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Combined effects of major depression, pain and somatic disorders on general functioning in the general adult population

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Abstract

This study was carried out to assess the prevalence of major depressive disorder (MDD) in persons suffering from pain symptoms in various locations, both with and without comorbid somatic disorders and to analyze the single and combined effects of MDD, pain symptoms and somatic disorders on general functioning in the community. The 12-month prevalence of MDD, somatic disorders and pain symptoms, grouped according to location, were determined among 4181 participants from a community sample. Depression was assessed utilising the Composite International Diagnostic Interview. Pain symptoms were self-reported by participants whereas medical diagnoses were validated by medical examinations. General functioning was evaluated utilising the established MOS-SF-36 scale. The prevalence of MDD was significantly increased for persons with pain in any location. In the absence of a somatic disorder, MDD prevalence was highest in persons with abdominal/chest pain (9.3%) and arm or leg pain (7.9%) and lowest in persons with back pain (6.2%). Mental and physical well-being were lowest for persons with both MDD and a somatic disorder, irrespective of pain locations. Increasing numbers of pain locations impaired mental and physical well-being across all groups, but the effect on mental well-being was most marked in participants with MDD and comorbid somatic disorders. The presence of pain increases risk of associated MDD. The number of pain locations experienced, rather than the specific location of pain, has the greatest impact on general functioning. Not only chronic pain, but pain of any type may be an indicator of MDD and decreased general functioning.

Keywords: Depression; Pain location; Medical comorbidity

1. Introduction

Numerous studies have shown depression to be highly prevalent among persons with chronic pain [14,16,32]. In clinical studies, rates of current major depression can range from 30% to 54% [4,34], significantly higher than the rate of 5–8% found in the general population [24].

It is well known that Major Depression (MDD) significantly impacts on quality of life and general functioning [6,7,15,19,22]. Disabling chronic pain comorbid with depression, is associated with greater clinical burden than depression alone [1,3], an association which has commonly been demonstrated in chronic low back pain [27]. A recent Canadian community study reported that the combination of chronic back pain and major depression is associated with greater disability than either condition alone [10].

The current literature has, however, focused primarily on chronic pain and its relationship to affective disorders and disability. To our knowledge, no research

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has explored the influence that acute pain symptoms or the specific location of pain has on mood and general functioning. It is not clear, for example, if the specific pain location or the number of pain locations experienced, independent of pain chronicity, influences the prevalence of depression. Finally, it is unclear, from the current literature, if quality of life and general functioning are influenced by any pain location or the total number of pain locations in comorbid MDD.

The influence that comorbid medical illness has on the relationship between pain and MDD has rarely been explored in past studies. The presence of co-morbid medical illness could reasonably be expected to confound any demonstrated association between pain and depression, since affective disorders could be the result of the underlying organic illness. In a recently published study which analyzed pain and comorbid depression and stratified for the presence of somatic disorders [13], the authors demonstrated that the presence of physical illness modified the relationship between MDD and pain. The diagnosis of medical disorders in that study, however, was based on participant self-report rather than medical examination, which is likely to have affected the validity and reliability of the medical diagnoses and the demonstrated associations.

The primary aim of this analysis was to assess the 12-month prevalence of major depression and its association with comorbid pain of differing locations, in a general population sample. A second aim was to explore the impact of major depression and comorbid pain on general functioning in the presence or absence of associated medical comorbidity. Our final aim was to investigate the impact of the number of pain locations on general functioning in respondents with comorbid MDD. All analyses were stratified for the presence/absence of medical disorders which were assessed, verified and diagnosed by a trained study physician.

2. Materials and methods

2.1. Sample

The German Health Interview and Examination Survey consisted of a core survey (GHS-CS) and several supplemental surveys including the Mental Health Supplement (GHS-MHS). The study was commissioned by the German Ministry of Research, Education and Science (BMBF) and approved by the relevant institutional review board and Ethics Committee. Its sample was a stratified random sample from 113 communities throughout Germany with 130 sampling units (random sampling steps: (1) selection of communities, (2) selection of sampling units, and (3) selection of inhabitants from population registries). Data collection was done between October 1997 and March 1999. The response rate of the core survey was 61.4% ($N = 7124$). Of the non-responders, 1860 (41%) did at least fill out a short questionnaire for a non-responder-analysis (gender, age, educational level, self-rated subjective health status, smoking status). There were no significant differences between these and the sample with regard to gender and age (exception: 70–79 year old women; but these were not eligible for the mental health part anyway, see below) and to self-rated subjective health status (first item of the SF-36) and smoking status, but there was a tendency to have a lower educational level in the non-responders. Thus, the sample of the core survey up to 65 years ($N = 6159$) was regarded as sufficiently representative to be utilised as a starting sample for the mental health supplement (GHS-MHS).

