Original article

The Burden of Disease in Germany at the National and Regional Level

Results in Terms of Disability-adjusted Life Years (DALY) from the BURDEN 2020 Study.

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Summary

Background: Summary measures such as disability-adjusted life years (DALY) are becoming increasingly important for the standardized assessment of the burden of disease due to death and disability. The BURDEN 2020 pilot project was designed as an independent burden-of-disease study for Germany, which was based on nationwide data, but which also yielded regional estimates.

Methods: DALY is defined as the sum of years of life lost due to death (YLL) and years lived with disability (YLD). YLL is the difference between the age at death due to disease and the remaining life expectancy at this age, while YLD quantifies the number of years individuals have spent with health impairments. Data are derived mainly from causes of death statistics, population health surveys, and claims data from health insurers.

Results: In 2017, there were approximately 12 million DALY in Germany, or 14 584 DALY per 100 000 inhabitants. Conditions which caused the greatest number of DALY were coronary heart disease (2321 DALY), low back pain (1735 DALY), and lung cancer (1197 DALY). Headache and dementia accounted for a greater disease burden in women than in men, while lung cancer and alcohol use disorders accounted for a greater disease burden in men than in women. Pain disorders and alcohol use disorders were the leading causes of DALY among young adults of both sexes. The disease burden rose with age for some diseases, including cardiovascular diseases, dementia, and diabetes mellitus. For some diseases and conditions, the disease burden varied by geographical region.

Conclusion: The results indicate a need for age- and sex-specific prevention and for differing interventions according to geographic region. Burden of disease studies yield comprehensive population health surveillance data and are a useful aid to decision-making in health policy.

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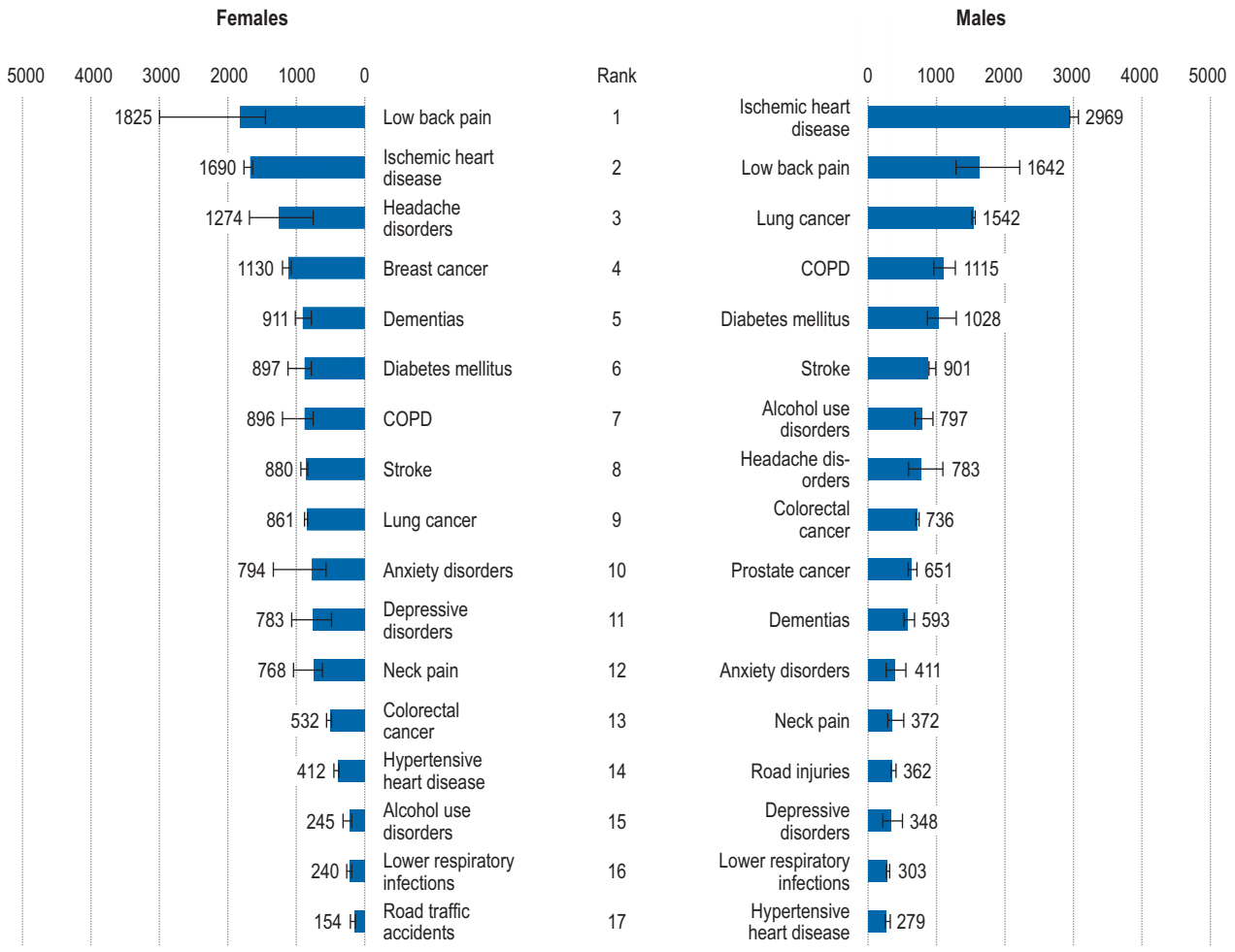
Epidemiological measures such as incidence, prevalence, and deaths are essential for monitoring population health. However, examining them in isolation cannot adequately assess the significance of various diseases. Assessment of the burden of disease in the general population is therefore becoming increasingly important in supporting health policy decision-making. Summary measures of population health integrate a variety of diseases as a cause of health impairment (morbidity) and death (mortality). The significance of the different diseases for population health can be measured by applying standardized rules (1, 2). Thus, the disability-adjusted life year (DALY) measures the total burden of disease comprising mortality (years of life lost due to death [YLL]) and morbidity (years lived with disability [YLD]) (3–6). DALY are health gap measures which quantify deviations of the current population health from a defined norm. In contrast, health expectancy measures (for example, healthy life years) represent the remaining years of life spent in good health (7).

FIGURE 1



Total burden of disease (DALY per 100 000 population [pop]) for selected causes of burden of disease by sex (Level 3, Germany), error bars correspond to the 95% UI; source: BURDEN 2020; YLL: cause of death statistics 2017 (31), Federal Statistical Office of Germany 2018 (32); YLD: *eTable 3*; our own calculations; only 17 ranks each are presented here since no DALY were calculated for prostate cancer in women and breast cancer in men, and the residual category "Other transport injuries" is not shown (*eTable 1*, *eTable 2*); data limitations must be taken into account when making a direct comparison of DALY (*eTable 3*); COPD, chronic obstructive pulmonary disease; DALY, disability-adjusted life years; RI, road injuries; YLL, years of life lost due to death; YLD, years lived with disability

The metrics YLL, YLD and DALY date back to the Global Burden of Disease (GBD) study (4, 8, 9). This study estimates the burden of disease for global comparisons according to variables such as sex, age and country. Since the GBD study has only limited access to data at a national level and must therefore draw upon universal assumptions and extensive statistical methods, evaluation of the burden of disease has so far not been possible for Germany at the sub-national level. Yet decisions about health care require information below the federal level. So, regional burden of disease analyses are of considerable additional value for the assessment of population health because they provide information for guiding and prioritizing health care and prevention measures. Based on an improved data basis, the pilot project BURDEN 2020 ("The Burden of Disease in Germany at the National and Regional Level") adapted the method used for measuring disease burden on the example of selected diseases and injuries with high public health relevance *(eBox)*. The use of claims data from statutory health insurances and own health surveys enabled for the first time regional analyses of selected diseases. Based on this continuously available information, burden of disease analyses can become a permanent component of public health surveillance in Germany (10).

