Prevalence of and factors associated with long-term sick leave in working-age adults with chronic low back pain in Germany

Running title: Chronic low back pain and sick leave

Louis Jacob, MD-PhD (ORCID: 0000-0003-1071-1239)[a,b,c]; Ai Koyanagi, MD-PhD (ORCID: 0000-0002-9565-5004)[a,b,d]; Lee Smith, PhD (ORCID: 0000-0002-5340-9833)[e]; Jae Il Shin, MD-PhD (ORCID: 0000-0003-2326-1820)[f]; Josep Maria Haro, MD-PhD (ORCID: 0000-0002-3984-277X)[a,b]; Tilman Garthe [g], Karel Kostev, PhD (ORCID: 0000-0002-2124-7227)[h]

[a] Research and Development Unit, Parc Sanitari Sant Joan de Déu, Dr. Antoni Pujadas, 42, Sant Boi de Llobregat, Barcelona, Spain

[b] Centro de Investigación Biomédica en Red de Salud Mental (CIBERSAM), Madrid, Spain

[c] Faculty of Medicine, University of Versailles Saint-Quentin-en-Yvelines, Montigny-le-Bretonneux, France

[d] ICREA, Pg. Lluis Companys 23, 08010 Barcelona, Spain

[e] Centre for Health, Performance and Wellbeing, Anglia Ruskin University, Cambridge, UK

[f] Department of Pediatrics, Yonsei University College of Medicine, Yonsei-ro 50, Seodaemun-gu, C.P.O. Box 8044, Seoul 120-752, Korea

[g] University Hospital, Frankfurt, Germany

[h] Epidemiology, IQVIA, Frankfurt, Germany

Correspondence:

Prof. Dr. rer. med. Karel Kostev

Epidemiology

IQVIA

Unterschweinstiege 2–14

60549 Frankfurt am Main

Germany

Tel.: +49-(0)69-66 04-4878

karel.kostev@iqvia.com

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Louis Jacob contributed to the design of the study, managed the literature searches, wrote the first draft of the manuscript, and corrected the manuscript. Ai Koyanagi, Lee Smith, Jae Il Shin, Tilman Garthe, and Josep Maria Haro contributed to the design of the study and corrected the manuscript. Karel Kostev contributed to the design of the study, performed the statistical analyses, and corrected the manuscript. All authors contributed to and have approved the final manuscript.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics approval and consent to participate

German law allows the use of anonymous electronic medical records for research purposes under certain conditions. According to this legislation, it is not necessary to obtain informed consent from patients or approval from a medical ethics committee for this type of observational study that contains no directly identifiable data.

Abstract

Objective: There is little data on the impact of chronic low back pain (CLBP) on long-term sick leave. Thus, the aim was to investigate the prevalence of and the factors associated with long-term sick leave in working-age adults with CLBP in Germany.

Methods: This retrospective study included adults aged 18–65 years diagnosed for the first time with CLBP in one of 1,193 general practices in Germany between 2000 and 2019. CLBP was defined as the presence of two diagnoses of low back pain with >90 days between them. Long-term sick leave was assessed in the year following the first diagnosis of low back pain, and was defined as >42 days of absence from work for health-related reasons. In Germany, employees on sick leave lasting >42 days are not paid by the employer anymore but by the health insurance fund. Finally, an adjusted logistic regression model was used to assess the association between predefined variables (e.g., age, sex and comorbidities) and long-term sick leave.

Results: A total of 59,269 working-age adults were included in this study (mean [SD] age 32.8 [11.5] years; 41.4% women). The prevalence of long-term sick leave in the sample was 49.1%. Long-term sick leave was significantly associated with young age, male sex, and several physical and psychiatric comorbidities (e.g., reaction to severe stress and adjustment disorder, gastritis and duodenitis, and depression).

Conclusions: Based on these results, public health measures are urgently needed to mitigate the deleterious effects of CLBP on work participation in Germany.