A screening questionnaire for mental disorders with eleven questions representing essential DSM-IV and ICD-10 criteria (CID-S, [40]) had been administered at the end of the medical examination of the core survey. All of the participants from the core survey who answered at least one of these items with yes (screen positives) and a random sample of the 50% of the participants who answered all screening questions in the negative (screen negatives) were included in the mental health supplement. Non-response did not differ between screen-negative and screen-positive respondents from the core survey. To account for the over-sampling of screen positives and for differential non-response among subgroups, data were weighted by selection probabilities and demographic characteristics (age, gender, and region) in the later analyses.

Respondents of the core survey older than 65 years were excluded from the GHS-MHS because the psychometric properties of the CIDI, the interview used in the study, have not yet been satisfactorily established for use in older populations [26]. The conditional response rate of the GHS-MHS was 87.6%, resulting in a total of $N = 4181$ respondents (out of the eligible $N = 4775$) who completed the mental health assessment. Sociodemographic characteristics of this sample matched the German general population aged 18–65 (49.7% females; mean age was 43.5 years (SD = 11.6); 19% lower, 58% middle, and 23% upper social class according to an index combining educational level, job status and income [38]. The presented (weighted) results can be regarded as representative for the German non-instutionalized adult population from 18 to 65 years of age with sufficient language skills to follow the interviews. Written informed consent was obtained for both surveys. Participants did not get any financial compensation for their study participation. A full description of the study methodology and sampling can be found in [23,40].

2.2. Assessment of medical conditions

The core survey consisted of (1) a self-report questionnaire on various health related and social domains, (2) a standardized computer-assisted medical interview, (3) anthropometric and blood pressure measurements and the collection of blood and urine samples, and (4) the above mentioned screening for mental disorders, which served as the first stage of the Mental Health Supplement (GHS-MHS). All examinations and interviews were done in study centres at the respective site. The self-report questionnaire evaluated the participants' current and past somatic symptoms and complaints, health care utilization, and impairments and disabilities. Completion of this questionnaire was followed with a face to face computer assisted structured interview from a study physician. The

interview explored a range of 42 medical conditions, assessing current symptoms and whether illness had ever previously been diagnosed by a physician. The study doctors would explain the medical conditions until they were confidant that the study participant understood what was meant. For some of the diagnoses the researchers would ask additional questions about severity, treatment or other information deemed relevant. Somatic diagnoses were made by the physician after medical examination and structured interview, though some diagnoses were revised on the basis of medical reports or of the laboratory test results which became available two weeks later. For the present analysis we used only diagnoses present within last 12 months. Moreover, the number of medical diagnoses was grouped into 'no medical disorder', one medical disorder' and 'two or more medical diagnoses'.

2.3. Assessment of pain

The participants were asked if they had experienced any pain during the past 12 months. They were also asked if their pain had been in specific locations (i.e. head, neck, shoulder, chest, abdomen, lower back). If so, pain reports were grouped according to these sites. Severity and duration of pain were not assessed.

2.4. Assessment of mental disorders

Psychopathological and diagnostic assessments were based on the computer-assisted version of the Munich Composite International Diagnostic Interview. The DIA-X/M-CIDI is a modified version of the World Health Organization CIDI, version 2.1 [25], supplemented by questions to cover DSM-IV and ICD-10 criteria. The DIA-X/M-CIDI is a fully structured interview that allows for the assessment of symptoms, syndromes, as well as 4-week, 12-month and lifetime diagnoses of DSM-IV mental disorders. With regard to Major Depression (MDD) reliability and validity of this instrument is good to very good. Details of the psychometric properties of the CIDI are reported elsewhere [39]. Most interviews of the mental health assessment were done within 2–4 weeks after the core survey medical examination at the homes of the respondents (average duration: 63 min) by study doctors specifically trained in the use of the computer-assisted version of the Munich Composite International Diagnostic Interview (DIA-X/M-CIDI).

