paper presents the results of the search for health information by the population in Germany. It concentrates on the types of media described above that the population 'often' uses to search for health information. The results are presented as prevalences and are listed separately for women and men. The analysis clearly demonstrates that the Internet is the most frequently reported source of health information in the 'often used' category. As such, this article focuses on the 'search for health information on the Internet' indicator and provides results (prevalences) for people who stated that they 'often used' the Internet to search for health information. Prevalences are stratified by sex, age group and socioeconomic status, and based on 95% confidence intervals. Statistical methods were used to test for significant differences between these groups. Statistically significant differences between women and men and/or the other (socioeconomic) groups under con-

KomPaS study

KomPaS: survey on communication and patient-safety

Data holder: Robert Koch Institute

Objectives: Describe informational needs, health literacy, patient safety, informed decision-making and physician's counselling from the population's point of view as part of patients' information, decision-making and communication-related behaviour and the doctor-patient relationship.

Survey method: Computer-assisted telephone interview survey

Study design: Cross-sectional study

Population: German-speaking resident population in private households in Germany aged 18 or over

Sampling: Telephone sample comprising 60% landline and 40% mobile phone numbers

Survey period: May to September 2017

Response rate: 17.2%

Sample size: 5,053 participants

Data from the KomPaS study demonstrate a high level of interest in health-related topics.

The Internet is the first choice among women and men who use media to search for health information.

sideration are indicated. A statistically significant difference between groups is assumed when the corresponding p-value is lower than 0.05. The analyses were carried out descriptively using the survey procedures available from STATA SE 15.1 [12].

The analyses are based on data from a total of 5,053 participants aged 18 or over (56.7% women, 43.3% men). In order to ensure that the results are representative of the German resident population, the calculations used a weighting factor to correct for deviations within the sample from the actual population structure (as of 31 December 2016).

Results and discussion

The data from the KomPaS study demonstrate that people are very interested in health-related topics. Just 1.9% of the participants (1.4% of women, 2.5% of men) indicated that they do not use any of the listed sources of information. Moreover, those who do use media use an average of four different types to search for health information. A total of 30.8% of the participants who used the free text field stated that they also obtained information from their doctors, and 26.6% reported that they also sought information through personal conversations with friends and acquaintances.

Figure 1 depicts the search for health information by women and men in order of the type of media that they 'often' use.

Figure 1 demonstrates that women who 'often' use media to search for health information use all types of media more frequently than men do, with the exception of medical hotlines provided by health insurers. The sex-based differences that are clear from Figure 1 are statistically significant (apart from differences in the use of apps and medical hotlines provided by health insurers). The Internet is the most popular choice for both women (26.0%) and men (23.1%) out of all of the listed types of media in the 'often' category. Other studies have observed the same sex-based results [13–16]. Baumann et al. (2017) extensively address sex-specific determinants and patterns of online behaviour

Figure 1
Percentage of participants who 'often' use media when searching for health information by sex, age and socioeconomic status (n=2,859 women; n=2,187 men)*
Source: KomPaS study (2017)