Method

The burden of disease concept quantifies in life years any deviation in population health from an "ideal" health status per reference year (*eMethods section* 1.1) (4). The mortality-related burden of disease (years of life lost due to death [YLL]) is calculated by multiplying the number of deaths with the standard remaining life expectancy at the age when death occurs. The

TABLE

Total burden of disease (DALY per 100 000 population) of the selected causes of burden of disease with increasing age (Level 3, Germany, both sexes)

Total	20 – 24	25 – 29	30 – 34	35 – 39	40 – 44	45 – 49	50 – 54	55 – 59	60 – 64	65 – 69	70 – 74	75 – 79	80 – 84	85 – 89	90 – 94	95 +
Lower respiratory infections	29	23	31	36	33	67	104	166	265	359	581	836	1435	2318	3297	4073
COPD				99	180	336	657	1199	1932	2575	3226	3274	3668	4085	4106	3596
Lung cancer		5	19	93	250	588	1152	2277	3241	3740	3861	3017	2290	1639	996	478
Breast cancer	2	44	165	304	436	591	731	837	961	1179	1302	1344	1469	1460	1597	1654
Prostate cancer					1	9	72	177	421	711	1113	1538	1717	1882	1485	1001
Bowel cancer	4	24	90	112	196	336	539	792	1111	1459	1772	1969	2232	2470	2557	2142
IHD		43	92	224	485	854	1350	2138	3092	4215	5406	7367	11 162	16 308	21 215	24 962
Stroke	31	40	71	123	178	327	430	658	935	1396	2128	3117	4762	6633	8294	8705
Hypertensive heart disease		1	2	3	25	39	76	126	245	370	593	1044	2087	3925	6667	10 115
Diabetes mellitus	33	51	84	129	251	414	668	981	1504	2041	2598	3210	4198	4793	4868	4436
Dementias					16	20	49	108	250	521	1 273	2 646	5 537	9 823	14 075	17 795
Depressive disorders	248	303	378	486	618	657	762	832	895	910	889	967	1038	1023	1067	1091
Anxiety disorders	402	468	544	601	671	735	815	846	831	815	777	736	705	654	603	536
Alcohol use disorders	959	740	679	524	584	619	746	690	671	395	234	161	110	48	25	6
Low back pain	1397	1674	1635	1758	1754	2447	2318	2084	2217	2645	2863	2539	1770	1770	1688	1610
Headache disorders	1607	1967	2042	1565	1532	1515	1197	995	839	560	425	340	290	273	274	232
Neck pain	346	397	592	525	589	914	894	771	720	914	748	839	685	613	534	440
Road injuries	645	429	316	258	218	240	248	224	185	156	159	164	153	121	56	23

Legend	<1340	1340 <3900	3900 <9000	9000 <17 000	≥17 000

Source: BURDEN 2020; YLL: Cause of death statistics 2017 (31), Federal Statistical Office of Germany 2018 (32); YLD: *eTable 3*; our own calculations; due to data limitations, a comparison of the causes of burden of disease is only presented from the age group of 20 year-olds onwards (*eTable 3*); both grouping and the resulting color scheme were created using the natural breaks method (33); COPD, chronic obstructive pulmonary disease; DALY, disability-adjusted life years; IHD, ischemic heart disease

methodology is described in detail elsewhere (11, 12). The morbidity-related burden of disease (years lived with disability [YLD]) provides a population-based quantification of years lived with health impairments. It is calculated from the prevalence of disease or injury, the distribution of the diseased population according to severity grades (severity distributions) and, for periodically occurring diseases, also the average duration of illness as well as severity-specific weights (disability weights) (*eMethods section 1.1*, [13]).

The initial assumption is that each diseased person lives one year with a disability per reporting year. The average duration of symptoms is also taken into account for episodic disabilities. Furthermore, the years lived with disability are converted to a unit of time equivalent to the YLL by applying disability weights (14, 15). Disability weights multiply each severity grade by a value between 0 (state of full health) and less than 1 (1 would be equivalent to death) (15, 16). A greater weight corresponds to a greater disability and results in a higher burden of disease (*eMethods section 1.2*). The DALY is the sum of YLL and YLD and is interpreted by the GBD study as years of healthy life lost (4).

The present analysis takes into account a selection of diseases and injuries (henceforth referred to as causes of burden of disease). Using the GBD four-level classification system (17), this selection includes at least one cause from the three main groups of causes of disease (level 1) of the GBD classification (*eTable 1*):

- communicable, maternal, neonatal, and nutritional diseases
- non-communicable diseases
- injuries.

These main groups are further subdivided at levels 2 to 4 into more specific causes of burden of disease. Thus, non-communicable diseases, for instance,

FIGURE 2

Relative contribution of YLL and YLD to the total burden of disease (absolute DALY) for the selected causes of burden of disease (level 3, Germany, both sexes)
Source: BURDEN 2020; YLL: Cause of death statistics 2017 (31), Federal Statistical Office of Germany 2018 (32); YLD: *eTable 3*; own calculations; the residual category "Other transport injuries" is excluded (*eTable 1*, *eTable 2*); COPD, chronic obstructive pulmonary disease; DALY, disability-adjusted life years; IHD, coronary heart disease; YLL, years of life lost due to death; YLD, years lived with disability

include neurological disorders (level 2), which in turn include headache disorders at level 3. The latter distinguish between migraine and tension type headache at level 4. The selection for the present study was conducted at Level 3 (a total of 172 causes of burden of disease) and includes 19 of the quantitatively most important causes (around 53% of the burden of disease calculated for Germany for 2017 by the GBD study) (18) (*eTable 2*).

The calculation of YLD is based on primary and secondary data sources, in particular age, sex and, in most cases, morbidity-adjusted claims data of patients insured by the local statutory health care fund AOK (*eTable 3*) (13, 19–22). Survey data on pain and addiction disorders (23–25), road traffic accident statistics (26), and groundwork done within the GBD study were also used (27). For both YLL and YLD uncertainty concepts (95% uncertainty intervals [UI]) were developed and merged (13). YLD were adjusted for age-related multimorbidity to avoid overestimation of the total (13, 28). The results are reported as absolute values as well as crude rates and age-standardized rates per 100 000 population (pop) for the year 2017 (European standard population 2013 [29]).

Results

The selected causes of burden of disease in the German population in 2017 produced 12.1 million DALY (UI: 11.9–13.1) (30). Women account for 6.0 million DALY (UI: 5.9–6.8), about as much burden of disease as men with 6.1 million DALY (UI: 6.0–6.6).

Without standardizing for age, this translates into a relative 14 584 DALY per 100 000 population, with a lower rate for women (14 303 DALY) than for men (14 872 DALY). When comparing all examined causes of burden of disease, ischemic heart disease (IHD) had the highest overall rate (2321 DALY), followed by low back pain (1735 DALY). At ranks 3 to 5 follow tracheal, bronchial, and lung cancer (henceforth referred to as "lung cancer" for short) with a rate of 1197 DALY, headache disorders with 1032 DALY, and chronic obstructive pulmonary disease (COPD) with 1004 DALY. Gender comparisons show clear differences with regard to the respective causes of burden of disease (*Figure 1*). IHD is ranked first for men (2969 DALY) and second for women with 1690 DALY after low back pain (1825 DALY). Furthermore, ranks 3 to 5 for women are occupied by headache disorders (1274 DALY), breast cancer (1130 DALY), and Alzheimer's disease and other dementias (henceforth "dementias" for short) (911 DALY). In men, on the other hand, lung cancer (1542 DALY), COPD (1115 DALY), and diabetes mellitus (1028 DALY) are ranked 3 to 5. Alcohol use disorders produce more than three times as much burden of disease in males than in females. In contrast, women experience more than twice as much burden of disease from depressive disorders.

A differentiated breakdown of the burden of disease at level 4 (*eFigure 1*) demonstrates hardly any significant shifts at the upper ranks in comparison with level 3. It is evident, however, that certain level-4 causes are responsible for the degree of level-3 burden of disease (*eTable 4*). Thus, type 2 diabetes (level 4) is responsible for 95% of the DALY of diabetes mellitus (Level 3), migraine accounts for 94% of the DALY of headache disorders, and major depression for 93% of the burden of disease due to depressive disorders.

In relative terms, the burden of disease increases with age overall and for both sexes, although ranking and, in turn, the importance of the selected causes of burden of disease vary with age (*Table*, *eTable 5*). Headache disorders, low back pain, road injuries, alcohol use disorders, and anxiety disorders lead the DALY rankings in younger adulthood. Cardiovascular diseases, stroke, dementias, diabetes mellitus, and COPD dominate with advancing age (e*Table 5*, [30]). An age-related decrease of DALY rates is evident for lung cancer, alcohol use disorders, and headache disorders.

