

Research paper

Trends in prevalence of depression in Germany between 2009 and 2017 based on nationwide ambulatory claims data

Annika Steffen^{a,*,1}, Julia Thom^{b,1}, Frank Jacobi^c, Jakob Holstiege^a, Jörg Bätzing^a^a Department of Regional Health Care Analysis and Health Care Atlas, Central Research Institute of Ambulatory Health Care in Germany (Zi)^b Unit 26 Mental Health, Department of Epidemiology and Health Monitoring, Robert Koch Institute, Berlin, Germany^c Psychologische Hochschule Berlin, Berlin, Germany

A B S T R A C T

Background: Studies based on health insurance funds unanimously indicate a rise in administrative prevalence of depression, while population surveys with standardized diagnostic procedures do not. We describe recent trends in the prevalence of depressive disorders as diagnosed in routine care from 2009–2017 in Germany.

Methods: We used nationwide ambulatory claims data from all residents with statutory health insurance, covering 87% of the total population. Cases were defined as persons with at least one documented diagnosis of depression (ICD-10-GM codes: F32, F33 or F34.1). The administrative prevalence was computed for each year according to age, sex, degree of urbanization and severity of depression diagnosis.

Results: The prevalence increased from 12.5% in 2009 to 15.7% in 2017 (+26%). Overall, women were twice as likely as men to receive a diagnosis, although the prevalence increased more strongly in men compared to women (+40% vs. +20%). Age- and sex-stratified analyses revealed the highest prevalence increase in adolescents and young men at the ages of 15–19 years (+95%) and 20–25 years (+72%). Rural areas with a low population density showed the highest rise in administrative prevalence (+34%), while big urban municipalities showed the lowest (+25%).

Limitations: Administrative claims data rely on diagnoses coded for billing purposes and thus depend on coding practice as well as patients' help seeking behavior.

Conclusions: Depressive disorders are of increasing importance in ambulatory health care in Germany. Parts of the increase may be attributed to changing cultural constructions of mental health along with the expansion of mental health care supply.

1. Background

Despite the popular notion of an epidemic of mental disorders, international studies on secular trends in depression prevalence have yielded conflicting results. While in some population surveys based on standardized diagnostic instruments, prevalence of depressive disorders was reported to be stable over time (de Graaf et al., 2012; Mojtabai and Jorm, 2015; Patten et al., 2015), in others, a rise was documented (Compton et al., 2006; Eaton et al., 2007; Goldney et al., 2010; Kovess-Masfety et al., 2009; Mojtabai et al., 2016; Weinberger et al., 2018). If rising prevalence was observed, recent studies reported increases particularly for younger age groups and female gender (Mojtabai et al., 2016; Weinberger et al., 2018). In Germany, mean depression prevalence of 7.4% remained overall stable between surveys in 1998 (conducted 1997–1999) and 2010 (conducted 2009–2012) but revealed shifts between the most affected subgroups (Bretschneider et al., 2018). While no significant changes could be observed for men, the 12-month prevalence rose significantly in women aged 18–34 years (8.8% vs. 15.6%) and decreased in women aged 50–65 years (9.8% vs. 5.0%).

Further, in view of stable overall prevalence, a significant decline in mild depression was found among women (24.1% vs. 13.8%), possibly indicating rises in treatment need, which beyond mere prevalence depends on depression severity.

Given these inconsistent results, international reviews conclude that there is currently no evidence for a definite rise in depression prevalence in the general population and that the perceived prevalence increase may be explained by population aging and growth, growing public awareness towards mental disorders and hence rising health care use (Baxter et al., 2014; Busfield, 2012; Jorm et al., 2017; Richter and Berger, 2013).

Aside from population surveys, administrative data that are routinely generated in the health care system (i.e. depression diagnoses coded in ambulatory care) may give valuable insights into time trends in public mental health, as trends in coded diagnoses do reflect those changes. Additionally, methodological shortcomings of population surveys, which mostly compare only two-time points and are limited by i.e. variation in sampling methodology and response, can be overcome by administrative databases (Harvey et al., 2017). Evidence on recent

* Corresponding author: Dr. Annika Steffen, Central Research Institute of Ambulatory Health Care in Germany (Zi), Salzuffer 8, 10587 Berlin, Germany
E-mail address: asteffen@zi.de (A. Steffen).

¹ shared first authorship

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trends in depression prevalence based on administrative data, however, is scarce and difficult to compare (O'Donnell et al., 2016; Skovlund et al., 2017), indicating the need for further evidence. In brief, a Danish study based on data from persons aged 10–49 years indicated a rising incidence in diagnosed depressive disorders between 2000 and 2013 but was limited to diagnoses from persons who attended a psychiatric hospital (Skovlund et al., 2017). Results from Canada using all physician billing claims and hospital discharge records showed a slight decline in prevalence between 2003 and 2009 among persons aged 15 years and older but did not differentiate between mood and anxiety disorders (O'Donnell et al., 2016).

In Germany, single statutory health insurance funds (SHI) have consistently documented a rising administrative prevalence of depressive disorders, though studies were mainly based on short observation periods. In particular, based on different SHI funds prevalence rose markedly from 8.2% (2009) to 12.9% (2012) (Jacobi et al., 2015), from 8.4% (2008) to 11.0% (2010) (IGES, 2012) and 9.3% (2007) to 11.1% (2010) (Gerste and Roick, 2014). The most elaborate and recent analysis covering a time period of nine years (2006–2015) in a local SHI sample observed a rise in 12-month prevalence from 12.0% to 16.3%, amounting to an increase of 36% (Stahmeyer et al., 2019).

