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Predictors of depression and anxiety disorders in a large cohort of employed German statutory health insurance patients

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Abstract

Introduction. Mental illness is very common and is one of the most frequent causes of occupational disability, resulting in a high economic burden. A large proportion of mental illnesses remain undetected for a long time because patients present to clinicians with physical rather than mental complaints. Data on the impact of individual non-mental diagnoses on subsequent development of mental illness are scarce. The aim of this study was to determine the influence of a wide range of diagnoses on the subsequent diagnosis of mental illness in German statutory health insurance patients.

Methods. A large retrospective cohort study was conducted using German statutory health insurance data from 2013 to 2020 of employed, insured individuals, aged 16 – 60 years. Analyses were conducted within individuals free of prior diagnoses of mental diseases or cancer to allow assessment of incident depression and/or anxiety. Exposure and outcome definitions were based on diagnoses coded by ICD 10-GM. Data were analysed with multivariate logistic regression analyses and stratified by age.

Results.The final study population consisted of 383365 participants. The incidence of depression and/or anxiety in this preselected population was 6.7 %. In multivariate analyses the risk of a new diagnosis of depression and/or anxiety was twice as high for women as for men (aOR 2.1, 95 % CI 2.0 – 2.2). The selected non-mental conditions were statistically significantly associated with new-onset depression and/or anxiety. The highest adjusted odds ratios were seen for hyperventilation (aOR 6.0 95 % CI 3.4 – 10.8), problems related to life-management difficulty (aOR 5.8 95 % CI 4.9 – 6.9), problems related to so-

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cial environment (aOR 4.8 95 % CI 2.9 – 7.9) and problems related to employment and unemployment (aOR 4.4 95 % CI 3.2 – 6.0). A diagnosis of spine or back disease led to a 1.3-fold increased risk of new-onset depression and/or anxiety (aOR 1.34 95 % CI 1.29 – 1.39). The relative risk of a new-onset diagnosis of depression and/or anxiety also increased with higher numbers of physician contacts and days of sickness leave.

Conclusion. We have identified non-psychological predictors of mental illness that can be used as warning signs of subclinical or future depression and/or anxiety. These predictors may help the treating clinician to identify an increased risk of subclinical or future mental illness.

Zusammenfassung

Einleitung. Psychische Erkrankungen sind weit verbreitet und eine der häufigsten Ursachen für Berufsunfähigkeit. Sie führen daher zu einer hohen volkswirtschaftlichen Belastung. Ein großer Teil der psychischen Erkrankungen bleibt lange Zeit unentdeckt, da sich die Patienten mit körperlichen und nicht mit psychischen Beschwerden bei Ärzten vorstellen. Es gibt kaum Untersuchungen über den Zusammenhang des Vorliegens spezifischer körperlicher Diagnosen und einer späteren Diagnose einer psychischen Erkrankung. Ziel unserer Analyse war es, den Einfluss spezifischer körperlicher Erkrankungen auf die spätere Diagnose einer psychischen Erkrankung bei Patienten zu ermitteln, die in Deutschland gesetzlich krankenversichert sind.

Methoden. In einer großen retrospektiven Kohortenstudie wurden Daten von 16 – 60 Jahre alten erwerbstätigen in Deutschland gesetzlich Krankenversicherten aus den Jahren 2013 – 2020 analysiert. Die Studienpopulation wurde auf Studienteilnehmer begrenzt, bei denen in den zuvor liegenden Jahren keine Diagnose einer psychischen Erkrankung oder Krebs vorlag, um dadurch das Neuauftreten von Depressionen und/oder Angstzustände beurteilen zu können. Die Erfassung der Diagnosen basierten auf Diagnosen, die nach ICD 10-GM kodiert wurden. Die Daten wurden mit multivariaten logistischen Regressionsanalysen analysiert und nach Alter stratifiziert.