Keywords: chronic low back pain; long-term sick leave; prevalence; associated factors; Germany

Introduction

Chronic low back pain (CLBP) is defined as low back pain lasting at least three months (Fourney et al. 2011). CLBP is usually nonspecific and is considered idiopathic (Last and Hulbert 2009). In some cases, CLBP may have a specific etiology such as disk herniation, facet degeneration or osteoporotic fracture. The worldwide prevalence of CLBP is around 20% in adults aged between 20 and 59 years, and this prevalence steadily increases with age during middle adulthood (Meucci et al. 2015). Less than one third of individuals with acute low back pain will develop CLBP (Fransen et al. 2002; Stevans et al. 2021). Risk factors for chronicity are multiple and include lifting at work, obesity, and early non-guideline concordant treatment. CLBP is in turn significantly associated with disability (da C Menezes Costa et al. 2012), impaired mental health (Atkinson et al. 1991), and low quality of life (Aminde et al. 2020).

In recent years, several studies have investigated the potential association between low back pain and sick leave (i.e., absence from work for health-related reasons (Whitaker 2001)) (Compare et al. 2016; Holtermann et al. 2010; Macías-Toronjo et al. 2020; Mehrdad et al. 2020; Petersen et al. 2019; Trinderup et al. 2018). For example, a study including 5,036 employees from Denmark showed that the prevalence of sick leave lasting at least three weeks was around 13% during the two-year study period, and this figure reached 20% in those with neck-shoulder pain and 21% in those with low back pain (Holtermann et al. 2010). The deleterious effects of low back pain and CLBP on work participation may be mediated by several factors such as fear avoidance beliefs (Trinderup et al. 2018), kinesiophobia (Macías-Toronjo et al. 2020), and the presence of psychiatric manifestations (Amiri and Behnezhad 2021). Although

previous studies have shed some light on the association between low back pain and sick leave, these studies are subject to a number of limitations that need to be acknowledged at this point. First, most of these bodies of research did not include participants with CLBP or were not specifically conducted in the CLBP population (Holtermann et al. 2010; Macías-Toronjo et al. 2020; Mehrdad et al. 2020; Petersen et al. 2019), although the effects of low back pain on sick leave likely vary with the duration of symptoms. Second, these studies frequently involved a small sample size of fewer than 1,000 individuals (Macías-Toronjo et al. 2020; Mehrdad et al. 2020; Petersen et al. 2019; Trinderup et al. 2018), and thus the generalizability of their results is uncertain. Third, little is known concerning how physical and psychiatric comorbidities impact the odds of sick leave in people with CLBP. Taking these limitations together, there is a clear need for further data on the relationship of CLBP to sick leave, particularly long-term sick leave, which is associated with a significant economic burden at the individual (Hultin et al. 2012) and societal levels (Gabbay et al. 2011).

Therefore, the goal of this retrospective study conducted in Germany was to investigate the prevalence of and the factors associated with long-term sick leave in working-age adults with CLBP.

Methods

Database

This study used data from the Disease Analyzer database (IQVIA) (Rathmann et al. 2018) which contains demographic, diagnosis, and prescription data obtained in

general and specialized practices in Germany. These data are collected in anonymized format from the computer systems used in these practices. Diagnoses are coded based on the German version of the International Classification of Diseases, 10th revision (ICD-10), while prescriptions are coded based on the Anatomical Classification of Pharmaceutical Products of the European Pharmaceutical Marketing Research Association (EphMRA). The quality of the data is assessed regularly on the basis of several criteria (e.g., completeness of documentation and linkage between diagnosis and prescription data). The panel of practices included in the Disease Analyzer database is representative of all primary care practices in Germany, and the selection of practices to include in the database relies on several variables (i.e., age of physician, specialty, community size category, and German federal state). Finally, approximatively 3% of all general and specialized practices in Germany are included in the Disease Analyzer database.