However, conclusions for nation-wide health trends are currently limited as single German SHI funds differ substantially from each other as well as from the general population in terms of sociodemographic, regional and, most importantly, morbidity characteristics of their insureds, even after controlling for age and sex and further health-related factors (Hoffmann and Icks, 2012). Also, it remains currently unknown whether the total population is equally affected by increases in administrative depression prevalence or whether increases are restricted to specific subgroups, e.g. according to age and sex.

In this regard, prior cross-sectional analyses of depression prevalence as well as severity based on administrative data consistently revealed associations with certain population characteristics (BKK, 2015; Bramesfeld et al., 2007; Erhart and Stillfried, 2012; Frank, 2016; Gerste and Roick, 2014; Grobe et al., 2018; Melchior et al., 2014) including age (increase across life span up to three-fold rates at oldest age), sex (around two-fold rates in women compared to men), and region (considerable variation in prevalence from 5% to 18% dependent on density of regional population and treatment facilities). Remarkably, at least half of all depression diagnoses are coded without an assigned degree of disorder severity, using unspecified ICD-codes of 'other' depressive episode/disorder (F32.8/F33.8) and 'unspecified' depressive episode/disorder (F32.9/F33.9) (Erhart and Stillfried, 2012; Gaebel et al., 2012; Gerste and Roick, 2014; Grobe et al., 2018; Melchior et al., 2014). Among specified diagnoses, moderate depressive episodes were the most frequent, followed by severe episodes, while mild episodes and dysthymia were coded least often. These extensive cross-sectional associations may reflect unequal distributions of access to health care and the quality of its delivery; hence, raising the question of their development over time.

In sum, hitherto conclusions on time trends in administrative depression diagnoses are limited with regard to 1) the representativeness of databases (i.e. different populations of insureds in former studies), 2) the number of observed time points (i.e. only one or two in most previous studies) and the length of observation period (i.e. if longitudinal at all, often restricted to 2–3 years), 3) the currency of the presented data (i.e. most German studies used data before 2012), and 4) the limited differentiated insight into trends across population subgroups.

To address these limitations, we set up a unique study to provide a current and complete picture of administrative depression epidemiology in Germany. Using the total sample of nationwide statutory ambulatory claims data from the years 2009 to 2017, which covers 87% of the German adolescent and adult population, we describe recent trends in administrative depression prevalence according to sex, age, urbanization, and depression severity.

2. Methods

2.1. Study population

The present analysis was based on nationwide ambulatory claims data of all statutory health insured individuals in the years 2009 to 2017, covering 87% of the total German population aged ≥ 15 years, including between 60.5 and 62.5 million patients each year. The data contain outpatient diagnoses coded according to the German modification of the International Classification of Diseases (ICD-10-GM) as well as information on the patient's age, sex, and region (district of residence out of all 402 districts in Germany, representing the administrative status in 2011).

2.2. Case definition

Patients were defined as cases if they had received at least one diagnosis of 'F32' (major depressive disorder, single episode), 'F33' (major depressive disorder, recurrent) or 'F34.1' (dysthymic disorder). Diagnoses from ambulatory care in Germany include a diagnostic modifier describing the diagnostic certainty ('assured', 'suspected', 'status post', 'excluded'). Hence, we restricted the analysis to diagnoses that included the diagnostic certainty 'assured'. In a second step, we grouped the cases into four groups according to the severity of diagnosis: 'mild' (F32.0, F33.0, and F34.1), 'moderate' (F32.1 and F33.1), 'severe' (F32.2, F32.3, F33.2, and F33.3), and 'unspecified' (F32.8, F32.9, F33.8, and F33.9). The diagnostic code 'F33.4' was not considered in this secondary analysis since it can neither be assigned to a severity level nor to the unspecified group. In case of different depression diagnoses on the individual patient level during one year, we chose the most severe diagnosis for classification.

2.3. Statistical analysis

The prevalence of diagnosed depressive disorders was calculated as the ratio of the number of insureds with diagnosis of depression relative to the total SHI population, separately for each year from 2009 to 2017. Depression prevalence was computed for Germany as a whole and stratified by sex, 5-year age groups, severity of diagnosis and degree of urbanization of the residential district with four standard categories: 'rural areas with a low population density', 'rural areas with population concentrations', 'urban districts', and 'big urban municipalities'. For comparisons across district type, directly age- and sex-standardized administrative prevalence was additionally computed using the age and sex distribution of the SHI population on 1st July 2009 as the reference population. To compare sex-specific trends in depression prevalence over time, risk ratios (prevalence among women vs. prevalence among men) were computed. Confidence intervals and corresponding p-values are not presented because the sample is nearly universal as it equals the whole population under study (all persons with statutory health insurance) and represents with >61 million around 87% of the total German population ≥ 15 years (i.e. all shown results are highly significant due to large sample size).

The analyses were conducted using SAS®, version 9.4.

3. Results

In 2009, a total of 12.5% of 60.5 million individuals ($N = 7,541,471$) with statutory health insurance in Germany were diagnosed with a depressive disorder, with 7.6% among men ($N = 2,143,337$) and 16.6% ($N = 5,398,134$) among women (Figure 1A). Over the observation period of nine years, the total administrative prevalence rose to 15.7% in 2017, corresponding to a relative increase of 26% (Figure 1A). The increase was more pronounced among men (+42%) compared to women (+21%) (Figure 1B). Between 2009 and 2017, the risk ratio (female vs. male) constantly decreased from 2.18 to 1.86 (Figure 1C).