The disease-specific significance of mortality and morbidity for population health is reflected in the relative contribution of YLL and YLD to DALY. Whereas the burden of disease for pain and mental disorders is entirely attributable to morbidity, the relative contribution of mortality for the other causes of burden of disease varies (*Figure 2*). For instance, the proportion of burden of disease due to death (YLL) is 34% for diabetes mellitus and 97% for lung cancer. The proportions differ only slightly between the sexes (with the exception of road injuries and alcohol use disorders, for example). With increasing age, the relative contribution of mortality to DALY also increases for most causes of burden of disease (30).

An example for a striking gender difference can be given through the DALY rates for road injuries. Although road injuries are responsible for the greatest burden of disease for both sexes for the ages between 15 and 34 years, the rate for males is almost 2.4 times higher (362 versus 154 DALY per 100 000 population) (*Figure 1*). With increasing age, more DALY resulting from road injuries are evident in men than in women for almost all age groups. This is mainly due to fatal road injuries (YLL), while the share of YLD is similar in both sexes (*eFigure 2*).

Sub-national differences are evident at the level of the 96 spatial planning regions (abbreviated to SPR), both in individual causes of burden of disease (30) and in the total of all DALY calculated so far (age-standardized per 100 000 population) (*Figure 3, Map I*). Overall, the regions Emscher-Lippe (North Rhine-Westphalia) and Bremerhaven have the highest burden of disease, relatively speaking, while the SPRs Munich and South Upper Rhine (Baden-Wurttemberg) have the lowest (30). Furthermore, similar sub-national patterns in the distribution of DALY emerge for certain causes of burden of disease. Higher DALY values are evident for IHD (*Figure 3, Map II*) in the SPRs in eastern Germany, which is exemplary for many cardiovascular diseases. On the other hand, the burden of disease for COPD (*Figure 3, Map III*) is highest particularly in the SPRs in western Germany and Berlin. This is similar for lung cancer. A clear difference is evident between the northern and southern SPRs for depressive disorders due to a, relatively speaking, smaller burden in northern Germany, with Berlin and Hamburg being exceptions (*Figure 3, Map IV*).

Discussion

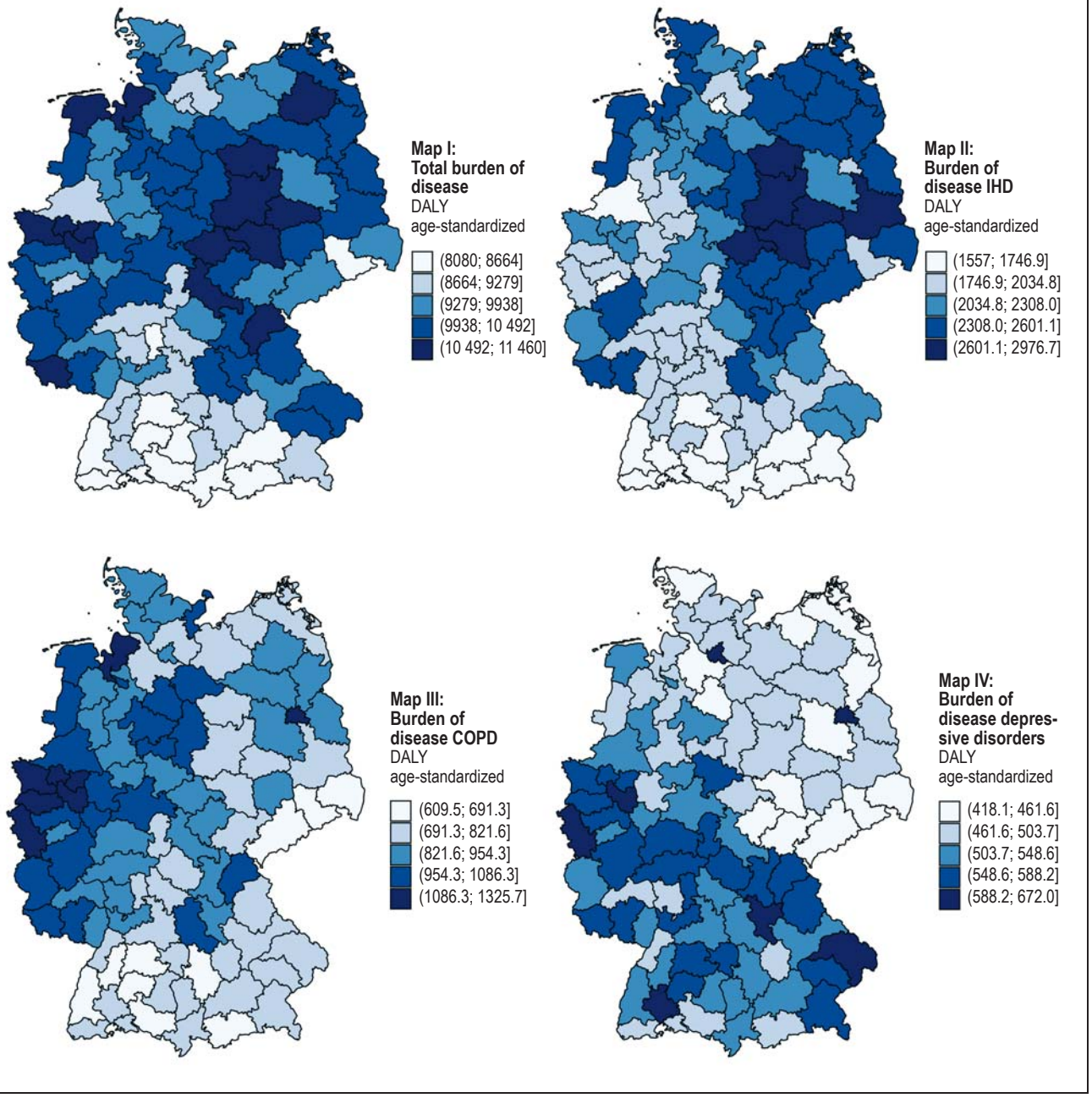
The present analysis provides an overview of the burden of disease caused by disability and death in Germany for 19 of the most important causes of burden of disease for the year 2017. The advantage of looking at burden of disease as opposed to isolated information on deaths and disease prevalence is that the impact of disease (YLD) and death (YLL) on population health can be compared using a standardized summary measure. The analysis was carried out using a uniform and transparent methodology and an improved, more complete, and sub-nationally differentiated database as compared with the GBD study. Although a comparison of the results with the findings of the GBD study for the year 2017 (17, 18) is only possible to a limited degree, on the whole it does show many matches for Germany. The causes of the highest burden of disease include

- IHD
- low back pain
- lung cancer
- headache disorders
- COPD
- diabetes mellitus.

Gender differences were particularly apparent in the other ranks. In females, breast cancer contributes significantly to the burden of disease, while dementias also ranks highly. In males, the burden of disease from alcohol use disorders and from road injuries is higher.

Given the high level of detail of the results, it is possible to identify which single causes of burden of disease (level 4) account for the largest proportion of disease-specific DALY (level 3), for example type 2 diabetes within diabetes mellitus and migraine within headache disorders. Furthermore, the results show that the significance of certain causes of burden of disease varies with increasing age. Whereas headache disorders and alcohol use disorders lead the DALY rankings for both sexes in younger adulthood, the burden of cardiovascular diseases and dementias rises with increasing age. The comparison of morbidity-related and mortality-related burden of disease highlights the different needs for action. Thus, morbidity-related burden of disease from mostly chronic, but rarely fatal illnesses such as pain disorders and mental disorders can be reduced if sequelae and severe forms of the disease are avoided. The high proportion of mortality-related burden of

FIGURE 3



Total burden of disease (age-standardized DALY per 100 000 population) at the spatial planning regions level (level 3, both sexes) for the sum of all causes of burden of disease (Map I), and for IHD (Map II), COPD (Map III) and depressive disorders (Map IV); range in brackets

Source: BURDEN 2020; YLL: Cause of death statistics 2017 (31), Federal Statistical Office of Germany 2018 (32); YLD: *eTable 3*; our own calculations; spatial planning regions, see Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) (34); Map I total burden of disease. Excluded from Map I are pain disorders and alcohol use disorders due to the lack of spatial data resolution (*eTable*); COPD, chronic obstructive pulmonary disease; DALY, disability-adjusted life years; IHD, ischemic heart disease; YLL, years of life lost due to death; YLD, years lived with disability

disease, for example due to cancer or cardiovascular disorders, indicates a high primary need for prevention (35) and the necessity to increase survival times of those affected by providing suitable forms of treatment.