Ergebnisse. Die endgültige Studienpopulation bestand aus 383365 Teilnehmern. Die Inzidenz von Depressionen und/oder Angstzuständen in der Studienpopulation betrug 6,7 %. In multivariaten Analysen war das Risiko einer neu aufgetretenen Diagnose von Depression und/oder Angst bei Frauen doppelt so hoch wie bei Männern (aOR 2,1, 95 % KI 2,0 – 2,2). Die untersuchten Diagnosen waren statistisch signifikant mit neu auftretenden Diagnosen von Depression und/oder Angst assoziiert. Die höchsten adjustierten Odds Ratios lagen bei Hyperventilation (aOR 6,0 95 % KI 3,4 – 10,8), Problemen mit Bezug auf Schwierigkeiten bei der Lebensbewältigung (aOR 5,8 95 % KI 4,9 – 6 ,9), Kontaktanlässen mit Bezug auf die soziale Umgebung (aOR 4,8 95 % KI 2,9 – 7,9) und Kontaktanlässen mit Bezug auf das Berufsleben (aOR 4,4 95 % KI 3,2 – 6,0) vor. Eine Diagnose von Wirbelsäulen- oder Rückenerkrankungen führte zu einem 1,3-fach erhöhten Risiko für neu auftretende Depressionen und/oder Angstzustände (aOR 1,34 95 % KI 1,29 – 1,39). Das relative Risiko einer neu auftretenden Diagnose von Depressionen und/oder Angstzuständen stieg auch mit einer höheren Anzahl von Arztkontakten und Krankheitstagen.

Schlussfolgerung. Wir haben nicht-psychologische Prädiktoren für psychische Erkrankungen identifiziert, die als Warnzeichen für subklinische oder zukünftige Depres-

sionen und/oder Angstzustände verwendet werden könnten. Diese Prädiktoren können dem behandelnden Arzt helfen, ein erhöhtes Risiko für subklinische oder zukünftige psychische Erkrankungen zu erkennen.

Introduction

Mental illness is very common with a lifetime prevalence of up to 73 % by the age of 50 years (Angst et al. 2016). It causes great personal suffering frequently leading to occupational disability, thus resulting in a heavy economic burden. According to the Global Burden of Disease study, mental illness is one of the most common causes of disability worldwide (Arias et al. 2022). Early detection of mental illness is important to be able to provide patients with early treatment and thus prevent chronicity and consequently disability (Nakao/Yano 2006).

However, a large proportion of mental illnesses still goes undetected because patients present to their physicians with physical rather than mental complaints (Gates et al. 2016; Kroenke 2003) and a mental disease diagnosis is often not made (Clarke et al. 2008). The link between physical conditions and mental illness is well established. Studies have consistently shown associations between the number of physical symptoms and mental diseases. (Bohman et al. 2012; Kroenke 2003). Still, little is known about the temporal relationship between the two, as most studies are based on survey or cross-sectional data (Kohlmann et al. 2016) that cannot answer the question whether mental conditions proceed physical conditions or the other way around. Moreover, there is not much information about the relationship between specific physical conditions and subsequent mental diseases.

Our aim was to determine whether and to what extent non-psychological diagnoses increase the risk for subsequent diagnosis of mental illness in German primary care. This setting offers the opportunity to identify and treat mental illness early to improve clinical outcomes, and to closely monitor patients identified as being at risk for developing a mental illness.

We conducted a large retrospective cohort study based on German statutory health data to investigate whether specific non-psychological diagnoses predict a subsequent diagnosis of depression and/or anxiety in employed persons who were free of mental health diagnoses at study inclusion. We compared the associations of the respective diagnoses with new onset depression and/or anxiety to identify the diagnoses with the potentially greatest impact.

Methods

We conducted a retrospective population-based cohort study using data of statutory health insured persons from a large German health insurance database (Deutsche Analysedatenbank für Evaluation und Versorgungsforschung – DADB, Gesundheitsforen Leipzig GmbH, Leipzig, Germany). The dataset is representative of the German population and includes demographic data (age, sex, occupational group) as well as information on time-related inpatient and outpatient diagnoses (coded according to ICD-10) and sickness absence from work.