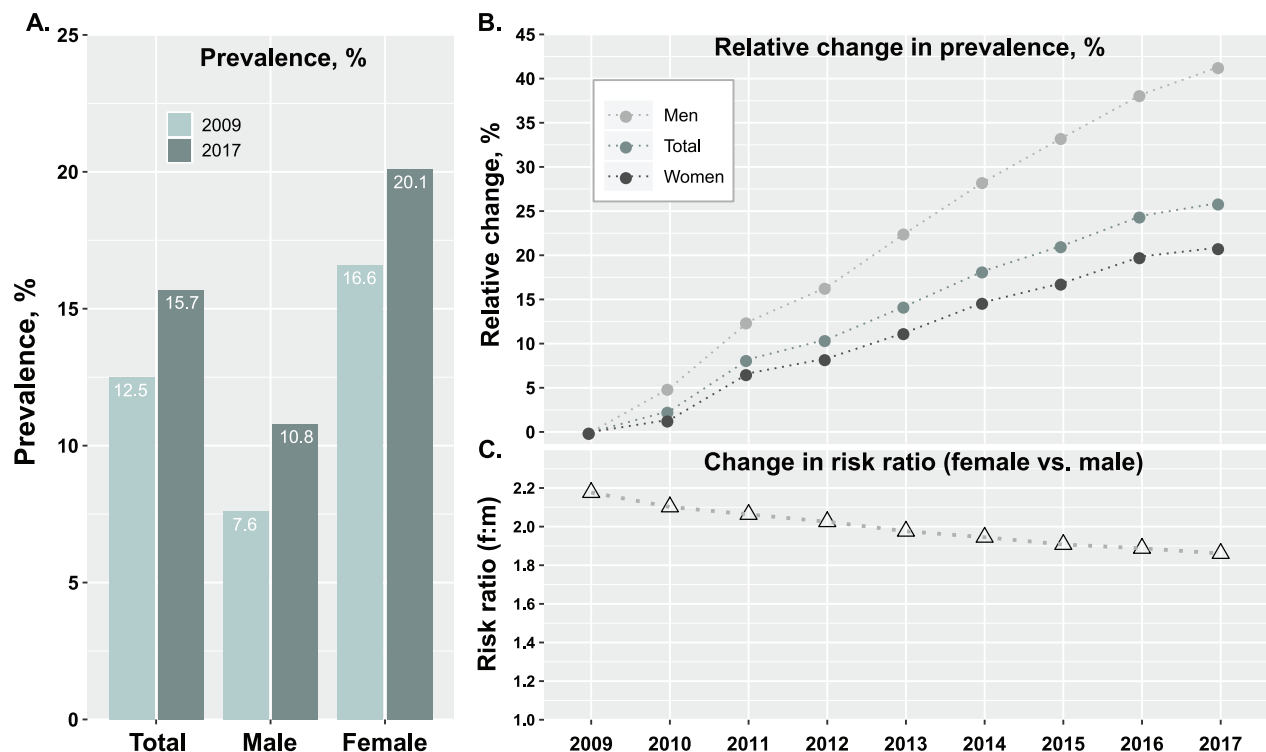


Fig. 1. Administrative prevalence of depressive disorders (A), relative change in prevalence (B) and change in risk ratio (female vs. male) (C) based on statutory health insured individuals ($N_{2017} = 62,545,398$)

The risk ratio (female vs. male) refers to the ratio of the depression prevalence among females relative to males.

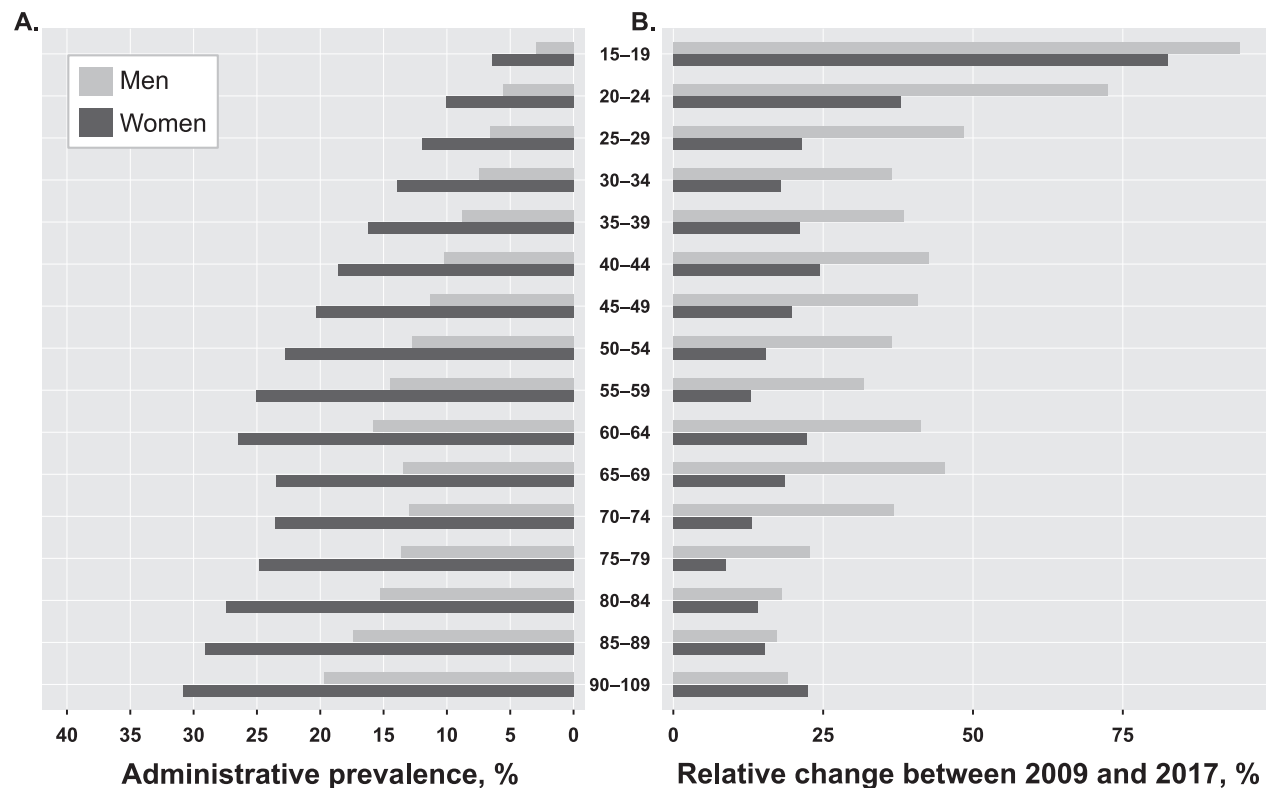


Fig. 2. Administrative prevalence of depressive disorders in 2017 (A) and relative change in prevalence between 2009 and 2017 (B) across age and sex