In detail, males and females differ in their share of burden of disease due to death or disability. Whereas the mortality rate due to hypertensive heart disease is higher in women than in men, the opposite applies for alcohol use disorders: Here, alcohol-related mortality is significantly higher in men. Patterns for cardiovascular diseases, COPD, and depressive disorders, amongst others, become evident when the results are differentiated down to a sub-national level. On the one hand, these findings raise questions about possible regional care needs. On the other hand, they help to identify other fields of action which should be further substantiated by sub-national analyses of environmental, behavioral, relational as well as metabolic risk factors (35).

Limitations

Fundamental limitations arise because important illnesses with a high burden of disease (for example, chronic kidney diseases or liver cirrhosis [18]) were initially not considered in the pilot project, resulting in a relevant, but nevertheless still incomplete picture for assessing burden of disease. Furthermore, a large variety of data bases was used because, whenever possible, data sources of high validity and with high spatial resolution were to be used for each of the causes of burden of disease. Whereas claims data are suitable for capturing cases reliably associated with the utilization of the health care system (for example, severe myocardial infarction), it was necessary to rely on survey data for pain disorders. Therefore, specific limitations need to be taken into consideration ([11, 12, 19, 23, 24, 36]; *eMethods section* 2.1). The biases associated with the respective data sources are counteracted by compensation mechanisms such as morbidity-adjusting extrapolation procedures for the claims data (21). The results based on claims data were checked for consistency as far as possible by using external data sources (see *eMethods section 2.1* for a detailed discussion). Furthermore, it was not possible in the course of the project to conduct prevalence estimates based on the survey data for children and adolescents nor at a sub-national level, which resulted in limitations when making comparisons between age groups and between sub-national regions. Suitable statistical methods to close these data gaps, including the use of sub-national estimation methods (37), are currently being tested. With regard to severity distributions, it was necessary for some of the diseases to resort to preliminary work from the GBD study which draws on mainly global, i.e., non-country specific and temporally invariant distributions (see *eMethods section 2.2* for methodological critique) (38). Non-country specific disability weights were fully adopted from the GBD study (39) (see *eMethods section 2.2* for methodical criticism).

Conclusion

All results of the BURDEN 2020 project are entered into a health information system (www.daly.rki.de). They therefore represent an important element of public health surveillance at the Robert Koch Institute. The epidemiological measures based on claims data, such as prevalence, for example, are also readily available according to age, sex, and region (www.krankheitslage-deutschland.de). The BURDEN 2020 project is therefore useful to inform decision-making processes in health policy, such as the implementation of federal framework recommendations according to the German prevention law or regional morbidity-oriented planning. It can also be extended to include further diseases and may be supplemented by time series, forecasts, and other assessments (health impact assessments).

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Conflict of interest statement

See funding reference for funding of individual staff and authors.
The authors confirm that no conflict of interest exists.

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► **Supplementary material**

eReferences, eMethods section, eTables, eFigures, eBox: www.aerzteblatt-international.de/m2022.0314

Supplementary material to:

The Burden of Disease in Germany at the National and Regional Level

Results in Terms of Disability-adjusted Life Years (DALY) from the BURDEN 2020 Study

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Dtsch Arztebl Int 2022; 119: 785–92. DOI: 10.3238/arztebl.m2022.0314

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eBOX

BURDEN 2020 study

The BURDEN 2020 study is a pilot project designed to adapt existing methods for calculating burden of disease for Germany (10). A national burden of disease study like BURDEN 2020 goes beyond comparative international systems such as the GBD (Global Burden of Disease) study: Data sources such as claims data from statutory health insurances, official statistics, and primary data collection are used for Germany that are known to be reliable on a nationwide and regional level (quality), whose strengths and limitations are known, can be regularly updated, and are considered reliable (acceptance). This builds up country-specific capacities in the field of burden of disease (competence), methodological decisions can be explained in a comprehensible way (transparency), and the results can be better communicated to national stakeholders (legitimacy). This creates an information system which can be expanded with complementary other components (flexibility).

In BURDEN 2020, complex modeling algorithms lie behind the three core indicators – years of life lost due to death (YLL), years lived with disability (YLD) and disability-adjusted life years (DALY) (17, 27, e1): Thus, ill-defined causes of death were redistributed, allowing to assign valid causes of death to all deceased persons in order to properly calculate the disease burden (12). Regional prevalences were estimated and, after adjusting for age and morbidity, extrapolated to the general population (19–21). Specific severity distributions and disease durations are included in the calculations to measure the actual burden of disease in the population (13, 27). The results were adjusted for multimorbidity, and a concept was developed to reflect the various sources of statistical uncertainty (13). As a result, extensive use of the existing diverse data in Germany laid the foundation for a consistent information system on the burden of disease (www.daly.rki.de). This allows to prioritize diseases and injuries according to their relevance for public health, to identify the needs-based prevention and health care and enhance planning and evaluation of public health measures.

eMETHODS

1. Calculation approach and additional information about the YLD indicator

1.1 Calculation approach

Disability-adjusted life years (DALY) comprise two different complementary indicators:

- the mortality component "years of life lost due to death" (YLL), i.e. the potential years of life lost due to premature death (4)
- the morbidity component "years lived with disability" (YLD) converted to a unit of time equivalent to YLL (3, 6).

The mortality component (YLL) is calculated by summing the number of deaths (i) for individual ages t per age group a (within each age group (a), sex category (s), sub-national region (r), for a specific cause (of death) (c)) multiplied by the remaining life expectancy at age of death (w) for both sexes (11).

$$[1]\ YLL_{a,s,r,c} = \sum_{w=1}^{t} i_{w,s,r,c} * rle_{w}$$

The morbidity component is calculated per cause (c) by summing the severity-specific (j) prevalent cases p, estimated on the basis of (point) prevalences (within each age group [a], sex category [s], and sub-national region [r]), multiplied by the severity-specific disability weight (dw). The latter corresponds to a weighting factor which varies between 0 (equivalent to perfect health) and smaller than 1 (1 would be equivalent to death), depending on the severity of the disease or health states (15). The weight quantifies the degree of health loss from disease or injury (15). Population surveys were conducted in various countries for the purpose of gathering this information. Two instruments were used in the surveys, paired comparisons [PC]) and population health equivalent questions [PHE]). The weights were derived from the results (15, 16, e2). In the present study, the lowest weight was 0.008 (uncertainty interval [UI]: 0.004–0.014) for mild injuries (within road injuries) and the highest was 0.658 (UI: 0.477–0.807) for severe major depressions.

$$[2]\ YLD_{a,s,r,c} = \sum_{j=1}^{k} p_{a,s,r,c,j} * dw_{c,j}$$

Here, k can range between one and eight, depending on the cause (c), and corresponds to the number of levels of severity per disease. The maximum number of severity levels for the selected causes of burden of disease for the pilot project was eight.

The sum of YLL and YLD finally determines the DALY (according to age group [a], sex [s], region [r] and cause [c]).

$$[3]\ DALY_{a,s,r,c} = YLL_{a,s,r,c} + YLD_{a,s,r,c}$$

1.2 Supplementary information about the YLD indicator

The YLD indicator can be interpreted in different ways, and various definitions are found in the literature that differ from the original version (years lived with disability [YLD]). Based on the conceptual idea behind DALY and its individual indicators, burden of disease is quantified as any deviation of current population health from an optimal health status quantified in the unit of life years (4). The difference between the actual age at death and a theoretical, statistical (more distant) life expectancy is calculated for mortality (e1). The term YLL (years of life lost) explicitly assumes that these years of life are lost to the population.

Concerning morbidity every year of life lived with disability is quantified. In order to compare the dimensions mortality and morbidity, the number of years spent with ill health are then converted into a unit of time equivalent to that of YLL by applying "disability weights" specific to the severity of the disease, in other words: YLD is weighted in relation to YLL (4, 16). After weighting, the GBD study refers to this as "years lived with disability" (YLD). However, the YLD then no longer represents the actual number of all life years spent with ill health but rather the length of time equivalent to YLL in the unit years of life.