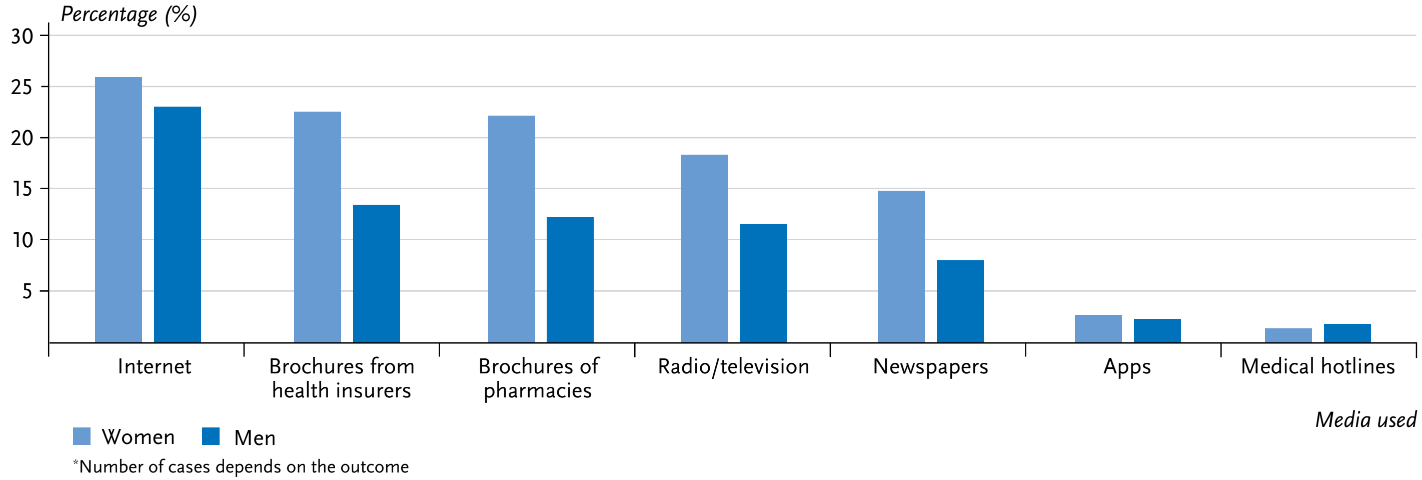

Table 1
Percentage of participants who 'often' use the Internet when searching for health information by sex, age and socioeconomic status (n=2,859 women; n=2,187 men)
Source: KomPaS study (2017)

Up to the age of 65, women use the Internet to search for health information more frequently than men do. This is reversed from the age of 65.

with regard to the search for health information [13]. Marstedt (2018) discusses the general motives for searching for health information on the Internet [10]. The results of the analyses undertaken by the KomPaS study are consistent with those of various others in terms of usage behaviour by different age groups [13–16].

Table 1 presents the respondents who 'often' use the Internet as a source of health information by age and sex. Women aged 65 or below use the Internet to search for health information more frequently than men in the same age group. This difference is statistically significant and particularly prominent among the 30 to 44 age group. Women are presumably more closely involved with issues related to health and illness and also more likely to act as a family's primary health informant than men are [2, 17].

In the group aged 65 and over, however, the statistically significant sex-based differences are reversed. It will be interesting to see whether this changes in the future.

Socioeconomic status also has a major impact on health information-seeking behaviour. Previous studies have shown that people in the low socioeconomic status group search for health information and use e-health services less often [5, 14–15, 18–19]. These results are confirmed by the KomPaS study. The sex-based differences in the search for health information on the Internet are also evident within socioeconomic status groups, with significant differences between the sexes in the low and medium status groups. Women in the low socioeconomic status group who 'often' use the Internet to search for health information do so less frequently than their male counterparts in the same status group. This sex-based relationship is reversed in the medium socioeconomic status group. At the same time, women in the high

	%	(95% CI)
Women (total)	**26.0**	**(23.8–28.4)**
Age group		
18–29 years	36.7	(28.6–45.6)
30–44 years	46.4	(40.2–52.7)
45–64 years	25.5	(22.6–28.6)
≥65 years	4.8	(3.7–6.1)
Socioeconomic status		
Low	11.4	(6.2–20.1)
Medium	26.7	(23.8–29.7)
High	36.6	(32.5–40.9)
Men (total)	**23.1**	**(20.8–25.6)**
Age group		
18–29 years	35.4	(28.1–43.5)
30–44 years	27.1	(21.4–33.7)
45–64 years	21.9	(18.8–25.3)
≥65 years	11.3	(9.1–13.9)
Socioeconomic status		
Low	19.2	(12.7–28.0)
Medium	20.5	(17.4–23.9)
High	30.3	(26.6–34.2)
Total (women and men)	**24.6**	**(23.0–26.3)**

CI = confidence interval

socioeconomic status group who 'often' use the Internet to search for health information do so more frequently than their male counterparts in the same status group. However, this difference is not statistically significant.

The results from the KomPaS study show that the search for health information on the Internet follows population group-specific patterns. These differences need to take into account when attempts are made to improve people's capacity to make decisions and to bolster their health literacy through the provision of Internet-based health information.

People in the low socioeconomic status group search the Internet for health information less often than people in the high or medium status groups.

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Please cite this publication as
Horch K (2021)
Searching for health information on the Internet – Results from the KomPaS study.
Journal of Health Monitoring 6(2): 67–73.
DOI 10.25646/7147

The German version of the article is available at:
www.rki.de/journalhealthmonitoring

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Funding

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Acknowledgment

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Imprint

Journal of Health Monitoring

Publisher
Robert Koch Institute
Nordufer 20
13353 Berlin, Germany

Editors
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Typesetting
Kerstin Möllerke, Alexander Krönke

Translation
Simon Phillips/Tim Jack

ISSN 2511-2708

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

Journal of Health Monitoring · 2021 6(2)
DOI 10.25646/7148
Robert Koch Institute, Berlin