In both sexes, the prevalence of diagnosed depression displayed a similar age-related pattern. It increased with age and peaked in the age group 60–64 years with values of 26.5% in women and 15.8% in men (Figure 2A). After a decline in the two following age groups (65–69 and

70–74 years), the prevalence gradually increased again, surpassing the previous peak with 30.8% in women and 19.7% in men in the highest age group of ≥ 90 years. With this age group being the only exception, the increase in prevalence over the life span was higher in men

Table 1

Age-specific risk ratio of depression (female vs. male) in 2009 and 2017 and relative change over time

Age group	Risk ratio (female vs. male) in 2009	Risk ratio (female vs. male) in 2017	Relative change in risk ratio between 2009 and 2017, %
15-19	2.29	2.15	-6.1
20-24	2.26	1.80	-20.0
25-29	2.23	1.82	-18.2
30-34	2.16	1.86	-13.6
35-39	2.10	1.84	-12.6
40-44	2.09	1.82	-12.7
45-49	2.12	1.80	-15.0
50-54	2.11	1.79	-15.5
55-59	2.02	1.73	-14.3
60-64	1.93	1.67	-13.5
65-69	2.13	1.74	-18.4
70-74	2.19	1.81	-17.3
75-79	2.05	1.82	-11.5
80-84	1.86	1.80	-3.4
85-89	1.70	1.67	-1.7
90-109	1.52	1.56	2.9

The risk ratio (female vs. male) was computed as the ratio of the depression prevalence among women relative to the depression prevalence among men. The relative change in risk ratio quantifies the percentage change in risk ratio (female vs. male) in 2017 relative to 2009.

compared to women. Time trends stratified by sex and age revealed the by far highest increase in diagnosed depression from 2009 to 2017 in adolescents and young men at the ages of 15-19 years (+95%) and 20-25 years (+72%) (Figure 2B). In women, administrative prevalence increased by 83% and 38% in the respective age groups. On the absolute scale, however, women still received a diagnosis of depression in 2017 much more frequently compared to men.

Table 1 presents the risk ratio (female vs. male) of the administrative prevalence for the years 2009 and 2017 across age groups and the relative change in risk ratio between 2009 and 2017. In 2017, the female preponderance was particularly marked in the adolescent age group (risk ratio of 2.15); it remained relatively stable throughout the life span with ratios around 1.8, before it decreased to 1.7 and 1.6 at high age (85-89 and ≥90 years). Compared to 2009, the difference in prevalence between women and men most strongly decreased in young adulthood (-20% and -18% in the age groups of 20-24 and 25-29, respectively). Most strikingly, the relative reduction in prevalence difference was substantially lower (relative change in risk ratio of -6%) in adolescents than in all other age groups up to the age group of 75-79 years.

The prevalence of diagnosed depressive disorders according to district type is presented in Table 2. During the whole observation period,

big urban municipalities exhibited the highest prevalence in diagnosed depression. In 2009, almost 14% of metropolitans received a diagnosis of depression. In 2017, the administrative prevalence amounted to 17.3%, reflecting an increase of 25%. In the remaining three district types, the prevalence was relatively similar in 2017, ranging from 15.2% in rural areas with population concentrations to 15.7% in urban districts. On the relative scale, rural areas with a low population density showed the highest increase in prevalence from 2009 to 2017 (+34%), followed by rural areas with population concentrations (+30%) and urban districts (+28%). Despite the generally higher prevalence in more densely populated regions and the relatively stronger increase in prevalence in less densely populated regions, we observed huge variation on the level of single districts (Figure 3).

In Table 3 trends in prevalence according to severity of diagnosis are shown. In 2009, the administrative prevalence of mild, moderate, severe and unspecified depression was 1.4%, 2.3%, 1.6%, and 7.2%, respectively. Over time, the prevalence of unspecified depressive disorders decreased by 24% to 5.5% in 2017. Linked to this, unspecified depression cases accounted for 36% of all depression cases in 2017 compared to 58% in 2009. The prevalence of specified diagnoses increased over time, most markedly for moderate depressive disorders (+128%), eventually accounting for 33% of all depression cases in 2017. Adolescents and young adults showed the highest relative increases in prevalence of moderate and severe depression prevalence compared to all other age groups. Additionally, the administrative prevalence of mild depression rose sharply in the oldest age groups both in men and women. The prevalence of unspecified depressive disorders showed a strong positive linear relationship with age, while moderate and severe depressive disorders peaked at the age of 60-64, both among men and women.