Study population

This retrospective study included adults aged 18–65 years diagnosed with CLBP for the first time in one of 1,193 general practices in Germany between January 2000 and December 2019. CLBP was defined as the presence of two diagnoses of low back pain (ICD-10: M54.4 [lumbago with sciatica] or M54.5 [low back pain]) with at least 90 days between them. The first diagnosis corresponded to the index date. To be included in the study, patients had to have health insurance. The selection of study patients is displayed in **Figure 1**.

Long-term sick leave (dependent variable)

Long-term sick leave was assessed in the year following the index date (i.e., the first diagnosis of low back pain), and was defined as a period of exceeding 42 days of absence from work for health-related reasons. In Germany, employees on sick leave lasting more than 42 days are no longer paid by the employer but by the health insurance fund, which may result in a lower monthly income (Konrad et al. 2019; Reber et al. 2018). Long-term sick leave occurred prior to or after the second low back pain diagnosis. In approximately half of the sample, sick leave was related to low back pain. In the other half of the study population, the medical reason for sick leave was undocumented, sick leave episodes pertaining to other conditions being excluded from the analyses.

Demographic variables and comorbidities (independent variables)

Demographic data included age on the index date and sex. Comorbidities were present in at least 5% of participants, and were assessed prior to, on, and after the index date. Physical comorbidities included hypertension (ICD-10: I10), gastritis, and duodenitis (ICD-10: K29), thyroid gland diseases (ICD-10: E00-E07), lipid metabolism disorders (ICD-10: E78), enthesopathies (ICD-10: M76 and M77), osteoarthritis (ICD-10: M15-M19), reflux disease (ICD-10: K21), diabetes mellitus (ICD-10: E10-E14), spondylosis (ICD-10: M47), obesity (ICD-10: E66), asthma (ICD-10: J45), chronic obstructive pulmonary disease (ICD-10: J44), and hemorrhoids and perianal venous thrombosis (ICD-10: K64). Psychiatric comorbidities included depression (ICD-10: F32 and F33), somatoform disorders (ICD-10: F45), reaction to severe stress and adjustment disorder (ICD-10: F43), sleep disorders (ICD-10: F51 and G47), and anxiety disorders (ICD-10: F41).

Statistical analyses

The characteristics of the study sample were described using N (%) for categorical variables and mean (standard deviation) values for continuous variables. Sick leave was further examined in the overall sample and by age and sex using three different variables: the number of days of sick leave (mean [standard deviation] and median [interquartile range]); prevalence of at least one day of sick leave; and prevalence of long-term sick leave. Finally, the association between demographic variables, index diagnosis (i.e., lumbago with sciatica or low back pain) and comorbidities (independent variables) and long-term sick leave (dependent variable) was investigated using an adjusted logistic regression model. This association was studied in the overall sample and in female and male participants, separately. The results of the regression analysis are displayed as odds ratios (ORs) and 95% confidence intervals (CIs). P-values <0.05 were considered statistically significant. Analyses were performed using SAS 9.4.

Results

This retrospective study conducted in Germany included 59,269 working-age adults. The mean (standard deviation) age was 32.8 (11.5) years, and the prevalence of women was 41.4% (**Table 1**). The three most frequent physical comorbidities were hypertension (24.9%), gastritis and duodenitis (21.4%), and thyroid gland diseases (19.9%). In terms of psychiatric comorbidities, common conditions included depression (18.9%), somatoform disorders (14.2%), and reaction to severe stress and adjustment disorders (12.2%). The mean (standard deviation) sick leave duration was 123 (137) days, while the proportion of participants on long-term sick leave was 49.1% (**Table 2**). The results of the adjusted logistic regression analysis are displayed in **Table 3**. Young