Since the YLL are interpreted as a "lost" year of life, the equivalent time with respect to the YLD is consequently also a "lost" year of life. This conclusion often leads to other denominations and interpretations of the YLD indicator. It is therefore also referred to as "years of healthy life lost due to disability" (e3) or as "years lost to disability" (e4). This can also be implied from the fact that in the GBD study the DALY indicator is referred to, and interpreted as one "year of healthy life lost" (4). Consequently, the common metric for YLL and, after applying weights to convert years of life spent with a disease, would be a "lost" year of healthy life.

Although the indicators YLL, YLD and DALY are commonly referred to as "years of healthy life lost", they in fact quantify those years of life which deviate from an ideal state of health. In order to avoid the idea of something actually being "lost", we instead usually refer to burden of disease in terms of the respective individual indicators YLL, YLD, and DALY. The lack of precision in naming the indicators can be explained by the conceptual ambiguity arising from the derivation of the different indicators.

2. Limitations

2.1: Limitations of the data sources used for calculating YLD

Health survey data and study data

The generalizability of the results may be limited when representative samples of a population are used to

estimate epidemiological indicators. Potential sources of error include measurement errors when measuring key outcomes, processing/editing errors when conducting studies, and nonresponse errors due to the refusal of respondents to participate (e12). This results in a variety of biases. Non-response in particular can have an impact on sample composition. This concerns not only representativeness of the characteristics age and sex, but also the inclusion of subpopulations, such as the homeless and persons with a migration background. The latter have so far been insufficiently addressed in population health surveys (e13). This generally results in sample sizes being too small for certain combinations of characteristics (age, sex, migration background, education, etc.) to make statistically sound statements about morbidity rates. These potential biases in the composition of the samples are best addressed by using multivariate analysis procedures and applying weighting procedures such as design and adaptive weighting, and possibly by considering the drop-out probability in longitudinal and cohort data sets, see for example (e10, e14).

Claims data from statutory health insurances

When using claims data to calculate epidemiological key indicators, data reliability should be assessed. It should be kept in mind that claims data primarily contain information relevant for the reimbursement of services, that misclassification may result from cases where health care services have not been utilized and diagnoses not documented, and there may be biases arising from billing and justification strategies (e15, e16). Non-utilization of health care services for headache, back pain, and neck pain was considered of relevance for the BURDEN 2020 project, so health surveys were conducted to collect data for these conditions. Non-utilization is less relevant for many other diseases, as cases with more severe disease are the largest contributors to YLD and therefore more likely expected to be associated with utilization of health care services and more complete documentation of patient diagnoses (e17). For example, documentation of diagnoses of those diseases requiring hospitalization are considered reliable because coding guidelines applied in the inpatient sector (for more detailed discussion, see [22]). This may be assumed to be the case with diseases such as severe myocardial infarction or with surgery for cancer. It is therefore also assumed that for many diseases disability is sufficiently mapped in claims data and hence the major part of the disease burden can be correctly calculated using this data base. In order to minimize misclassifications in claims data, disease-specific case definitions were developed using other data sources such as information on surgical procedures, drug prescriptions, and outpatient billing items in addition to patient diagnosis information (20, 22, e18–e20). However, the restriction remains that the validity of the diagnoses for some diseases or individual diagnoses (e.g., depression, dementia types) cannot be conclusively assessed at present. In the future, linkage between claims data and other data sources like cohort studies, such as the NAKO Health Study (e21) or clinical registries, will provide new insights (e22).

Apart from questions regarding internal validity, external validity of the claims data is also of relevance for population-based burden of disease calculations. In principle, generalizability of claims data results taken from one (type of) health insurer is limited because there is currently no random sample of the general population available (21, e23). Thus, systematic deviations from the general population have been found with respect to age and gender structure as well as morbidity (e24–e27). An extrapolation procedure was therefore used to correct not only differences in population structure but also health insurer-specific differences in morbidity as compared with the German general population (21). Finally, all of the results obtained on disease prevalence and severities were checked for plausibility and compared with external data sources (see detailed discussion in [22]). For this purpose, it was possible to use a large number of available publications from Germany for diabetes, for example, and the figures from the cancer registries were applied for cancer prevalence. However, the external plausibility check was often limited by the fact that suitable information was not available for Germany. Disease prevalence and severity distributions were then checked for plausibility using international burden of disease studies (18, e28).

Despite the limitations mentioned for internal and external validity, claims data of the statutory health insurance funds do have their advantages over other data sets: For instance, biases resulting from interviewer effects are excluded, as are recall bias, sampling, non-response, or the implicit exclusion of hard-to-reach groups, such as those of advanced age, the multimorbid, or persons with a migration background (e16, e29).

Claims data from statutory insured persons are used to map measures of disease prevalence in, amongst others, the Care Atlas (www.versorgungsatlas.de), the Diabetes Surveillance (www.diabsurv.rki.de) or the Health Atlas of the WIdO (www.gesundheitsatlas-deutschland.de). The present epidemiological metrics, generated by age, sex, and region and based on claims data, and the associated methodology documentation are available at www.krankheitslage-deutschland.de.

Road traffic accident statistics

Secondary data sources used include road traffic accident statistics, which cover all accidents recorded by the police that resulted in personal injury or property damage occurring on public roads or squares (26). The cause of the accident and the degree of injury are recorded, together with the age of the casualties and the type of vehicle. However, it cannot be ruled out that some Road injuries resulted in injuries relevant for calculating burden of disease but were not recorded by

the police. To make corrections for this, the proportion of accidents not recorded by the police was determined from health survey data and used for extrapolation (see [13] for the relevant procedure).

2.2: Limitations of using severity distributions and disability weights

We resorted to the preliminary work of the GBD study for those causes of burden of disease for which we were unable to estimate the severity distributions ourselves (27). Use of GBD results, however, is subject to limitations because the GBD study applies global distributions that are mostly held constant over time (27, e28). However, use of national results is preferable because previous studies have shown striking differences between globally constant versus national distributions (for cancer see [28]). All disability weights were taken from the GBD study (27). The origin of the weights is the subject of lively discussion in the scientific community, as they are an essential underlying assumption of the DALY concept and make comparison with mortality possible at all (4).

Criticism of disability weights is directed on the one hand towards their meaning as health-related disability, which ignores individual resources such as access to help with daily activities or additional income to cope with these restrictions (14). On the other hand, it is criticized that the quantification of disability weights addresses not so much the actual objective loss of health but more the individual perception of the loss (e30). This is attributed to the lay form of describing health states that are rated by respondents in terms of severity (e31). It is this evaluation that ultimately forms the basis for estimating the weights (15, 16). Criticism is also leveled at the choice of statistical methods used for calculation, which, for example, neglects adjustments for comorbidities (e31). Furthermore, the possible impact of (social) context effects on the level of weights between countries cannot be ruled out (15, e2, e31).

eTABLE 1

Presentation of the analyzed causes of burden of disease within the hierarchy of levels (morbidity)

Level 1	Level 2	Level 3	Level 4
Communicable, maternal, neonatal and nutritional diseases	Respiratory infections	Lower respiratory infections	→ Lower respiratory infections
		[…]	
	[…]		
Non-communicable diseases	Cancer diseases	Colorectal cancer	→ Colorectal cancer
		Tracheal, bronchial and lung cancer	→ Tracheal, bronchial and lung cancer
		Breast cancer	→ Breast cancer
		Prostate cancer	→ Prostate cancer
		[…]	
	Cardiovascular diseases	Ischemic heart disease	→ Ischemic heart disease
		Stroke	ischemic stroke
			intracerebral hemorrhage
			subarachnoid hemorrhage
		Hypertensive heart disease	→ Hypertensive heart disease
		[…]	
	Chronic respiratory diseases	Chronic obstructive lung disease	→ Chronic obstructive lung disease
		[…]	
	Neurological disorders	Alzheimer's disease and other dementias	→ Alzheimer's disease and other dementias
		Headache disorders	Migraine
			Tension type headache
		[…]	
	Mental disorders	Depressive disorders	Major depression
			Dysthymia
		Anxiety disorders	→ Anxiety disorders
		[…]	
	Alcohol, drugs and other substances	Alcohol use disorders	→ Alcohol use disorders
		[…]	
	Diabetes and kidney diseases	Diabetes mellitus	Type 1 diabetes mellitus
			Type 2 diabetes mellitus
		[…]	
	Musculoskeletal disorders	Low back pain	→ Low back pain
		Neck pain	→ Neck pain
		[…]	
	[…]		
Injuries	Transport injuries	Road injuries	Pedestrian road injuries
			Cyclist road injuries
			Motorcyclist road injuries
			Occupant road injuries
			Other road injuries
		Other transport accidents	→ Other transport injuries
	[…]		