4. Discussion

This study reports an administrative depression prevalence of nearly the entire German adolescent and adult population over a recent 9-year time span. We recorded an increase of 26% in prevalence of diagnosed depressive disorders in ambulatory health care in Germany between 2009 and 2017. In 2017, every 6th SHI insurant received at least one depression diagnosis. The findings extend previous studies by identifying the time trend to be continuous, but not homogeneously distributed across demographic subgroups. Even though the rise in prevalence was evident across all subgroups, it was particularly pronounced among men, adolescents and young adults as well as in rural areas with low population density. As a result, differences in the prevalence of diagnosed depression across sex, age and region diminished during the last decade. Interestingly, the preponderance of unspecified depression diagnoses decreased markedly, documenting a

Table 2

Trends in prevalence (%) of diagnosed depressive disorders according district type

	Big urban municipality (N ₂₀₁₇ = 3,031,504)		Urban districts (N ₂₀₁₇ = 3,788,474)		Rural areas with population concentrations (N ₂₀₁₇ = 1,630,146)		Rural areas with low population density (N ₂₀₁₇ = 1,377,765)	
	raw	adjusted	raw	adjusted	raw	adjusted	raw	adjusted
2009	13.8	13.6	12.2	12.0	11.7	11.4	11.5	11.1
2010	14.4	14.2	12.7	12.5	11.9	11.5	11.8	11.4
2011	15.1	14.9	13.3	13.0	12.9	12.5	12.9	12.3
2012	15.3	15.1	13.5	13.2	13.3	12.8	13.4	12.8
2013	15.6	15.5	13.9	13.5	13.6	13.1	13.8	13.2
2014	16.3	16.2	14.4	14.1	14.2	13.6	14.5	13.8
2015	16.6	16.6	14.9	14.5	14.6	14.0	14.9	14.1
2016	17.1	17.1	15.4	15.0	15.0	14.4	15.2	14.5
2017	17.3	17.3	15.7	15.3	15.2	14.6	15.5	14.7
change 2009-2017, %	25.4	27.1	28.0	26.6	30.3	28.1	34.4	31.8

raw, not adjusted for differences in age and sex distribution between district types; adjusted, directly age- and sex-standardized using the age and sex distribution of the statutory health insured population at 1st July 2009 as the reference population.

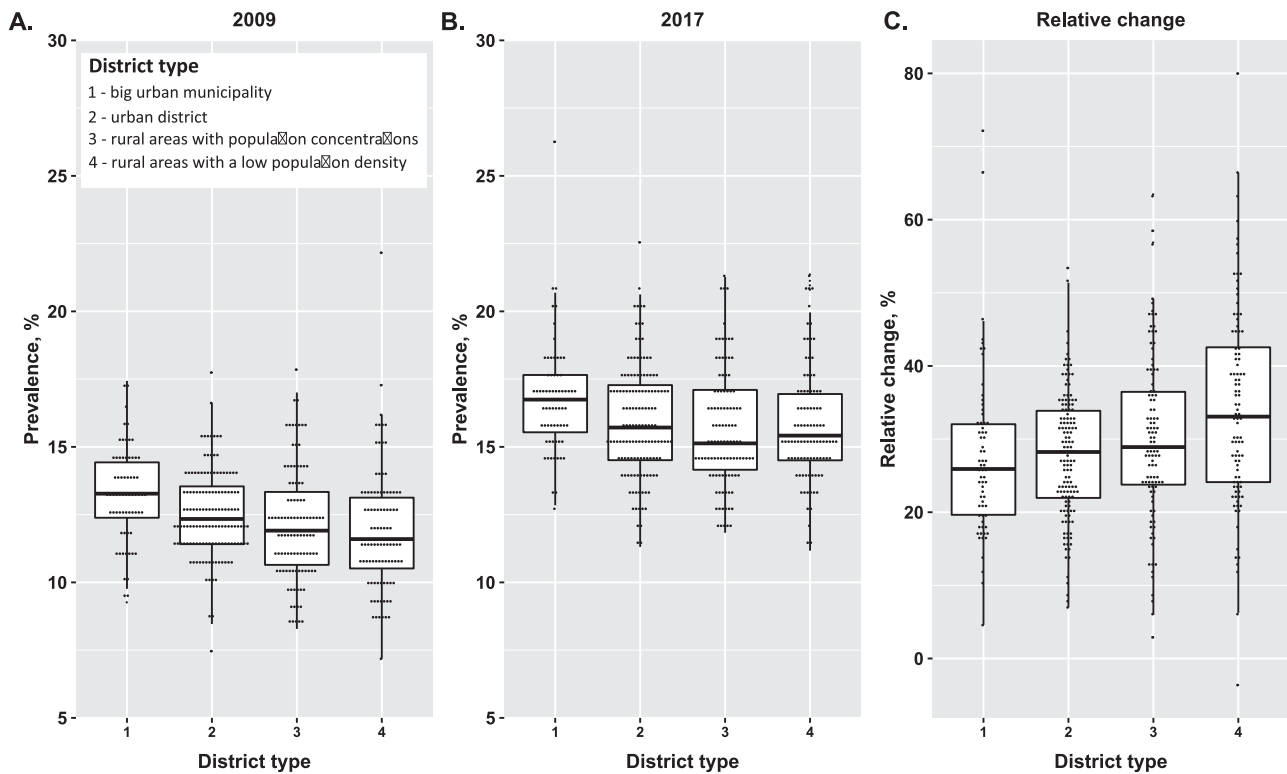


Fig. 3. Administrative prevalence of depressive disorders in 2009 (A) and 2017 (B) as well as relative change in prevalence between 2009 and 2017 across type of district (C) based on statutory health insured individuals ($N_{2017}=62,545,398$). The bottom and top of the box correspond to the first and third quartile of the prevalence distribution, respectively. The horizontal line indicates the median. The vertical lines extend from the box to the largest value at most 1.5 times the interquartile range from the box.

more specific coding.