age was found to be positively and significantly associated with long-term sick leave in the overall sample (reference: 51–65 years; 18–30 years: OR=2.14, 95% CI=2.02–2.25; 31–40 years: OR=1.50, 95% CI=1.43–1.58; and 41–50 years: OR=1.24, 95% CI=1.18–1.29). In addition, long-term sick leave was more common in men than in women (OR=1.63, 95% CI=1.57–1.69). There was no significant association between index diagnosis and long-term sick leave (reference: lumbago with sciatica; low back pain: OR=1.03, 95% CI=0.99-1.06). In terms of physical comorbidities, there was a significant relationship between long-term sick leave and gastritis and duodenitis (OR=1.33, 95% CI=1.27–1.38), chronic obstructive pulmonary disease (OR=1.13, 95% CI=1.05–1.21), enthesopathies (OR=1.10, 95% CI=1.05–1.16), and hypertension (OR=1.06, 95% CI=1.01–1.10). Finally, in terms of psychiatric comorbidities, long-term sick leave was significantly associated with reaction to severe stress and adjustment disorder (OR=1.51, 95% CI=1.43–1.60), depression (OR=1.31, 95% CI=1.25–1.37), somatoform disorders (OR=1.19, 95% CI=1.13–1.25), and sleep disorders (OR=1.14, 95% CI=1.08–1.20). Similar findings were obtained in female and male participants, separately.

Discussion

Main findings

This study, which included more than 59,000 patients with CLBP who were followed in general practices in Germany between 2000 and 2019, revealed that the prevalence of long-term sick leave following the first diagnosis of low back pain was around 49%. Interestingly, younger and male patients were more likely to go on long-term sick leave than older and female patients, respectively. Long-term sick leave was also positively

and significantly associated with several physical (i.e., gastritis and duodenitis, chronic obstructive pulmonary disease, enthesopathies, and hypertension) and psychiatric comorbidities (i.e., reaction to severe stress and adjustment disorder, depression, somatoform disorders, and sleep disorders). To the best of the authors' knowledge, this is one of the largest studies to date to have investigated the prevalence of long-term sick leave in people with CLBP. At the same time, it is the first study to have analyzed the relationship between common physical and psychiatric comorbidities and long-term sick leave in this population.

Interpretation of findings

One major finding of this study is that almost one in two patients with CLBP went on long-term sick leave in the year following the initial diagnosis of low back pain. Although there is an important body of literature on the association between low back pain and sick leave (Compare et al. 2016; Holtermann et al. 2010; Macías-Toronjo et al. 2020; Mehrdad et al. 2020; Petersen et al. 2019; Trinderup et al. 2018), research on the specific relationship between CLBP and long-term sick leave is relatively scarce. One study of 559 patients with CLBP from Denmark found that the prevalence of long-term sick leave was around 24.8% and that fear avoidance beliefs increased the risk of long-term sick leave (Trinderup et al. 2018). The difference in the proportion of individuals going on long-term sick leave between the two studies may be explained by the fact that, in the present study, long-term sick leave was defined as more than 42 days of absence in the year following the first diagnosis of low back pain, whereas in the Danish study, long-term sick leave corresponded to sick leave after 12 months of follow-up. There may also be substantial differences between Germany and Denmark with regard to the management of CLBP and the economic consequences of sick leave

for the employee. For example, in Germany, employees with more than 42 days of absence are no longer paid by their employer but by their health insurance (Konrad et al. 2019; Reber et al. 2018). Thus, there is a clear need for further data collected in other countries and regions of the world concerning the association between CLBP and long-term sick leave.

The present study also showed that younger adults and men were more likely to go on long-term sick leave than older adults and women, respectively. Younger employees are frequently exposed to higher psychosocial work demands and physical workloads than their older counterparts (Åkerstedt et al. 2019). In this context, returning to work may be more difficult for younger than for older employees with CLBP. Similarly, previous research has indicated that physical workload is higher for men than for women of working age. For example, a cross-sectional study including 7,243 individuals living in Denmark found that men more frequently reported lifting more than 20 ton-years during their working lives than women (20.5% versus 10.1%) (Møller et al. 2019). Furthermore, this study showed that several physical and psychiatric comorbidities were significantly associated with long-term sick leave, and, interestingly, ORs were slightly higher for psychiatric than for physical disorders. A large number of studies have highlighted the high prevalence of psychiatric conditions in people with CLBP. It was observed in a study of 565 CLBP patients from Norway that the prevalence of any psychiatric disorder was around 31%, and that the two most common conditions were somatoform disorders (18%) and anxiety disorders (12%) (Reme et al. 2011). Another cross-sectional study including 85,088 participants from 17 countries showed a positive and significant association between chronic back or neck pain and mental disorders (Demyttenaere et al. 2007). The ORs were particularly