In this analysis MDD within the last 12 months was considered as the diagnostic entity of interest. MDD is characterized by a persistently sad or irritable mood, difficulties in thinking, concentrating, and remembering, physical slowing or agitation, anhedonia, thoughts of guilt, worthlessness, hopelessness, and emptiness and persistent physical symptoms that do not respond to treatment. MDD includes single and recurrent depressive episodes. MDD in the course of bipolar disorders was not included in the analyses.

2.5. Assessment of health related quality of life

The MOS-SF-36 was developed as part of the Medical Outcome Study in the 1980s [35,36]. In non-psychiatric populations the SF-36 has shown a good validity and reliability and is one of the most frequently used instruments world-wide for measuring health care outcomes. It has been validated within psychiatric populations, such as in depressive individuals [37] and in outpatient schizophrenic individuals. In addition to the two overall scores of the physical and mental summary component scores used in the present analyses, the SF-36 questionnaire includes the following health dimensions: general health, mental health, vitality, pain, physical role functioning, emotional role functioning, and social functioning. The instrument is translated into many languages [17] including German [9].

2.6. Statistical analysis

Sociodemographic variables, twelve months prevalence rates of MDD, medical disorders (three groups: no, one or $\geqslant 2$ medical disorders) and pain locations are presented stratified for gender and presence of somatic disorders (Table 1 and Fig. 1). Differences between groups of categorical variables were tested with Chi-square test and continuous variables with *t*-test procedures.

For further analysis the presence of MDD and somatic disorders were grouped into four categories: (1) no MDD/no somatic disorder; (2) MDD without somatic disorder; (3) Somatic disorder without MDD; (4) MDD with somatic disorder. ANOVA procedures adjusted for age, gender and social status were carried out to investigate differences of the continuous measures of the physical and mental summary scores of the SF-36 scale between the four categories (as above) stratified by pain location (Figs. 2 and 3). The impact of the number pain locations on physical and mental quality of life summary scores stratified for the four categories of the presence of MDD and somatic disorders was assessed using linear regression analyses adjusted for age, gender and social status (Table 2). All residuals of the linear regression analyses were normally distributed (assessed with Durban–Watson test).

Table 1
The 12-month prevalence rates of major depressive disorder (MDD) according to age, pain locations and gender (GHS-MHS, *N*=4181)

	Total ($N=4181$) (%)	Male ($N=2102$) (%)	Female ($N=2079$) (%)	*p*-value*
Age				
18–29	21.4	21.8	21.0	
30–39	25.9	26.2	25.6	
40–49	21.4	21.5	21.3	
50–59	20.0	19.7	20.3	
60–65	11.3	10.8	11.8	>0.05
Social status				
Low	19.1	17.5	20.8	
Medium	57.6	57.9	57.3	
High	23.2	24.6	21.9	<0.01
MDD	8.3	5.5	11.2	<0.001
Pain locations				
Head	70.1	60.8	79.5	<0.001
Neck/shoulders	57.1	49.2	65.1	<0.001
Arms/legs	42.0	40.9	43.1	0.15
Chest/abdomen	35.6	31.6	39.6	<0.001
Lower back	63.2	60.3	66.1	<0.001

* *p*-value of Chi^2-test for differences of proportions between female and male participants.

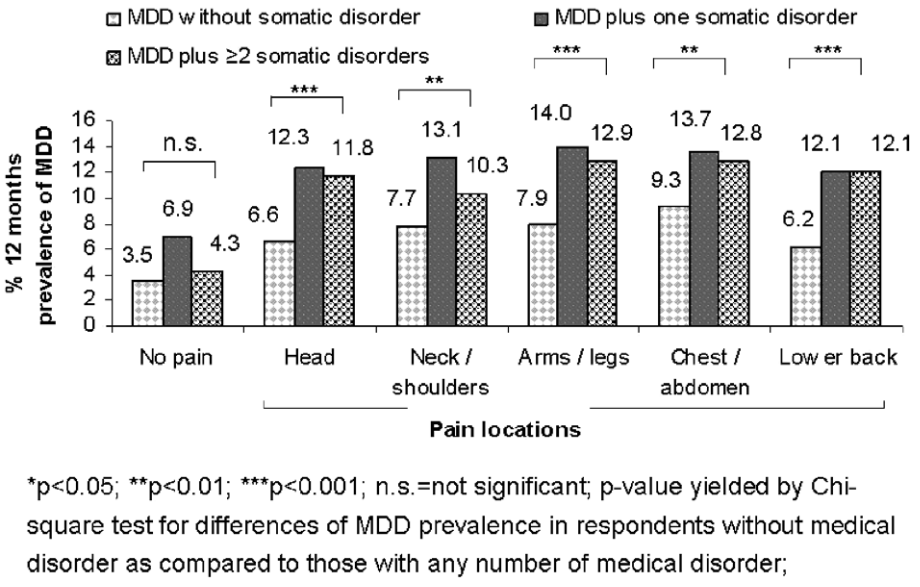

Fig. 1. 12-Month prevalence of MDD according to comorbid somatic disorders and stratified by pain location.