4.1. Strengths and limitations

A major strength of the present study is its large sample size comprising ambulatory claims data of all SHI insured persons in Germany, reflecting 87% of the total population. Thus, selection bias is negligible compared to population surveys and studies based on single SHI funds. The structure and size of the database allowed continuous observation over a time period of nine years and detailed stratified analyses. In contrast to research based on self-reported clinician diagnoses assessed among survey participants in field studies, the use of claims data is advantageous as self-reported diagnoses are found to be flawed by recall and reporting bias (Drapeau et al., 2011; Grobe et al., 2018) and vary strongly between surveys (Swart, 2012).

Limitations of the study are mainly attributable to the nature of administrative data, which warrant careful interpretation. Administrative data are routinely collected for the purpose of physician billing claims, not for epidemiological research. As reviews on the accuracy of diagnoses of mental disorders from claims data in Germany as well as in other countries (Becker et al., 2009; Davis et al., 2016; Fiest et al., 2014; IGES, 2012; Townsend et al., 2012; Trautmann and Beesdo-Baum, 2017) point out, the reliability of the clinical diagnostic process and coding procedures has to be questioned when comparing it to standardized diagnostic procedures such as clinical interviews according to DSM/ICD criteria as a reference. A number of studies report under-recognition of depressive disorders as well as over-coding of subclinical cases in clinical practice, especially by primary care physicians (Kendrick et al., 2005; Mitchell et al., 2009; Tyrer, 2009). Additionally, the data set of the present study does not capture cases of depression that have been diagnosed in inpatient settings only, SHI insureds consulting private practices only and people insured in private health insurance funds. Nevertheless, it is unlikely that the

generalizability of prevalence estimates is notably affected by these constellations because the proportion of people with full private health insurance is only about 10% and, among SHI insureds, sole inpatient treatment, as well as sole treatment in private practices, is assumed to be relatively rare.

4.2. Prevalence of diagnosed depression and relative change over time

Our finding on the magnitude of depression prevalence and its continuous increase in recent years underscores the increasing importance of depressive disorders in ambulatory care in Germany. As this secular trend in administrative data can reflect ambiguous phenomena, several aspects and possible explanations have to be taken into account.

First, a corresponding rise in depressive morbidity could explain the time trend in administrative data. However, studies based on standardized diagnoses of mental disorders including depression indicate stable mental morbidity in Germany between 1998 and 2010 (Jacobi et al., 2014b), with 7.4% of the population fulfilling the criteria for major depression (Bretschneider et al., 2018). The total amount of administrative diagnoses (12.8% in 2010) thus exceeds the number of standardized assessed cases in the general population considerably; however, comparability of both indicators is restricted as survey data i.e. do not include cases with the subclinical syndrome as unspecified administrative diagnoses do. When unspecified diagnoses were disregarded in the present analysis, administrative prevalence amounted to 5.6% in 2010 and 10.1% in 2017, resulting in less deviation from population surveys while simultaneously underscoring the strong increase in more specified coding. Nevertheless, even if comparability of depression prevalence in a population survey and administrative data is optimized, opposing age distributions of diagnoses in each data source indicate further conceptual differences of both morbidity indicators (Grobe et al., 2018).

Second, despite a stable number of depression cases valid according

Table 3
Trends in prevalence (%) of diagnosed depressive disorders according to severity

		mild (N2017 = 1,685,108)			moderate (N2017 = 3,213,925)			severe (N2017 = 1,404,250)			unspecified (N2017 = 3,524,606)			Proportion other/unspecified			Change (2009–2017), %
		Prevalence in 2009, %	Prevalence in 2017, %	Change (2009–2017), %	Prevalence in 2009, %	Prevalence in 2017, %	Change (2009–2017), %	Prevalence in 2009, %	Prevalence in 2017, %	Change (2009–2017), %	Prevalence in 2009, %	Prevalence in 2017, %	Change (2009–2017), %	Prevalence in 2009, %	Prevalence in 2017, %	Change (2009–2017), %	
Total	1,36	2,69	5,14	128	2,25	0,34	127	7,25	5,54	-24	58,20	35,48	-39				
Men	0,85	1,86	3,49	151	1,39	0,82	114	4,33	3,75	-13	56,75	34,92	-38				
Women	1,80	3,45	6,62	121	2,99	2,79	36	9,77	7,15	-27	58,82	35,73	-39				
Age	Men																
15–19	0,23	0,62	1,02	233	0,31	0,34	127	0,85	1,01	19	55,27	33,83	-39				
20–24	0,41	1,02	1,90	184	0,67	0,82	114	1,76	1,83	4	54,68	32,93	-40				
25–29	0,57	1,14	2,28	139	0,95	0,94	69	2,34	2,20	-6	52,99	33,52	-37				
30–34	0,68	1,26	2,63	119	1,20	1,08	52	2,88	2,49	-13	52,57	33,33	-37				
35–39	0,76	1,46	3,13	130	1,36	1,34	50	3,35	2,89	-14	52,69	32,78	-38				
40–44	0,83	1,63	3,62	136	1,53	1,64	55	3,71	3,29	-11	52,00	32,34	-38				
45–49	0,91	1,78	4,00	137	1,69	1,92	53	4,17	3,59	-14	51,94	31,76	-39				
50–54	1,05	1,99	4,50	133	1,93	2,27	50	4,84	3,98	-18	51,87	31,27	-40				
55–59	1,22	2,27	5,06	129	2,21	2,60	42	5,74	4,56	-20	52,19	31,50	-40				
60–64	1,23	2,58	5,27	177	1,90	2,65	60	6,42	5,32	-17	57,26	33,63	-41				
65–69	0,99	2,51	3,79	194	1,29	1,84	58	5,84	5,36	-8	62,92	39,69	-37				
70–74	0,99	2,56	3,35	170	1,24	1,62	41	6,13	5,48	-11	64,42	42,07	-35				
75–79	1,09	2,71	3,45	141	1,43	1,63	27	7,29	5,84	-20	65,67	42,87	-35				
80–84	1,15	2,99	3,86	145	1,57	1,74	24	8,80	6,68	-24	68,08	43,73	-36				
85–89	1,15	3,14	4,36	154	1,72	1,94	27	10,45	7,97	-24	70,38	45,80	-35				
90–109	1,14	3,34	4,71	175	1,71	2,13	30	12,07	9,53	-21	72,87	48,34	-34				
Age	Women																
15–19	0,55	1,39	2,44	254	0,69	0,68	125	1,99	1,94	-3	56,44	30,03	-47				
20–24	0,97	1,97	3,57	130	1,55	1,33	78	4,01	3,18	-21	55,11	31,64	-43				
25–29	1,35	2,30	4,28	93	2,22	1,49	40	5,21	3,88	-26	52,92	32,44	-39				
30–34	1,55	2,60	4,99	86	2,68	1,76	31	6,23	4,57	-27	52,76	32,84	-38				
35–39	1,67	2,90	5,89	96	3,01	2,14	32	7,10	5,28	-26	53,01	32,59	-39				
40–44	1,80	3,17	6,73	103	3,31	2,66	37	7,87	6,02	-24	52,73	32,37	-39				
45–49	1,98	3,35	7,36	102	3,64	3,11	36	9,09	6,50	-28	53,50	31,99	-40				
50–54	2,22	3,64	8,18	101	4,07	3,62	31	10,68	7,31	-32	54,16	32,13	-41				
55–59	2,43	3,92	9,03	104	4,44	4,10	26	12,06	8,01	-34	54,34	31,96	-41				
60–64	2,29	4,22	9,10	150	3,64	4,14	49	12,93	9,01	-30	59,72	34,05	-43				
65–69	2,02	4,17	6,93	144	2,84	3,03	32	12,61	9,33	-26	63,77	39,78	-38				
70–74	2,05	4,29	6,52	129	2,85	2,86	18	13,51	9,89	-27	64,84	41,98	-35				
75–79	2,08	4,50	6,73	123	3,01	3,02	15	15,09	10,55	-30	66,17	42,56	-36				
80–84	1,95	4,74	7,42	151	2,96	3,29	23	16,47	11,99	-27	68,48	43,70	-36				
85–89	1,81	4,69	7,68	159	2,96	3,37	26	17,80	13,34	-25	70,52	45,85	-35				
90–109	1,63	4,68	7,85	181	2,79	3,45	35	18,19	14,83	-18	72,28	48,14	-33				