strong for dysthymia, generalized anxiety disorder, and post-traumatic stress disorder. The deleterious effects of CLBP on mental health may be at least partially mediated by chronic pain, impaired quality of life (Aminde et al. 2020), physical disability (da C Menezes Costa et al. 2012), and social isolation (Hawthorne et al. 2013). In turn, psychiatric comorbidities are known to negatively impact work participation and lead to sick leave. A systematic review and meta-analysis of 15 studies identified a positive and significant relationship between symptoms of depression and sick leave (risk ratio=1.52), and this association tended to be stronger in men than in women (Amiri and Behnezhad 2021). Furthermore, an observational, prospective study of 1,182 participants with adjustment disorder from Spain found that the median duration of sick leave due to this psychiatric condition was 91 days (Catalina-Romero et al. 2012). In the same study, the prevalence of long-term sick leave was estimated at around 22%.

Clinical implications and areas for future research

Based on the findings of the present study, slightly less than one in two patients with CLBP go on long-term sick leave in Germany. The prevalence of long-term sick leave is high in this population, and measures promoting an early return to work should be implemented to support people with low back pain. These measures may include the evaluation of red flags to rule out secondary causes of low back pain and the promotion of physical activity, core strengthening exercises, and yoga (Becker and Childress 2019). Moreover, it is extremely important to identify fear avoidance beliefs and psychosocial factors which may prevent an early recovery and an early return to work following low back pain. Finally, more data from other countries and regions of the world are needed to better characterize the association between CLBP and long-term sick leave. Besides, this association should be explored in specific occupational groups

and compared between occupations with different physical demand levels. Future studies of a longitudinal nature should also investigate factors playing a potential mediating role in the relationship between CLBP and long-term sick leave.

Strengths and limitations

Two strengths of this study are the large sample size and the use of data representative of general practices in Germany. Nonetheless, the results of this study should be interpreted in the light of several limitations. First, CLBP was defined as the presence of two low back diagnoses with an in-between period of at least 90 days, and therefore a substantial proportion of CLBP may, in fact, correspond to recurrent low back pain. Second, no data were available on the severity of CLBP, although patients with higher pain levels may be more likely to go on long-term sick leave than their counterparts with lower pain levels. Third, the occupational status of participants was not documented in the database. As physical demand at work may be associated with both CLBP and long-term sick leave, physical demand may have played a confounding role in the relationship assessed in the present study. Fourth, no information was available on health behaviors such as physical activity and alcohol consumption. Given that these health behaviors are associated with sick leave (Lahti et al. 2010; Marzan et al. 2021), this lack of data may have biased the results of the logistic regression analysis. Fifth, only the most common physical and psychiatric comorbidities were included in the study (i.e., those found in at least 5% of the sample). Less common disorders may also be significantly associated with the odds of long-term sick leave.

Conclusions

This study including more than 59,000 individuals with CLBP from almost 1,200 general practices in Germany showed that the prevalence of long-term sick leave was around 49%. Young age, male sex, and several physical and psychiatric disorders were positively and significantly associated with the odds of long-term sick leave. In this context, measures promoting an early return to work after low back pain should be implemented in the German working-age population. Finally, further research is needed to identify factors playing a potential mediating role in the relationship between CLBP and long-term sick leave.