3. Results

In this sample, 8.3% of the participants (female: 6.0%; male: 11.0%; $p < 0.001$) had no pain at all during the past 12 months. The majority of participants reported at least one pain location as presented in Table 1. On average, participants reported 2.7 ± 1.4 pain locations (female: 2.9 ± 1.4; male: 2.4 ± 1.4; $p < 0.001$) in the past 12 months.

MDD and most pain locations (except pain in arms/legs) were significantly more frequent in female than in male (Table 1). MDD prevalence in participants without somatic disorders was increased in all pain locations with highest rates in those participants with pain in the abdomen/chest (9.3%) followed by pain in arms/legs (7.9%). Lower back pain had the lowest MDD prevalence (6.2%) among all pain locations (Fig. 1). Furthermore, MDD was significantly more prevalent in participants with somatic disorders as compared to the group without somatic disorders which held true for participants either with or without pain. Moreover, the significantly increased MDD prevalence in comorbid somatic disorders applied to all pain locations, but not to participants without pain.

Fig. 2 presents the impact of single and combined effects of MDD and somatic disorders on physical

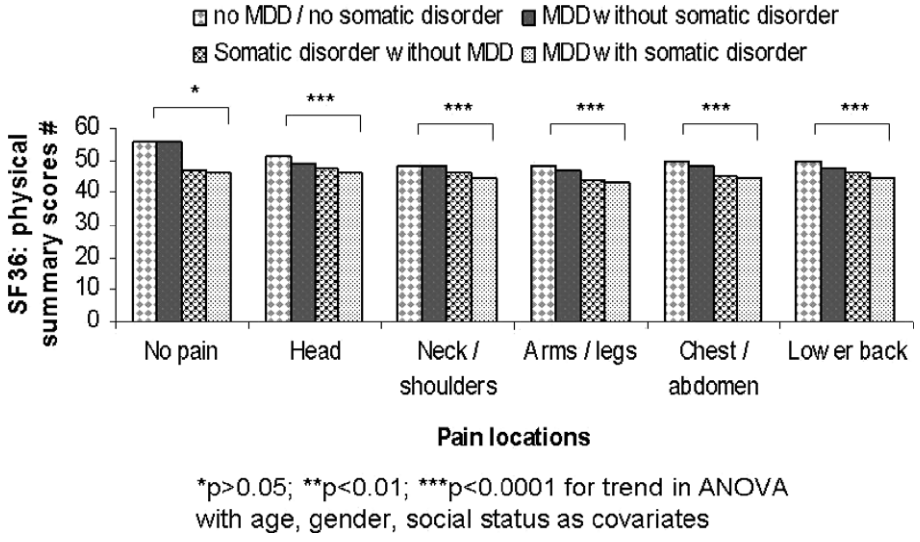

Fig. 2. Physical summary score of the SF-36 of single MDD and MDD plus comorbid somatic disorders stratified by pain location. #Higher scores indicate better general functioning and quality of life than lower scores.