Source: Quelle: BURDEN 2020; our own presentation derived from the GBD study [27]; → Levels 3 and 4 are identical; […] indicates that further diseases/clinical entities are missing for complete representation of the respective group

eTABLE 2

Causes of burden of disease, selected for calculation and listed according to their relative proportion of all disability-adjusted life years (DALY) (level 3) based on the GBD study (2017) (Germany, both sexes)

Rank	Cause of burden of disease (Level 3)	Relative proportion of total DALY for Germany*1 (in %)
1	Ischemic heart disease	9.3
2	Low back pain	6.6
3	Tracheal, bronchial and lung cancer	4.0
4	Stroke	4.0
5	Chronic obstructive lung disease	3.9
6	Alzheimer's disease and other dementias	3.6
7	Diabetes mellitus	2.9
8	Headache disorders	2.7
9	Neck pain	2.3
10	Depressive disorders	2.2
11	Colorectal cancer	2.1
12	Anxiety disorders	1.9
13	Breast cancer	1.7
14	Alcohol use disorders	1.3
15	Road injuries*2	1.3
16	Lower respiratory infections	1.2
17	Prostate cancer	1.0
18	Hypertensive heart disease	1.0
	Total	**53.0**

*1 The results fluctuate due to methodological adjustments during the GBD study and are also recalculated for earlier years with each wave of results. The exact values reported here are therefore no longer available in the information systems of the GBD study.

*2 The use of road traffic accident statistics also produced the group "Other transport injuries" (level 3) after operationalization of "Road injuries" (level 3). These are not explicitly listed here because they were originally not selected as an entity for the project.

eTABLE 3

Data sources and methodologies (morbidity component)

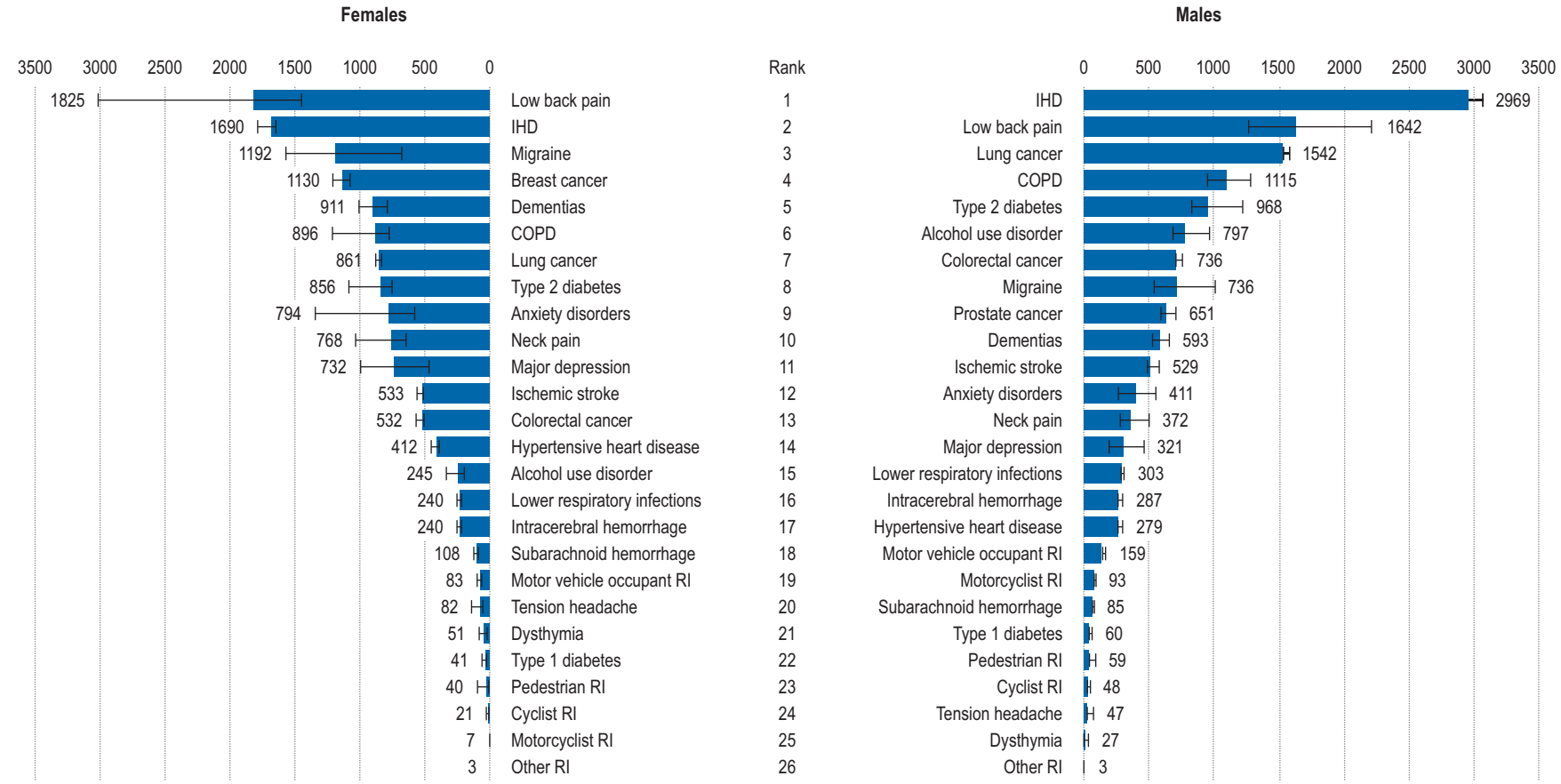
Cause of burden of disease	Regional divisions*	Excluded age groups	Components	Data source	Year	Reference	Unit	Methodology
Lower respiratory infections	D, FS, SPR	none	Incidence	AOK claims data	2017	(19, 20)	Rate (cases per 100 000 person-years)	Age, sex and morbidity-adjusted extrapolation (21)
			Severity distribution	GBD study	2017	(27, e5)	Relative proportion of case rate	
			Duration	GBD study	2017	(27, e5)	Days per year	
			Disability weight	GBD study	2017	(27)	Weight	
Tracheal, bronchial and lung cancer	D, FS, SPR	<25 years (data limitation)	Prevalence	AOK claims data	2017	(19, 20)	10-year prevalence	Age, sex and morbidity-adjusted extrapolation (21)
			Severity distribution	AOK claims data	2017	(19, 20)	Relative proportion of 10-year prevalence	Age and sex stratification
			Disability weight	GBD study	2017	(27)	Weight	
Breast cancer	D, FS, SPR	<20 years (data limitation)	Prevalence	AOK claims data	2017	(19, 20)	10-year-prevalence	Age, sex and morbidity-adjusted extrapolation (21)
			Severity distribution	AOK claims data	2017	(19, 20)	Relative proportion of 10-year prevalence	Age stratification (females only)
			Disability weight	GBD study	2017	(27)	Weight	
Prostate cancer	D, FS, SPR	<40 years (data limitation)	Prevalence	AOK claims data	2017	(19, 20)	10-year prevalence	Age, sex and morbidity-adjusted extrapolation (21)
			Severity distribution	AOK claims data	2017	(19, 20)	Relative proportion of 10-year prevalence	Age stratification (males only)
			Disability weight	GBD study	2017	(27)	Weight	
Colorectal cancer	D, FS, SPR	<20 years (data limitation)	Prevalence	AOK claims data	2017	(19, 20)	10-year prevalence	Age, sex and morbidity-adjusted extrapolation (21)
			Severity distribution	AOK claims data	2017	(19, 20)	Relative proportion of 10-year prevalence	Age and sex stratification
			Disability weight	GBD study	2017	(27)	Weight	
Coronary heart disease	D, FS, SPR	Myocardial infarction <25 years, angina pectoris none, heart failure <25 years (expert opinion)	Prevalence	AOK claims data	2017	(19, 20)	1-year prevalence; rate (cases per 100 000 person years)	Age, sex and morbidity-adjusted extrapolation (21); rate corresponds to myocardial infarctions as proportion of heart disease
			Severity distribution	AOK claims data; GBD study	2017	(19, 20, 27)	Relative proportion of 1-year prevalence or 1-year rate	Age and sex stratification (heart failure and myocardial infarction); angina pectoris taken from GBD study
			Disability weight	GBD study	2017	(27)	Weight	