We analysed data from 1.2 million employed insured persons aged 16 – 60 years with at least 5 years of follow-up between 2013 and 2020. The presence or absence of a diagnosis of depression and/or anxiety was defined in the years 2018 to 2020. To identify *new-onset* depression and/or anxiety, persons with a prior diagnosis of any mental disease in the preceding 5 years (pre-observation period: 2013 – 2017 for mental disease diagnostic year 2018, 2014 – 2018 for mental disease diagnostic year 2019, 2015 – 2019 for mental disease diagnostic year 2020, respectively) were excluded. Persons with cancer were also excluded to eliminate the impact of cancer on the development of mental diseases. The final study population contained 383,365 participants. Within this population we tested the hypothesis that there are conditions that are associated with new-onset depression and/or anxiety. We therefore analysed the associations between potential predictors of mental disease in the 3 preceding years (exposure period: 2015 – 2017 for mental disease diagnostic year 2018, 2016 – 2018 for mental disease diagnostic year 2019, 2017 – 2019 for mental disease diagnostic year 2020, respectively) with the diagnosis of new-onset depression and/or anxiety in the years 2018 – 2020, respectively (Figure). Potential predictors of mental illness were selected on the basis of scientific literature and expert knowledge and the availability of an appropriate ICD 10 code.

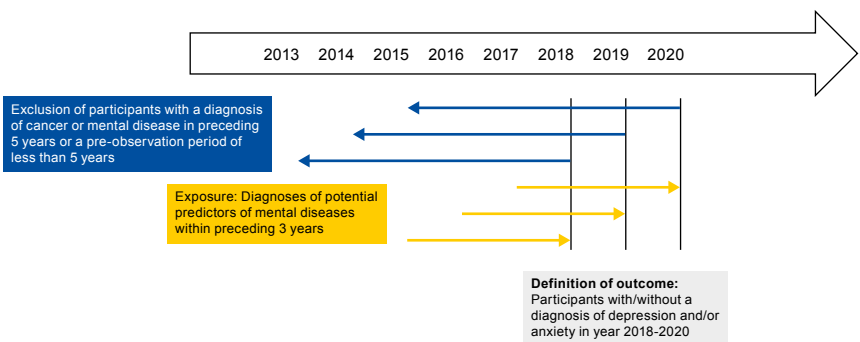

Figure: Study outline

Outcome definition: Exposure and outcome definitions were defined according to ICD-10-GM-2023. The outcome depression and/or anxiety was defined as at least one inpatient diagnosis or two outpatient diagnoses of depression (ICD10 F32 – F33) and/or anxiety (ICD10 F40 – F41) in diagnostic year 2018, 2019 or 2020.

Exclusion criteria: Persons were excluded if they had a diagnosis of mental disease (ICD-10 F*) or cancer (ICD-10 C*+D37-D48) within the 5 years pre-observation period.

Exposure variables: The following potential predictors for depression and/or anxiety coded by ICD10-GM were included in the model: problems related to social environment (Z60 in ICD10-GM including mobbing), disorders of the heartbeat (R00.0), fatigue (G93.3), fibromyalgia (M79.7), headache (G44, R51), heartburn (R12), hyperventilation (R06.4), irritable bowel syndrome (K58), migraine (G43), problems related to employment and unemployment (Z56 in ICD10-GM including stress), problems related to life-management difficulty (Z73 in ICD10-GM including burn-out), sleep disorders (G47), spine or back disease (M40 – M54), syncope and collapse (R55), tinnitus (H93.1), Paraesthesia of skin (R20.2), vertigo (R42, H81.8, H81.9). Migraine and headache were integrated individually in the model to investigate whether the impact of the headache differed depending on the coding used. Additionally, the frequency of physician visits and sickness leave within the 3 years of exposure time were also included in the model.

Statistical analysis: Data were first analysed descriptively. In a second step multivariate logistic regression analyses were performed. All exposure variables were entered into the model. Additionally, age, gender and profession were included to adjust for confounding effects of these variables. Profession was applied as a categorical variable with 30 professional groups. Age was entered as a categorical variable using age groups (18 – 29yrs, 30 – 45yrs, 46 – 60yrs). The multivariate logistic regression models were run for all insured and stratified separately for the three respective age groups to identify potential effect modification by age.