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Health Monitoring

Submitted: 09.07.2020
Accepted: 25.09.2020
Published: 16.06.2021

Physical activity counselling by physicians – Results from the KomPaS study

Abstract

Physical activity counselling aimed at promoting physical and sporting activity is easily accessible and has the potential to reach many people. Until now, very little has been known about the factors influencing physical activity counselling and their frequency. However, the study 'KomPaS: survey on communication and patient-safety', provides current data about this topic. The analyses published here are based on data from 4,561 people aged 18 or older who were interviewed by telephone between May and September 2017 and who stated that they had visited a physician's practice or outpatient clinic in the last twelve months. 28.6% of participants reported having received a physician's counselling about sporting activity during the past twelve months. Sex, age and socioeconomic status have an impact on how frequently participants reported a physical activity counselling by a physician as well as changes to physical activity. As such, differences associated with sex, age and socioeconomic status should be taken into account during physical activity counselling so as to provide various population groups with targeted support.

PROMOTION OF PHYSICAL ACTIVITY · BEHAVIOUR-RELATED PREVENTION · PHYSICIAN'S RECOMMENDATIONS · PHYSICAL ACTIVITY

Introduction

Physical activity can help reduce the risk of noncommunicable diseases and counteracts the aggravation of chronic diseases [1, 2]. In Germany, less than half of the adult population meets the World Health Organization's recommendations on physical activity [3]. As such, the promotion of physical and sporting activity remains one of the central challenges faced by health promotion and disease prevention in Germany today. A wide variety of measures are currently used to face these challenges, and, in addition to environmental and policy-related approaches and measures that target people's daily lives, this includes the provision of physician's counselling within health care settings [4].

As many people visit a physician's practice at least once a year [5, 6], and most people still tend to consult physicians about health-related issues [7], physical activity counselling can be used to provide patients highly accessible, needs-based advice on physical activity. Furthermore, assessments of physical activity can also be used to deliver tailored counselling to patients, which should include referral to experts on physical activity, sports clubs and other providers of physical and sporting activity [8].

In Germany, the 2015 Preventive Health Care Act strengthened physician's counselling such as that medical health checks can include prevention-oriented counselling, such as advice about physical activity. The Act also allows

KomPaS study

KomPaS: survey on communication and patient-safety

Data holder: Robert Koch Institute

Objectives: Describe informational needs, health literacy, patient safety, informed decision-making and physician's counselling from the population's point of view as part of patients' information, decision-making and communication-related behaviour and the doctor-patient relationship.

Survey method: Computer-assisted telephone interview survey

Study design: Cross-sectional study

Population: German-speaking resident population in private households in Germany aged 18 or over

Sampling: Telephone sample comprising 60% landline and 40% mobile phone numbers

Survey period: May to September 2017

Response rate: 17,2%

Sample size: 5,053 participants

that physicians can issue patients with a letter recommending individual behaviour-related preventive measures offered by their health insurance [9]. This ties in with experiences made in nine federal states in Germany, where physicians have been able to prescribe patients with preventive services that promote physical activity [10].

Until now, there have been very few studies about the frequency of physician's physical activity counselling and their influencing factors, particularly at the population level. Nevertheless, data are available from the German National Health Interview and Examination Survey 1998 (GNHIES98) and the German Health Interview and Examination Survey for Adults (DEGS1). In 1998, about one tenth of the population aged between 18 and 64 reported having attended a physical activity counselling. These figures decreased from 9.3% to 7.7% among women and from 11.1% to 9.4% among men in the period between the studies (1997–1999 and 2008–2011) [11, 12]. The study 'KomPaS: survey on communication and patient-safety' provides current data about the frequency of physician's counselling on physical and sporting activity from the point of view of the population. This section of the study focused on the extent to which uptake of physical activity counselling differs according to sex, age and socioeconomic status.

Indicator

Data on the use of physical activity counselling provided by physicians was collected for the KomPaS study using a representative telephone survey undertaken between May and September 2017. The survey covered the adult resident population in Germany. Participants were asked whether they had visited a physician's practice or an outpatient clinic in the past twelve months. Those who answered in the affirmative were then asked: 'Were you provided with counselling about any of the following health-related topics during any of these visits in the last 12 months?'. The topics covered physical activity but also nutrition and stress management. Participants who reported a counselling were asked whether they believed the counselling had led them to change their behaviour ('Did you modify your behaviour as a result', response categories: 'yes' and 'no'). These items were taken from the DEGS1 study [13] and adapted from a written survey for use with a telephone survey.