Stroke	D, FS, SPR	none	Prevalence	AOK claims data	2017	(19, 20)	10-year prevalence	Age, sex and morbidity-adjusted extrapolation (21)
			Severity distribution	GBD study	2017	(27, e6)	Relative proportion of 10-year prevalence	
			Disability weight	GBD study	2017	(27)	Weight	
Hypertensive heart disease	D, FS, SPR	<25 years (expert opinion)	Prevalence	AOK claims data	2017	(19, 20)	1-year prevalence	Age, sex and morbidity-adjusted extrapolation (21)
			Severity distribution	AOK claims data	2017	(19, 20)	Relative proportion of 1-year prevalence	Age and sex stratification
			Disability weight	GBD study	2017	(27)	Weight	
Chronic obstructive lung disease	D, FS, SPR	<35 years (expert opinion)	Prevalence	AOK claims data	2017	(19, 20)	1-year prevalence	Age, sex and morbidity-adjusted extrapolation (21)
			Severity distribution	GBD study	2013	(27, e7)	Relative proportion of 1-year prevalence	
			Disability weight	GBD study	2017	(27)	Weight	
Alzheimer's disease and other dementia	D, FS, SPR	<40 years (expert opinion)	Prevalence	AOK claims data	2017	(19, 20)	1-year prevalence	Age, sex and morbidity-adjusted extrapolation (21)
			Severity distribution	GBD study	2017	(27, e6)	Relative proportion of 1-year prevalence	
			Disability weight	GBD study	2017	(27)	Weight	
Alcohol use disorders	D	<18 and >64 years (survey-related restriction)	Prevalence	Epidemiological survey of substance abuse	2018	(25)	1-year prevalence	Extrapolation considering sampling approach
			Severity distribution	GBD study	2017	(27, e6)	Relative proportion of 1-year prevalence	
			Disability weight	GBD study	2017	(27)	Weight	
Anxiety disorders	D, FS, SPR	none	Prevalence	AOK claims data	2017	(19, 20)	1-year prevalence	Age, sex and morbidity-adjusted extrapolation (21)
			Severity distribution	GBD study	2017	(27, e6)	Relative proportion of 1-year prevalence	
			Disability weight	GBD study	2017	(27)	Weight	
Depressive disorders	D, FS, SPR	Major depression and dysthymia < 15 years (expert opinion)	Prevalence	AOK claims data	2017	(19, 20)	1-year prevalence	Age, sex and morbidity-adjusted extrapolation (21)
			Severity distribution	AOK claims data, GBD study	2017	(19, 20, 27)	Relative proportion of 1-year prevalence	Age and sex stratification (major depression: AOK claims data; dysthymia: GBD study)
			Disability weight	GBD study	2017	(27)	Weight	
			Duration	RKI study data	2009–2012	(36)	Days per year	Extrapolation considering sampling approach (major depression)

Diabetes mellitus	D, FS, SPR	Type 1 diabetes none, Type 2 diabetes <10 years (expert opinion)	Prevalence	AOK claims data	2017	(19, 20)	1-year prevalence	Age, sex and morbidity-adjusted extrapolation (21)
			Severity distribution	AOK claims data	2017	(19, 20)	Relative proportion of 1-year prevalence	Age and sex stratification
			Disability weight	GBD study	2017	(27, e8, e9)	Weight	
Low back pain	D	<18 years (restriction due to telephone survey)	Prevalence	RKI survey data	2019/2020	(23)	1-year prevalence	Extrapolation considering sampling approach
			Severity distribution	RKI survey data	2019/2020	(23)	Relative proportion of 1-year prevalence	Extrapolation considering sampling approach
			Disability weight	GBD study	2017	(27)	Weight	
			Duration	RKI survey data	2019/2020	(23)	Days per year	Extrapolation considering sampling approach
Neck pain	D	<18 years (restriction due to telephone survey)	Prevalence	RKI survey data	2019/2020	(23)	1-year prevalence	Extrapolation considering sampling approach
			Severity distribution	RKI survey data	2019/2020	(23)	Relative proportion of 1-year prevalence	Extrapolation considering sampling approach
			Disability weight	GBD study	2017	(27)	Weight	
			Duration	RKI survey data	2019/2020	(23)	Days per year	Extrapolation considering sampling approach
Road injuries	D, FS, SPR	none	Prevalence	Road injury statistics	2017	(26, e10, e11)	1-year prevalence	Number of transport injuries corrected for the proportion of accidents not recorded by the police by using survey data (see [13] for details)
			Severity distribution	GBD study	2017	(27)	Relative proportion of 1-year prevalence	Proportion of injuries (or groups of injuries) within the respective road traffic accident; use of the Global Burden of Disease results (see [13] for details)
			Disability weight	GBD study	2017	(27)	Weight	Use of average disability weights (see [13] for details)
Headache disorders	D	<18 years (restriction due to telephone survey)	Prevalence	RKI survey data	2019/2020	(24)	1-year prevalence	Extrapolation considering sampling approach
			Severity distribution	RKI survey data	2019/2020	(24)	Proportion of days per year with symptoms of all days of the year	Extrapolation considering sampling approach
			Disability weight	GBD study	2017	(27)	Weight	

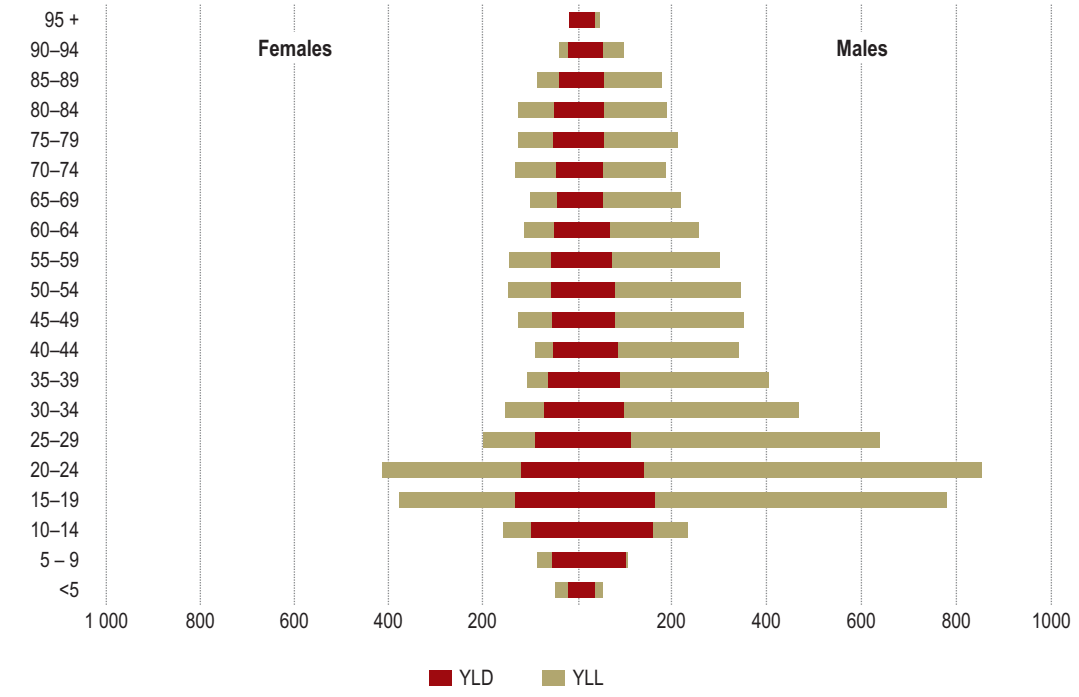
* D, Germany; FS, federal states; SPR, spatial planning regions

eFIGURE 1



Total burden of disease (DALY per 100 000 population [pop]) of the selected causes of burden of disease by sex (level 4, Germany), error bars correspond to the 95% UI
Source: BURDEN 2020; YLL: Cause of death statistics 2017 (31), Federal Statistical Office of Germany 2018 (32); YLD: (*eTable 3*); our own calculations; only 26 ranks each are presented here because no DALY were calculated for prostate cancer in women and breast cancer in men, and the residual category "Other transport injuries" is not shown (*eTable 1, eTable 2*); data limitations must be taken into account when making a direct comparison of DALY (*eTable 3*); COPD, chronic obstructive pulmonary disease; DALY, disability-adjusted life years ; RI, Road injuries; YLL, years of life lost due to death; YLD, years lived with disability

eFIGURE 2



Burden of disease (DALY per 100 000 population by YLL and YLD) for road injuries with increasing age and according to sex (level 3, Germany)