Ethical approval: This study was performed according to the guidelines of 'Good Practice Secondary Data Analysis'(GPS) and in accordance with the current Declaration of Helsinki (2013). It did not require patient IRB/EC review. This study used de-identified data and poses no risk to individuals included in the analysis. No Independent Ethics Committee submissions or approval were required in this study. Informed consent could be waived for this retrospective approach.

Table 1

Incidence of depression and/or anxiety and distribution of baseline characteristics and specific diagnoses in the total population and stratified by age

	Total population (N=383365)	Age 16-29 years (N =90895)	Age 30-45 years (N =147176)	Age 46-60 years (N =145294)
Incidence of depression and/or anxiety	25549 (6.7%)	4556 (5.0%)	9694 (6.6%)	11299 (7.8%)
Female gender	122,742 (32%)	32377 (35.6%)	44478 (30.2%)	45887 (31.6%)
Diagnosed conditions within 3 preceding years				
Disorders of the heart beat	2969 (0.8%)	450 (0.5%)	984 (0.7%)	1535 (1.06%)
Fatigue	153 (0.04%)	24 (0.03%)	47 (0.03%)	82 (0.06%)
Fibromyalgia	180 (0.05%)	12 (0.01%)	40 (0.03%)	128 (0.09%)
Headache	10892 (2.8%)	4644 (5.1%)	3570 (2.4%)	2678 (1.8%)
Heartburn	850 (0.2%)	89 (0.1%)	348 (0.2%)	413 (0.3%)
Hyperventilation	84 (0.02%)	37 (0.04%)	28 (0.02%)	19 (0.01%)
Irritable bowel syndrome	1563 (0.41%)	317 (0.3%)	595 (0.4%)	651 (0.4%)
Migraine	11156 (2.9%)	2975 (3.3%)	4107 (2.8%)	4074 (2.8%)
Sleep disorders	5852 (1.5%)	280 (0.3%)	1446 (0.98%)	4126 (2.8%)
Spine or back disease	51152 (13,3%)	6422 (7.1%)	16539 (11.2%)	28191 (19.4%)
Syncope or collapse	1150 (0.3%)	393 (0.4%)	313 (0.2%)	444 (0.3%)
Tingling	708 (0.2%)	76 (0.08%)	268 (0.2%)	364 (0.3%)
Tinnitus	3937 (1.03%)	266 (0.3%)	1069 (0.7%)	2602 (1.8%)
Vertigo	4013 (1.05%)	747 (0.8%)	1242 (0.8%)	2024 (1.4%)
Problems related to employment and unemployment	266 (0.07%)	29 (0.03%)	100 (0.07%)	137 (0.09%)
Problems related to life-management difficulty	926 (0.24%)	146 (0.2%)	390 (0.3%)	390 (0.3%)
Problems related to social environment	109 (0.03%)	20 (0.02%)	32 (0.02%)	57 (0.04%)
Sickness leave within 3 preceding years				
None	383365 (35.7%)	45520 (50.1%)	48525 (33.0%)	42869 (29.5%)
1 to 20 days	145467 (37.9%)	30685 (33.8%)	61180 (41.6%)	53602 (36.9%)
21 to 42 days	48103 (12.5%)	8196 (9.0%)	19283 (13.1%)	20624 (14.2%)
43 to 90 days	33608 (8.8%)	4692 (5.2%)	12344 (8.4%)	16572 (11.4%)
Over 90 days	19273 (5.0%)	1802 (2.0%)	5844 (4.0%)	11627 (8.0%)
Doctor contacts per year				
None	258063 (67.3%)	62487 (68.7%)	104777 (71.2%)	90799 (62.5%)
5 to 8 doctor contacts	91305 (23.8%)	21519 (23.7%)	31907 (21.7%)	37879 (26.1%)
9 and more doctor contacts	33997 (8.9%)	6889 (7.6%)	10492 (7.1%)	16616 (11.4%)

Results

The dataset contained data of 1,206,627 employed persons aged 16 – 60 years that were statutory health insured in Germany in the years 2013 to 2020 and had an observation period of at least 5 years. After the exclusion of persons with a preceding mental or cancer diagnosis within the 5-year pre-observation period, the final study population consisted of 383,365 participants. Participants were predominantly male (68 %).