to the DSM/ICD criteria in the general population, increases in health care use of people with formerly undiagnosed depression may cause a rise in administrative prevalence, resulting in a closing of the help-seeking gap. However, non-help-seeking of people with mental disorders as assessed by standardized diagnostic instruments decreased only slightly from 62% to 57% between the surveys in 1998 and 2010 (Brandstetter et al., 2017). Similarly, specific analyses for depression did not detect changes in health care use either (Nübel et al., 2019).

Third, temporal changes in how physicians detect, code and document mental disorders in their billing claims could be responsible for the rise in administrative depression prevalence. In relation to this, empirical evidence on time trends is lacking, with the exception of repeated findings of under-recognition and under-treatment of depression as well as over-coding in the sense of assigning a depression diagnosis instead of another existing mental disorder in primary care (Becker and Abholz, 2005; Lecrubier, 2007; Maske et al., 2017; Mitchell et al., 2009; Trautmann and Beesdo-Baum, 2017). Qualitative research suggests that misclassification of depression is caused by non-adherence to the classification system (ICD) in favor of a more clinical hermeneutic case theory and intuition (Becker et al., 2009) and by focusing on impairment rather than formal and standardized diagnoses (Pilars de Pilar et al., 2012). At the same time, it cannot be ruled out that in some cases a previously documented diagnosis of depression is carried forward in the documentation software of the medical practice even after remission without the re-evaluation of the clinical symptoms.

Further, it has to be considered that in Germany as well as in other high-income countries, a remarkable expansion of health care supply for people with mental disorders (pharmacological, psychological, inpatient and outpatient treatment) could be observed over the last decade (Harvey et al., 2017; Jorm et al., 2017; Meadows et al., 2019; Mulder et al., 2017; Thom et al., 2019). In light of stable morbidity, possible explanations for the rise in administrative prevalence include: (1) People are coded with depression although they do not meet the classification criteria, resulting in poorly targeted treatment delivery. Thus, even if awareness of mental disorders increases, it might not translate into mental health gains due to poor quality of the diagnostic process. Possibly, some patients might even not know that they got diagnosed with depression, explaining why self-reported help-seeking does not change over time while the prevalence of coded diagnoses does. (2) Rising administrative prevalence might not reflect depressive morbidity per se but rather changes in burden of disease. Against the background of a growing amount of sick leave and disability benefits due to mental disorders in Germany (Thom et al., 2019) as well as internationally (Harvey et al., 2017; Viola and Moncrieff, 2016), functional limitations due to mental health problems might get more impairing over time, due to e.g. changing working conditions and demands. (3) Increasing supply of mental health care and numbers of administrative depression diagnoses as well as stable morbidity prevalence altogether may root in the same process of changing cultural constructions of mental health, which is described as growing mental health literacy (Angermeyer et al., 2009; Schomerus et al., 2012) or, more critically, as medicalization of normality (Clark, 2014; Mulder, 2008). Sensitization towards psychological concepts and introspection are discussed to contribute to the perception of deteriorating mental health in the general population (Kovess-Masfety et al., 2009; Patten et al., 2014), thus possibly accounting for a rising conception of distress as justifying a diagnosis of depression. Whereas in former times, under-recognition and under-treatment of mental disorders were primarily considered problematic, we meanwhile have to consider over-coding as a potential problem in mental health care. In this context, epidemiological research from field studies and administrative databases have to be accompanied by and linked to qualitative research and sociological perspectives in order to elucidate how and why physicians code which depression diagnoses in whom and what contributes to respective changes over time.