Source: BURDEN 2020; YLL: Cause of death statistics 2017 (31), Federal Statistical Office of Germany 2018 (32); YLD: *eTable 3*; our own calculations; DALY, disability-adjusted life years; YLL, years of life lost due to death; YLD, years lived with disability

eTABLE 4

Total burden of disease (disability-adjusted life years [DALY] absolute numbers and relative contributions) for the selected causes of burden of disease (levels 3 and 4, Germany, both sexes)

Cause of burden of disease (levels 3 and 4)	DALY			Proportion of level 3 to 4 (in percent)		
	DALY	UI_lb	UI_ub	Proportion	UI_lb	UI_ub
Lower respiratory infections	224 306	222 505	238 565	–	–	–
Tracheal, bronchial and lung cancer	989 188	981 443	1 012 245	–	–	–
Breast cancer	473 366	454 905	527 690	–	–	–
Prostate cancer	265 264	246 455	300 985	–	–	–
Colorectal cancer	523 155	512 617	550 669	–	–	–
Ischemic heart disease	1 918 193	1 897 796	2 033 859	–	–	–
Stroke	735 883	727 508	799 155	–	–	–
– subarachnoid hemorrhage	79 902	78 564	93 831	10.9	10.3	12.3
– intracerebral hemorrhage	217 344	211 666	234 109	29.5	27.6	30.8
– ischemic stroke	438 638	425 609	484 579	59.6	57.6	61.6
Hypertensive heart disease	286 381	266 860	331 850	–	–	–
Chronic obstructive lung disease	829 714	696 238	965 784	–	–	–
Alzheimer's disease and other dementias	623 515	539 034	711 638	–	–	–
Alcohol use disorders	427 545	366 548	501 661	–	–	–
Depressive disorders	469 767	391 219	607 266	–	–	–
– dysthymia	32 399	18 940	61 783	6.9	3.7	12.8
– major depression	437 369	350 627	562 627	93.1	87.2	96.3
Anxiety disorders	500 130	366 541	702 047	–	–	–
Diabetes mellitus	794 940	665 042	1 050 903	–	–	–
– Type 2 diabetes mellitus	753 404	633 899	991 637	94.8	92.8	95.9
– Type 1 diabetes mellitus	41 536	37 759	53 284	5.2	4.1	7.2
Low back pain	1 434 132	1 117 225	1 815 326	–	–	–
Neck pain	473 413	383 336	681 440	–	–	–
Road injuries	212 245	208 370	263 745			
– pedestrian road injury	40 967	23 628	70 115	19.3	10.7	28.0
– cyclist road injury	28 518	25 406	40 668	13.4	11.1	17.7
– motorcyclist road injury	40 981	40 376	45 855	19.3	16.4	21.2
– occupant road injury	99 393	95 063	113 043	46.8	39.8	50.7
– other road injury	2387	1999	7353	1.1	0.9	3.2
Other transport injuries	16 461	15 485	26 584	–	–	–
Headache disorders	853 028	666 889	1 104 548	–	–	–
– tension headache	799 418	601 368	1 024 549	93.7	87.7	94.8
– migraine	53 610	44 542	98 706	6.3	5.2	12.3

ub, upper bound; lb, lower bound; UI, 95% uncertainty interval

eTABLE 5

Total burden of disease (DALY per 100 000 population [pop]) of the selected causes of burden of disease with increasing age and according to sex (level 3, Germany)

a) Females

	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85–89	90–94	95 +
Lower respiratory infections	35	29	28	25	23	37	71	126	190	223	392	612	1097	1890	2849	3593
COPD				101	167	308	583	1038	1677	2089	2574	2533	2917	3290	3460	3236
Lung cancer		8	19	73	224	513	887	1716	2344	2591	2547	1786	1309	938	599	330
Breast cancer	3	92	339	615	877	1194	1477	1670	1877	2261	2439	2420	2489	2246	2149	2030
Prostate cancer																
Bowel cancer	6	33	53	110	186	311	447	573	751	1000	1284	1513	1836	2188	2368	2036
IHD		37	43	99	172	316	490	765	1307	2048	3127	4813	8412	13 646	19 320	23 749
Stroke	36	62	78	121	179	309	353	501	635	977	1625	2635	4390	6471	8342	8829
Hypertensive heart disease			1	2	4	20	44	84	171	257	507	1009	2168	4245	7200	10 911
Diabetes	34	54	81	126	202	326	492	721	1107	1558	2109	2793	3922	4682	4868	4485
Dementias					16	19	48	107	212	458	1177	2508	5518	9963	14 523	18 509
Depressive disorders	344	417	521	662	847	901	1035	1107	1192	1229	1186	1283	1346	1258	1231	1204
Anxiety disorders	520	618	716	798	879	968	1098	1123	1089	1087	1037	964	895	779	670	571
Alcohol use disorders	546	418	270	143	223	195	379	292	395	170	116	81	49	29	25	7
Low back pain	1371	1676	1618	1728	1720	2574	2444	2196	2333	2850	3067	2740	1924	1893	1764	1649
Headache disorders	2075	2646	2580	2025	1932	1961	1517	1316	982	612	455	355	289	266	265	226
Neck pain	483	544	899	801	887	1156	1135	994	930	1171	967	1 064	859	722	597	473
Road injuries	415	204	157	112	94	130	150	148	118	103	137	128	129	91	43	18

b) Males

	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85–89	90–94	95 +
Lower respiratory infections	24	17	33	46	43	97	136	206	343	508	796	1117	1922	3115	4594	6186
COPD				97	192	363	730	1360	2198	3104	3974	4201	4750	5562	5976	5181
Lung cancer		2	19	113	276	662	1412	2840	4182	4993	5365	4556	3704	2942	2145	1131
Breast cancer																
Prostate cancer					1	17	143	355	862	1486	2386	3462	4191	5379	5782	5409
Bowel cancer	2	15	124	114	207	359	629	1012	1487	1958	2330	2538	2804	2995	3103	2608
IHD		49	140	345	794	1381	2194	3515	4964	6575	8014	10 559	15 125	21 257	26 700	30 304
Stroke	26	19	65	125	177	345	506	816	1249	1853	2702	3718	5297	6934	8156	8163
Hypertensive heart disease		1	2	5	46	58	107	168	322	494	692	1087	1969	3329	5124	6613

Diabetes	31	49	88	133	299	500	841	1242	1919	2568	3157	3732	4595	4998	4870	4221
Dementias					17	22	51	110	289	590	1382	2817	5564	9564	12 776	14 649
Depressive disorders	161	197	243	315	393	417	494	555	585	563	550	571	593	586	594	594
Anxiety disorders	295	328	382	409	465	507	537	567	560	520	481	452	431	423	409	379
Alcohol use disorders	1334	1038	1068	897	940	1036	1106	1090	961	640	369	261	197	83	26	2
Low back pain	1421	1673	1650	1788	1788	2322	2195	1970	2095	2421	2629	2287	1549	1541	1468	1439
Headache disorders	1181	1338	1531	1116	1138	1079	882	673	689	504	391	321	292	288	298	256
Neck pain	222	261	301	255	295	676	657	546	500	633	497	558	433	409	350	296
Road injuries	855	638	467	401	340	347	343	300	255	214	185	208	187	177	95	44

Legende	<1340	1340 <3900	3900 <9000	9000 <17 000	≥17 000

Source: BURDEN 2020; YLL: Cause of death statistics 2017 (31), Federal Statistical Office of Germany 2018 (32); YLD: *eTable 3*; own calculations; due to data limitations, a comparison of the causes of burden of disease is only presented from the age group of 20 year-olds onwards (*eTable 3*); both grouping and the resulting color scheme were created using the natural breaks method (33); COPD, chronic obstructive pulmonary disease; DALY, disability-adjusted life years; IHD, ischemic heart disease