Overall 6.7 % of the participants had a new-onset diagnosis of depression and/or anxiety in the years 2018 to 2020, increasing with age from 5 % in the age-group of 16 – 29 years to 7.8 % in the age-group of 46 – 60 years (figure 1). New onset depression was diagnosed in 15,761 (4.1 %), new-onset anxiety in 5,138 (1.3 %) of the study population and 4,650 (1.2 %) were diagnosed with a new-onset of both, depression and anxiety.

Within the exposure period, spinal or back disorders were diagnosed most frequently (13 % of all participants), followed by migraine (2.9 %) and headache (2.8 %) (Table 1). Other conditions such as fatigue, fibromyalgia, hyperventilation and problems related to the social environment were rare with less than 0.1 %.

The prevalence of most conditions was increasing with age. This trend was most pronounced for spine and back disease (increase from 7.1 % for age 16 – 29 years to 19.4 % for age 46 – 60 years) and for insomnia (increase from 0.3 % to 2.8 %). In contrast, a decrease with age was seen for migraine (from 3.3 % to 1.8 %), headache (5.1 % to 1.8 %) and hyperventilation (from 0.04 % to 0.01 %). Sickness leave and frequency of physician visits also increased with age.

In multivariate analyses the risk of a new diagnosis of depression and/or anxiety was twice as high for women as for men (aOR 2.1, 95 % CI 2.0 – 2.2). Multivariate analyses were repeated within the different age groups. The relative risks were higher in women in the age groups 30 – 60 years in comparison to women at age 16 – 29 years. Age itself was not a strong predictor for new onset depression and/or anxiety with relative risks ranging between 1.0 – 1.1. All of the selected diagnoses were statistically significantly associated with new-onset depression and/or anxiety. The highest odds ratios were seen for hyperventilation (aOR 6.0 95 % CI 3.4 – 10.8), problems related to life-management difficulty (aOR 5.8 95 % CI 4.9 – 6.9), problems related to social environment (aOR 4.8 95 % CI 2.9 – 7.9) and problems related to employment and unemployment (aOR 4.4 95 % CI 3.2 – 6.0). A diagnosis of spine or back disease led to a 1.3 fold increased risk of new-onset depression and/or anxiety (aOR 1.3 95 % CI 1.3 – 1.4). The relative risk of a new-onset diagnosis of depression and/or anxiety also increased with higher numbers of physician contacts and days of sickness leave. Within each age group new onset of depression and/or anxiety increased with duration of sick leave and number of doctor contacts per year. The aORs for hyperventilation, insomnia, abnormalities of heart beat and heartburn were higher in the age groups 16 – 29 years and 30 – 45 years compared to age group 46 – 60 years. In contrast, spine and back disease, fibromyalgia and problems related to social environment and life management difficulty had higher aORs in the age-group 46 – 60 years compared to the younger age groups. However, confidence intervals were largely overlapping.

Table 2

Multivariate analyses of the association between specific diagnoses and new onset of depression and/or anxiety. Models are adjusted for professional group and all other variables shown in this table. aOR: adjusted Odds Ratio. 95 % CI: 95 % Confidence Interval