4.3. Relative change according to age, sex, and urbanization

The increase in depression prevalence was most pronounced in the age groups 15–19 years and 20–24 years and might indicate an age-specific reduction in treatment gap, as a comparison of survey and claims data previously pointed out with respect to the age group 20–29 years (Grobe et al., 2018). Correspondingly, results of the US National Ambulatory Medical Care Surveys (1995–1998 vs. 2007–2010) showed an increase in diagnoses of mental disorders, which was also significantly stronger among adolescents (<21 years) compared to adults (≥21 years) (Olfson et al., 2014). Considering that help-seeking is moderated by functional impairment (Michel et al., 2018) and only to a little degree by mental health literacy (Tomczyk et al., 2018) and stigma (Clement et al., 2015), one might infer a rising impairment of young adults. Although adolescents and young adults still showed by far the lowest number of depression diagnoses compared to all older age groups in 2017, the striking rise in this age segment calls for future research efforts.

In addition, sex differences were found to be diminishing. The convergence of the risk ratio (female vs. male) is attributable to a stronger increase of administrative prevalence in men (not to a decline in women) and was strongest in age group 20–24 years. In light of findings of stable sex ratios from epidemiological survey data with standardized diagnostic procedures (Bretschneider et al., 2018), this likely indicates changes in treatment supply and utilization rather than changes in “true” morbidity. For example, there is evidence that men in contrast to women tend to seek help from psychotherapists and psychologists more often in 2010 as compared to 1998 whereas help-seeking in women was stable over time (Nübel et al., 2019). As men's help-seeking for depression is closely linked to non-conformity to traditional masculine norms (Seidler et al., 2016), the observed reduction of the gender difference might be attributed to an underlying shift in German gender roles over the past two decades. Likewise, there is evidence that depressed men are affected by loss in health-related quality of life due to deterioration of social and emotional role functioning over time more strongly than women (Bretschneider et al., 2018). As trends in the national burden of disease between 1990 and 2010 suggest, depression rose from rank 10 to rank 7 as cause of disability-adjusted life years in men, while (only) from rank 4 to rank 3 in women (Plass et al., 2014).

Our study documents spatial variation in administrative depression prevalence according to the district's degree of urbanization in line with previous research (BKK, 2015; Busch et al., 2013; Erhart and Stillfried, 2012; Melchior et al., 2014). Urban-rural disparities are a well-described phenomenon in mental disorders and have been consistently demonstrated in national and international cross-sectional population surveys (Jacobi et al., 2014a; Peen et al., 2010; Solmi et al., 2017). Our study suggests regional variation lessened between 2009 and 2017. While prevalence rose in all district types, increases were strongest in rural regions with low population density (+34.4%), resulting in an attenuation of urban-rural disparities. Reasons for this spatial approximation are still subject to speculation and may need further investigation in future studies. However, one may hypothesize that the observed trend may be partly attributed to changes in help-seeking behavior in rural areas and/or increased local coverage with health care services, in particular psychotherapists, which took place in rural regions in Germany during recent years (Kassenärztliche Bundesvereinigung, 2018).

4.4. Relative change according to depression severity

Research on unspecific depression diagnoses still lacks consensus on the definition of these rather heterogeneous syndromes (Kroenke, 2006; Zimmerman et al., 2013) and indicates subthreshold depression not to be an a priori risk factor for the development of a full-blown major depression (Tuihof et al., 2018). The high share of unspecified

depression diagnoses in routine care was often criticized; according to the national guideline for the treatment of depression introduced in 2009 (DGPPN, 2009), specifying a degree of depression severity is requested in order to decide on most suitable treatment. In this regard, our finding of a decrease of unspecified diagnoses by 24% is a welcome development. Notably, the increase in moderate depression (+128%) is higher than the increase in mild depression (+98%), while a stronger increase in the latter would have been more self-evident assuming that other/unspecified diagnoses most likely represent subclinical or mild cases.

5. Conclusions

The present study based on administrative data from nearly the entire German adolescent and adult population highlights the increasing importance of depressive disorders in ambulatory care over the last decade in a country with a strong economy and health care infrastructure. Besides the general rise in diagnosis frequency, our study revealed a near doubling of prevalence among adolescents and a remarkable reduction of the gender difference. Changes in gender roles as well as a general trend towards the greater influence of psychological theory and practices, including increased mental health literacy and help-seeking behavior, may underlie the observed dynamics in administrative depression epidemiology. To disentangle the effect of single contributors, further research complementing administrative and field studies with data-linkage designs, qualitative research and the consideration of societal developments are needed. As the number of administrative depression diagnoses is increasing with an astonishingly steady slope, a slowdown or even termination of that process appears to be unlikely in the near future. Hence, further clarification of that public health concern seems mandatory.

6. Declarations

6.1. Ethics approval and consent to participate

Not applicable.

6.2. Consent for publication

Not applicable.

6.3. Availability of data and material

The datasets analyzed during the current study are not publicly available due to ethical and privacy reasons.

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Authors' contributions

Study concept and design: AS, JT, FJ, JH, and JB. Analysis and interpretation of data: AS, JT, FJ, JH, and JB. Drafting of the manuscript: AS and JT. Critical revision of the manuscript for important intellectual content: AS, JT, FJ, JH, and JB. Statistical analysis: AS and JH. All authors read and approved the final manuscript.

Declaration of Competing Interests

The authors declare that they have no competing interests.

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