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Table 1

Characteristics of the study sample (N=59,269)

Variable	Value
Age (in years)	
Mean (standard deviation)	32.8 (11.5)
18–30	10,777 (18.2)
31–40	12,995 (21.9)
41–50	17,878 (30.2)
51–65	17,619 (29.7)
Sex	
Female	24,554 (41.4)
Male	34,715 (58.6)
Index diagnosis	
Lumbago with sciatica	22,013 (37.1)
Low back pain	37,256 (62.9)
Physical comorbidities documented prior to, on, and after the index date	
Hypertension	14,782 (24.9)
Gastritis and duodenitis	12,652 (21.4)
Thyroid gland diseases	11,815 (19.9)
Lipid metabolism disorders	10,494 (17.7)
Enthesopathies	7,880 (13.3)
Osteoarthritis	7,531 (12.7)
Reflux disease	6,389 (10.8)
Diabetes mellitus	6,217 (10.5)
Spondylosis	5,785 (9.8)
Obesity	5,609 (9.5)
Asthma	5,101 (8.6)
Chronic obstructive pulmonary disease	3484 (5.9)
Hemorrhoids and perianal venous thrombosis	3,411 (5.8)
Psychiatric comorbidities documented prior to, on, and after the index date	
Depression	11,190 (18.9)
Somatoform disorders	8,431 (14.2)
Reaction to severe stress and adjustment disorder	7,251 (12.2)
Sleep disorders	6,451 (10.9)
Anxiety disorders	3,611 (6.1)

Data are N (%) unless otherwise specified.
Index date corresponded to the first diagnosis of low back pain.

Table 2

Sick leave in the overall sample and by age and sex

Group	Sick leave (days), mean (SD)	Sick leave (days), median (IQR)	At least one day of sick leave (%)	Long-term sick leave (%)
Overall	123 (137)	33 (0–257)	72.5	49.1
Age (in years)				
18–30	151 (138)	142 (3–291)	81.1	60.2
31–40	128 (137)	66 (1–262)	75.5	51.7
41–50	117 (137)	19 (0–250)	72.2	47.0
51–65	107 (135)	11 (0–233)	65.3	42.6
Sex				
Female	106 (134)	10 (0–228)	66.6	42.9
Male	134 (139)	93 (2–273)	76.7	53.5
Index diagnosis				
Lumbago with sciatica	120 (137)	26 (0–253)	71.5	48.1
Low back pain	125 (138)	40 (0–261)	73.4	49.9

Abbreviation: SD standard deviation; IQR interquartile range.
Sick leave was assessed in the year following the first diagnosis of low back pain (i.e., index date).
Long-term sick leave was defined as more than 42 days of sick leave in the year following the first diagnosis of low back pain