	All insured				Age 16-29 years				Age 30-45 years				Age 46-60 years			
	aOR	95% CI			aOR	95% CI			aOR	95% CI			aOR	95% CI		
Female gender	**2.1**	2.00	-	2.20	**1.8**	1.60	-	1.90	**2.30**	2.20	-	2.50	**2.20**	2.00	-	2.30
Age																
16-29 years	**1**															
30-45 years	**1.1**	1.08	-	1.20												
46-60 years	**1.0**	0.97	-	1.06												
Diagnoses																
Disorders of the heart beat	**1.8**	1.63	-	2.06	**2.3**	1.67	-	3.06	**2.1**	1.71	-	2.54	**1.3**	1.07	-	1.53
Fatigue	**4.1**	2.65	-	6.31	**4.7**	1.61	-	13.60	**8.1**	4.00	-	16.57	**3.2**	1.76	-	5.99
Fibromyalgia	**2.7**	1.81	-	3.97	**1.3**	0.22	-	7.41	**3.3**	1.46	-	7.23	**2.5**	1.66	-	3.87
Headache	**1.8**	1.67	-	1.90	**1.8**	1.57	-	1.98	**1.6**	1.45	-	1.81	**1.7**	1.49	-	1.89
Heartburn	**1.7**	1.33	-	2.07	**1.8**	0.92	-	3.59	**1.7**	1.16	-	2.37	**1.4**	1.04	-	1.99
Hyperventilation	**6.0**	3.35	-	10.80	**9.5**	3.91	-	22.97	**10.2**	3.60	-	29.03	**4.7**	1.38	-	15.90
Irritable bowel syndrome	**2.0**	1.75	-	2.39	**3.1**	2.17	-	4.32	**1.9**	1.43	-	2.41	**2.0**	1.62	-	2.58
Migraine	**1.4**	1.35	-	1.54	**1.6**	1.41	-	1.84	**1.5**	1.34	-	1.65	**1.4**	1.26	-	1.54
Sleep disorders	**2.6**	2.40	-	2.82	**5.4**	3.86	-	7.46	**2.9**	2.50	-	3.43	**2.4**	2.18	-	2.64
Spine or back disease	**1.3**	1.29	-	1.39	**1.2**	1.12	-	1.40	**1.3**	1.19	-	1.36	**1.4**	1.36	-	1.51
Syncope or collapse	**1.6**	1.33	-	1.97	**1.6**	1.13	-	2.33	**1.7**	1.19	-	2.52	**1.7**	1.26	-	2.20
Tingling	**1.5**	1.14	-	1.84	**1.7**	0.85	-	3.51	**1.8**	1.21	-	2.58	**1.2**	0.84	-	1.67
Tinnitus	**1.7**	1.51	-	1.86	**1.5**	0.95	-	2.42	**1.7**	1.42	-	2.13	**1.8**	1.57	-	2.02
Vertigo	**2.0**	1.81	-	2.18	**2.1**	1.65	-	2.63	**2.2**	1.84	-	2.55	**1.9**	1.69	-	2.18
Problems related to employment and unemployment	**4.4**	3.17	-	6.02	**5.5**	2.05	-	14.53	**3.0**	1.70	-	5.31	**4.5**	2.90	-	6.96
Problems related to life-management difficulty	**5.8**	4.93	-	6.87	**4.0**	2.53	-	6.29	**5.8**	4.51	-	7.53	**5.9**	4.56	-	7.62
Problems related to social environment	**4.8**	2.90	-	7.89	**4.9**	1.36	-	17.58	**7.7**	2.98	-	19.67	**6.4**	3.25	-	12.60
Sick leave within 3 years																
No sick leave	**1**				**1**				**1**				**1**			
1 to 20 AU days	**1.5**	1.46	-	1.60	**1.5**	1.39	-	1.71	**1.3**	1.24	-	1.43	**1.6**	1.47	-	1.72
21 to 42 days of sick leave	**2.7**	2.57	-	2.87	**2.6**	2.29	-	2.94	**2.4**	2.25	-	2.65	**3.0**	2.71	-	3.22
43 to 90 days of sick leave	**4.5**	4.29	-	4.78	**4.1**	3.61	-	4.73	**4.0**	3.64	-	4.32	**5.0**	4.61	-	5.46
Over 90 days of sick leave	**7.2**	6.74	-	7.60	**5.2**	4.33	-	6.18	**6.4**	5.80	-	7.08	**8.3**	7.61	-	9.08
Number of doctor contacts																
0 to 4 doctor contacts per year	**1**				**1**				**1**				**1**			
5 to 8 doctor contacts per year	**1.4**	1.34	-	1.44	**1.6**	1.45	-	1.72	**1.5**	1.39	-	1.56	**1.2**	1.16	-	1.29
9 or more doctor contacts per year	**2.2**	2.08	-	2.27	**2.8**	2.50	-	3.10	**2.4**	2.19	-	2.54	**1.9**	1.81	-	2.05