The following analyses are based on data from 4,561 people aged 18 or over (2,636 women, 1,925 men) who visited a physician's practice or outpatient clinic in the twelve months prior to the KomPaS study, which was the case with 90.8% of women and 85.6% of men. This article reports relative frequencies with 95% confidence intervals (95% CI) stratified by sex, age and socioeconomic status. Wide confidence intervals indicate a greater level of statistical uncertainty in the results. A significant difference is assumed in cases where the p-value is less than 0.05 after taking weighting and survey design into account. In order to provide representative results for the total resident population in Germany, the household sizes in the sample were adjusted to reflect the distribution in the population. This was followed by design and adjustment weighting to correct for deviations from the population structure (as of 31 December 2016) with regard to age, sex, education and place of residence (federal state). All analyses were carried out using Stata 15.1 [14]. A detailed description of the methodology and the sample used for the KomPaS study can be found in the study report [15].

Table 1
Frequency of physician's counselling about physical and sporting activity by sex, age and socioeconomic status (n=2,636 women, n=1,925 men)
Source: KomPaS study (2017)

	%	(95% CI)
Women (total)	**27.4**	**(25.0–29.8)**
Age group		
18–29 years	26.7	(18.2–37.4)
30–44 years	25.4	(20.4–31.1)
45–64 years	29.2	(25.8–32.7)
≥65 years	27.0	(23.5–30.8)
Socioeconomic status		
Low	28.5	(21.1–37.3)
Medium	27.9	(25.0–31.0)
High	23.3	(20.0–27.1)
Men (total)	**29.9**	**(27.3–32.7)**
Age group		
18–29 years	28.2	(20.6–37.3)
30–44 years	23.9	(18.1–30.9)
45–64 years	35.1	(31.1–39.3)
≥65 years	28.6	(24.6–32.8)
Socioeconomic status		
Low	30.6	(22.0–40.8)
Medium	27.2	(23.8–31.0)
High	34.6	(30.6–38.7)
Total (women and men)	**28.6**	**(26.8–30.4)**

CI = confidence interval

Almost one third of participants reported having attended a physician's counselling about sporting activity in the last twelve months.

Results and discussion

Almost one third of participants (28.6%) reported that they had attended a physical activity counselling provided by a physician on sporting activity during the past twelve months (Table 1). No significant differences were identified between the sexes, and relative frequencies differed only slightly (women 27.4%, men 29.9%). The proportion of women who reported a counselling did not change significantly with age. In contrast, 45- to 64-year-old men reported a counselling much more frequently than men in other age groups. For example, 45- to 64-year-olds differed from the 30- to 44-year-old group by 11.2 percentage points, a frequency that is almost one third higher. Although no significant differences were identified for socioeconomic status within groups of women or men, differences were identified between the sexes: 34.6% of men in the high socioeconomic status group reported having attended a counselling provided by a physician on sporting activity, compared to 23.3% of women in the same status group.

According to data from the KomPaS study from 2017, the frequency of physical activity counselling by physicians has more than doubled since DEGS1 (2008–2011), when around one tenth of those surveyed reported having attended a counselling about sporting activity [11, 12]. Even if the two surveys used different survey modes (a written questionnaire versus a telephone-based interview), they asked the same questions, albeit adapted to the mode in question, and the results are therefore comparable. Reasons for the higher frequency are likely to lie in the increased focus on physical activity in health promotion, prevention and therapy over the last decade, which is also reflected in measures such as the 'prescription of physical activity' [10] and the introduction of the Preventive Health Care Act in 2015 with its physician's recommendations on prevention. The 2019 Prevention Report by Germany's National Prevention Conference states that initial, non-representative analyses also indicate that physicians most frequently prescribed physical activity programmes when issuing a prevention recommendation [9]. Further research should clarify the reason why 45- to 64-year-old men and men in the high socioeconomic status group most frequently reported physical activity counselling. This is important because it had been assumed that the low socioeconomic status group would display the highest fre-

Figure 1
Self-reported changes in behaviour after a physician's counselling about physical and sporting activity by socioeconomic status (n=1,343)
Source: KomPaS study (2017)

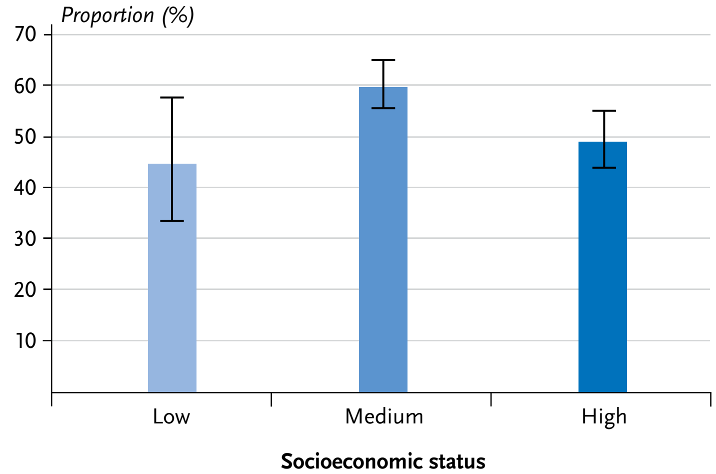
Significant differences between the sexes were only identified for the high socioeconomic status group.