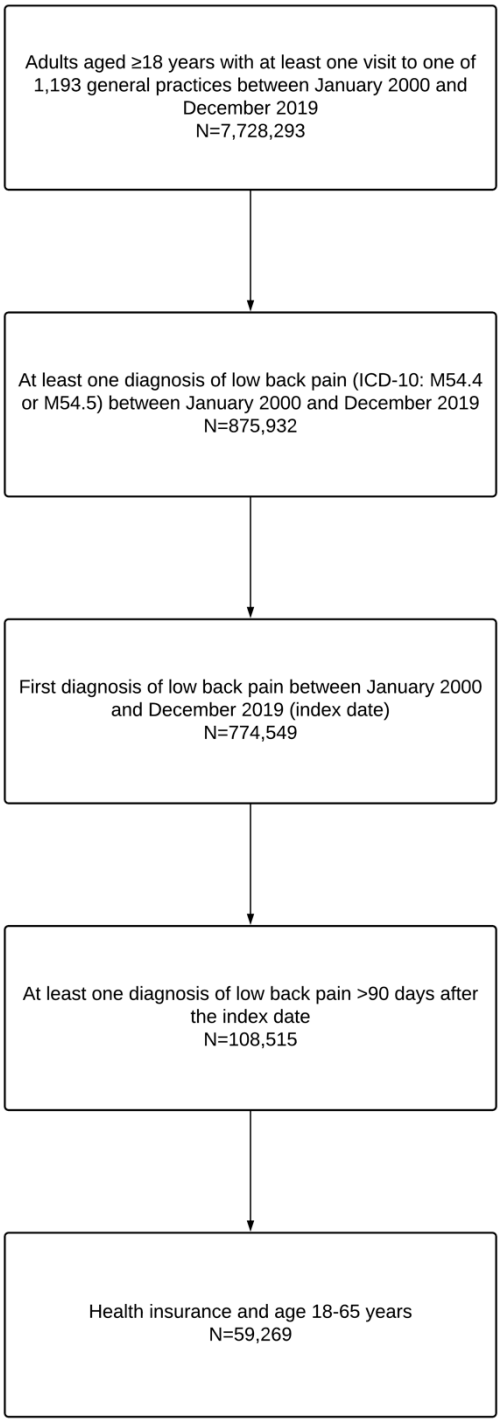
Table 3

Association between demographic variables, index diagnosis and comorbidities (independent variables) and long-term sick leave (dependent variable)

Variable	All patients		Female patients		Male patients	
	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Age (in years)						
18–30	2.14 (2.02–2.25)	<0.001	1.81 (1.67-1.97)	<0.001	2.40 (2.25-2.57)	<0.001
31–40	1.50 (1.43–1.58)	<0.001	1.27 (1.18-1.37)	<0.001	1.69 (1.59-1.80)	<0.001
41–50	1.24 (1.18–1.29)	<0.001	1.19 (1.11-1.27)	<0.001	1.27 (1.20-1.35)	<0.001
51–65	Reference		Reference		Reference	
Sex						
Female	Reference		-		-	
Male	1.63 (1.57–1.69)	<0.001	-		-	
Index diagnosis						
Lumbago with sciatica	Reference		Reference		Reference	
Low back pain	1.03 (0.99-1.06)	0.121	1.01 (0.96-1.06)	0.796	1.04 (1.00-1.09)	0.066
Physical comorbidities documented prior to, on, and after the index date						
Gastritis and duodenitis	1.33 (1.27–1.38)	<0.001	1.35 (1.27-1.42)	<0.001	1.32 (1.26-1.38)	<0.001
Chronic obstructive pulmonary disease	1.13 (1.05–1.21)	0.005	1.14 (1.02-1.27)	0.020	1.10 (1.01-1.21)	0.048
Enthesopathies	1.10 (1.05–1.16)	<0.001	1.08 (1.00-1.16)	0.057	1.12 (1.05-1.19)	0.001
Hypertension	1.06 (1.01–1.10)	0.005	1.15 (1.08-1.22)	<0.001	1.06 (0.97-1.07)	0.761
Psychiatric comorbidities documented prior to, on, and after the index date						
Reaction to severe stress and adjustment disorder	1.51 (1.43–1.60)	<0.001	1.59 (1.48-1.71)	<0.001	1.42 (1.31-1.54)	<0.001
Depression	1.31 (1.25–1.37)	<0.001	1.34 (1.26-1.43)	<0.001	1.29 (1.21-1.38)	<0.001
Somatoform disorders	1.19 (1.13–1.25)	<0.001	1.20 (1.13-1.29)	<0.001	1.20 (1.11-1.29)	<0.001
Sleep disorders	1.14 (1.08–1.20)	<0.001	1.13 (1.04-1.23)	0.003	1.16 (1.08-1.25)	<0.001

Abbreviations: OR odds ratio; CI confidence interval.
Sick leave was assessed in the year following the first diagnosis of low back pain.
Long-term sick leave was defined as more than 42 days of sick leave in the year following the first diagnosis of low back pain.
The logistic regression model included long-term sick leave as the dependent variable and variables listed in Table 1 as independent variables (except sex for the sex-stratified analyses). Only comorbidities significantly associated with long-term sick leave are displayed in the Table.

Figure 1


Adults aged ≥18 years with at least one visit to one of 1,193 general practices between January 2000 and December 2019
N=7,728,293
At least one diagnosis of low back pain (ICD-10: M54.4 or M54.5) between January 2000 and December 2019
N=875,932
First diagnosis of low back pain between January 2000 and December 2019 (index date)
N=774,549
At least one diagnosis of low back pain >90 days after the index date
N=108,515
Health insurance and age 18-65 years
N=59,269

a