Discussion

In this population-based study of employed statutory health insured persons without mental disease or malignant cancer at baseline all of the investigated conditions were associated with an increased risk of new-onset depression and/or anxiety. This increase was greatest for hyperventilation, fatigue, problems related to life-management difficulty (including burn-out), problems related to social environment (including mobbing), problems related to employment and unemployment (including stress) and the number of days on sick leave. Spine and back conditions were frequent and consistently increased the risk in all age groups. However, the magnitude of the increased risk of a subsequent diagnosis of depression and/or anxiety in persons with spine and back conditions was not that pronounced. Due to the longitudinal study design the temporal sequence of diagnoses could be established. The results suggest that these diagnoses preceded the onset of depression and/or anxiety – and/or that depression and/or anxiety were already present but still undiagnosed or subclinical. The strength of the

impact on new-onset depression and/or anxiety was age-dependent for some of the conditions in the study.

In our study population, the frequency of depression and/or anxiety increased with age. However, in multivariate analyses age was not a risk factor for new-onset depression and/or anxiety. This suggests that the association between age and depression and/or anxiety may be explained by the higher frequency of physical diseases in older people, and that age itself is not a predictor for depression and/or anxiety. Spine and back conditions were the most frequent medical conditions diagnosed in our study population. They accounted for more than half of the diagnosed medical conditions and increased with age. A link between back problems and mental illness has long been recognised. (Hotopf et al. 1998; Larson et al. 2001; Nakao/Yano 2006). However, in our study, back conditions only slightly increased the risk of new-onset depression and/or anxiety, with relative risks ranging from aOR 1.2 (95 % CI 1.1 – 1.4) in 16 – 29 year olds to aOR 1.4 (95 % CI 1.4 – 1.5) in 46 – 60 year olds, which seemed lower than expected but may be explained by the longitudinal study design. A British study (Hotopf et al. 1998) investigated the temporal relationship between back pain and psychiatric disorders. In this study, back pain was associated with a 3-fold increased risk of mental health problems in cross-sectional analysis. When the same data were analysed longitudinally, mental illness predicted back pain with increasing severity in a dose-response relationship up to 1.9 times, and back pain predicted mental illness 1.5 times (adjusted for social factors). The authors of this population-based study concluded a bi-directional relationship between backpain and psychiatric disorders. Their results are in line with the 1.3 fold increased risk for new-onset depression and/or anxiety in our study that investigated employed patients free of mental illness and cancer at baseline in a primary care setting. Taking our results together with those in the literature, we conclude that back problems have a high impact at a population level, as they are very common and the results are clearly significant. However, the magnitude of the increased risk is not so large. Therefore, risk discrimination may be of limited value to the clinician seeking to detect subclinical depression and/or anxiety and to identify patients at increased risk of developing mental illness.

The highest risk increases in our study were seen for hyperventilation and fatigue. In the 16 – 45years age group, patients with hyperventilation had a 10-fold increased risk of being diagnosed with depression and/or anxiety within the following 3 years. Although hyperventilation is closely related to anxiety and constitutes one of the symptoms of somatoform disorders (ICD10 F45.3) this should not have biased our results as our study population excluded patients with mental illness at baseline and the ICD 10 code R06.4 was investigated that explicitly excludes psychogenic hyperventilation. Fatigue was associated with a 4-fold increased risk of new-onset depression and/or anxiety. Here, the age group

30 – 45 years seemed to be at the highest risk of a subsequent diagnosis of depression and/or anxiety. However, confidence intervals were overlapping, therefore this has to be interpreted with caution.

High relative risks for the later onset of depression and/or anxiety were also seen for the ICD 10 codes for problems related to life-management difficulty (including burn-out), problems related to social environment (including mobbing) and problems related to employment and unemployment (including stress). The effects of the first two diagnoses were particularly pronounced in the older age groups from 30 – 60 years, the latter in the younger age group from 16 – 29 years. Patients with these diagnoses should therefore also be monitored for subclinical or new-onset of depression and/or anxiety by their primary care provider. The result is not so surprising as the link between burnout and depression, for example, is well known and the conditions can be difficult to distinguish.