Men in the 45- to 64-year-old age group more frequently reported having attended a counselling than men in other age groups.

quency of counselling because people in this group generally do sports less often and face greater health burdens than people in other status groups [16, 17].

When participants were asked whether they had changed their behaviour due to a physician's counselling about sporting activity, more than half of women and men (total: 55.6%) stated that they had done so. Due to the low number of cases, no sex-specific results are reported here for age or socioeconomic status. In general, no significant differences were identified by age but significant differences were found between the medium and high socioeconomic status group. Participants in the medium status group stated significantly more frequently that they had changed their behaviour after a physician's counselling than the high status group (60.1% versus 49.1%, Figure 1). The differences between the medium and the low socioeconomic status group are not statistically significant. Further analyses should investigate the reasons for the differences in socioeconomic status and sex in the implementation of physical activity counselling.

It is important to note that as the KomPaS study is a cross-sectional study, no causal conclusions can be drawn from the results presented here. Furthermore, the study only collected (self-reported) data on the population's point of view, and not on the type, quality and impact of physician's counselling. High-quality individual studies are still lacking, particularly when it comes to the effectiveness of counselling [4]. An analysis using data from DEGS1 showed that participants who reported a counselling were 2.5 times more likely to take part in behavioural preventive measures aimed at promoting physical activity [18]. Overall, however, there is insufficient and contradictory evidence about the



effectiveness of physical activity counselling [4]. About half of available studies identify minor short- or medium-term effects [4, 19]. However, the counselling under study often took place within the context of physical activity programmes instead of being individual measures [4]. In addition, the results of a study on the 'prescription of physical activity' [20] indicate that physicians need even more information about the importance of physical and sporting activity for health, as well as about the availability of physical activity programmes in their local area. In another study, half of patients surveyed expressed a desire for more support from their health insurers to enable them to take up physical activity [21]. Therefore, further research is needed into patients' assessments, and at the same time those of the physicians providing counselling, as well as characteristics of the counselling for physical-sporty activity, and, above all, their effectiveness.

The differences highlighted by the KomPaS study in terms of physical activity counselling by sex, age and socioeco-

The medium socioeconomic status group more frequently reported having changed their behaviour after a physician's counselling than the lower or higher status group.

nomic status indicate that counselling have further potential. In addition to settings-based preventive measures, for example, in companies and the community, counselling by physicians is easily accessible and is able to reach a relatively large section of the population. Structured counselling [22] and successful doctor-patient communication are promising approaches that should be implemented and further strengthened as part of physician's training [23]. If physical activity counselling by physicians are to be effective, however, the differences associated with sex, age and socioeconomic status need to be taken into account – even if further research is still needed on this issue.

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Please cite this publication as
Jordan S, Starker A (2021)
Physical activity counselling by physicians – Results from the KomPaS study.
Journal of Health Monitoring 6(2):74–80.
DOI 10.25646/7148

The German version of the article is available at:
www.rki.de/journalhealthmonitoring

Data protection and ethics

The study 'KomPaS: survey on communication and patient-safety' was subject to strict compliance with the data protection provisions set out in the EU General Data Protection Regulation (GDPR) and the Federal Data Protection Act (BDSG). The Federal Commissioner for Data Protection and Freedom of Information approved the study on 21 June 2017. The Commissioner had no data privacy concerns about the study being carried out in the manner that was planned.

The participants were informed about the aims and content of the study as well as about data protection, and provided their informed consent to participate. Participation in the study was voluntary.

Funding

The study 'KomPaS: survey on communication and patient-safety' was funded by the German Federal Ministry of Health (funding code: ZMVI1-2516FSB410).

Conflicts of interest

The authors declared no conflicts of interest.

Acknowledgment

The authors would like to thank the study participants. The authors are also very grateful to their colleagues at the Robert Koch Institute who provided support during the implementation of the study.

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Imprint

Journal of Health Monitoring

Publisher
Robert Koch Institute
Nordufer 20
13353 Berlin, Germany

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Typesetting
Kerstin Möllerke, Alexander Krönke

Translation
Simon Phillips/Tim Jack

ISSN 2511-2708

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health