In addition to the diseases diagnosed according to ICD10, the effects of sick leave days and the number of doctor contacts were also examined. While sick leave days increased with age, frequent doctor visits were particularly elevated in the age group of 46 – 60 year olds. Both parameters predicted new-onset depression and/or anxiety in a dose-response relationship. Sick leave was a very strong predictor of new-onset depression and/or anxiety, even more so with increasing age. In the 46 – 60 year age group, there was an 8.3-fold increased risk of new-onset depression and/or anxiety if sick leave was 90 days or more in the previous 3 years. This parameter is therefore a very strong indicator for the treating physician to monitor the patient for subclinical or new-onset depression and/or anxiety. The likelihood of a later diagnosis of depression and/or anxiety in connection with the number of doctor contacts was also increased. The risk was higher in the 16 – 29 year age group (2.8-fold) than in the 45 – 60 year age group (aOR 1.9-fold) suggesting that the frequency of doctor contacts is more likely to be an indicator of subclinical depression and/or anxiety in younger people than in older people. Our study also showed a 2-fold increased risk of new-onset depression and/or anxiety in women compared to men. One explanation of this is the influence of genetic and hormonal factors (Albert 2015). In addition, other sociological influences are conceivable. Doctors might be more likely to diagnose mental illness in women than in men and the greater use of health services by women and the associated higher likelihood of subsequent diagnoses could also explain part of this result. The higher likelihood of a diagnosis of depression and/or anxiety among women in the 30 – 45 and 45 – 60 year age groups may also reflect the greater stress at this stage of life, when the dual burden of family and career is often particularly high for women in Germany.

Strengths and limitations

The main strengths of this study are the population-based primary care setting and the longitudinal study design. The strict restriction of the study population to exclude applicants with an ICD10 F diagnosis in the 5 years pre-observation period allowed the identification of predictors in patients who had not yet been diagnosed with a mental disorder and thus to assess risk factors of new-onset of depression and/or anxiety. In addition, the large size of the study population and the adjustments made in the multivariate analyses contribute to the strength of this study as the effects of the pre-existing exposures could be assessed independently from each other. This way it was possible to assess the impact of numerous potential risk factors on new onset depression and/or anxiety simultaneously. In addition, the study provides a good description of somatic predictors of mental disease in an unbiased primary care population in Germany and the stratification by age group added value by a detailed description of these factors and by allowing to investigate whether the associations between predictor variables and new onset depression and/or anxiety differed by age. To our knowledge this has not been shown as detailed in such a setting before. However, one of the limitations is that confidence intervals of the ICD10 diagnoses examined often overlapped when the analyses were stratified by age. Therefore, some of the observed differences by age group lacked power to prove that they were really statistically significant. An important limitation of this study is that our diagnoses were mainly based on ICD diagnoses. Some of the codes did not allow a more detailed identification of predictors. This was especially evident for the Z-ICD codes that summarise different exposures. Moreover, physicians may not always code for mental conditions because they do not want to confront the patient with a mental diagnosis. A further limitation may be the choice of the primary care setting within a general population that is at the same time one of the strengths of our study. Persons who do go to the doctor are more likely to be diagnosed with concurrent disease than persons who don't go to the doctor. This may have increased the associations between our predictor variables and new-onset depression and/or anxiety.

This study adds

In a primary health care setting early diagnosis of mental illness is particularly important and effective, as it allows for early treatment improving the prognosis and reducing disability. In the past, only 25 – 30 % of mental disease have been reported to be recognized by the doctors when patients presented at their physicians with physical symptoms (Clarke et al. 2008). Patients often do not offer psychological complaints themselves, and doctors may not have time for an in depth interview at every visit. When a patient presents with physical complaints,

a medical doctor usually has to rule out serious physical disease first. We have identified predictors for mental illness that can be used as a warning sign of subclinical or future depression and/or anxiety in a primary care setting. Therefore, non-psychological predictors of mental illness can help the treating physician to discriminate where it would be worth asking additional questions. This is also particularly important as studies have shown that depression with physical symptoms has a worse prognosis than depression without physical symptoms (Bohman et al. 2012). Our results are generalizable for the situation in the German health care system today. For other regions the associations may differ.

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