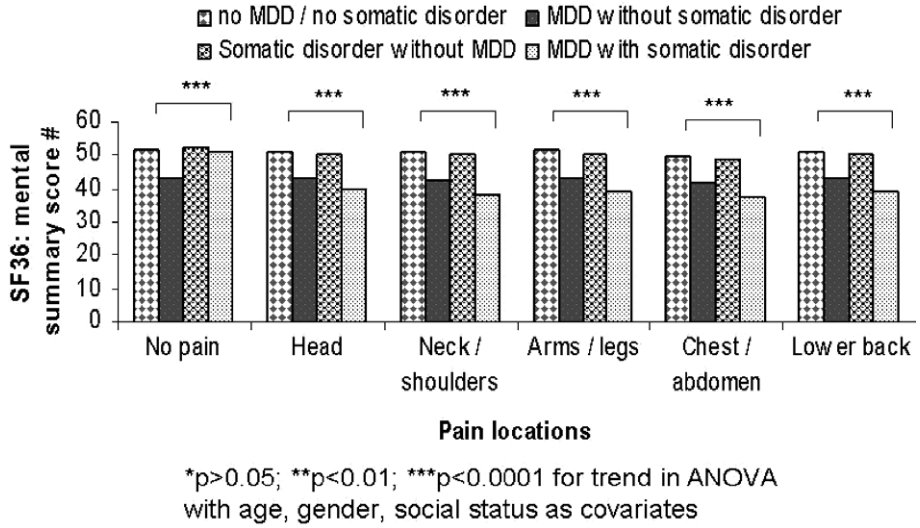

Fig. 3. Mental summary score of the SF-36 of single MDD and MDD plus comorbid somatic disorders stratified by pain location. #Higher scores indicate better general functioning and quality of life than lower scores.

general functioning (SF-36: physical summary score) stratified for pain locations. Physical functioning was best when no MDD, no medical disorder and no pain were present. The single categories of MDD and somatic disorder and the combined category of MDD plus somatic disorders showed reduced physical functioning. In these single and combined categories the reductions in functioning were highly significant for each single pain location, but not when pain was absent.

Applying the same type of analyses to mental functioning (SF-36 mental summary score) (Fig. 3), it was found that the single presence of somatic disorders had only little impact on mental functioning across all pain locations, whereas the single effect of MDD and MDD combined with somatic disorders had the largest negative impact on mental functioning, again regardless of pain location.

In addition to these analyses that considered specific pain locations, we finally investigated the impact of the number of pain locations on physical and mental functioning across the single and combined categories of MDD and somatic disorder (Table 2). Table 2 shows that an increasing number of pain locations were significantly related to a decrease in physical and mental functioning. The significant impact of the number of pain locations on physical functioning was generally larger on physical than on mental functioning as expressed by higher standardized beta coefficient.

While the number of pain locations in MDD alone had the lowest negative impact on mental functioning

Table 2
Impact of number of pain locations (past 12 months) on physical and mental quality of life stratified by single and combined categories of MDD and somatic disorders

	Unstandardized beta coefficient; SE[a]	*p*-value[a]	Standardized beta coefficient[b]
SF-36 physical summary score			
No MDD/no somatic disorder ($N = 1668$)	−1.8; 0.11	0.0005	−0.357
MDD without somatic disorder ($N = 103$)	−2.6; 0.51	0.0005	−0.436
Somatic disorder without MDD ($N = 2166$)	−2.3; 0.12	0.0005	−0.369
MDD plus somatic disorder ($N = 244$)	−2.4; 0.39	0.0005	−0.355
SF-36 mental summary score			
No MDD/no somatic disorder ($N = 1688$)	−0.70; 0.12	0.0005	−0.142
MDD without somatic disorder ($N = 103$)	−0.56; 0.73	0.24	−0.08
Somatic disorder without MDD ($N = 2166$)	−1.0; 0.13	0.0005	−0.174
MDD plus somatic disorder ($N = 244$)	−2.1; 0.54	0.0005	−0.283

[a] Unstandardized beta coefficient, standard error (SE) and *p*-value for multivariable linear regression analysis adjusted for gender, age and social status: dependent variables are SF-36 physical or mental summary scores; the independent variable is the total number of pain locations; linear regression analysis is carried out separately for single and combined categories of MDD and somatic disorders.

[b] Standardized beta coefficient expresses the contribution of the number of pain locations to the model: figures between (+/−) 0.3–0.5 express a moderate contribution whereas figures <0.3 express a mild contribution of the number of pain locations to the overall model.

followed by somatic disorder alone, MDD comorbid with somatic disorders conferred the highest negative impact on mental functioning. In contrast, physical well-being was negatively influenced by increasing numbers of pain locations to a similar extent across all single and combined categories of MDD and somatic disorders.

4. Discussion

4.1. 12-month prevalence of MDD and pain

This population based study showed that any pain (chronic and non-chronic) in the past 12-month was associated with increased prevalence rates of MDD which supports previous studies in the field [10,11]; however, the rates reported here were lower as opposed to previous studies concentrating on chronic pain prevalence in MDD [10]. A main reason for the expected differences in MDD prevalence rates in our study as compared to other recent studies is may be related to the differences in pain categories or pain definition (chronic pain v/s any pain) applied in these studies [10,11]. When we consider our finding on the prevalence of MDD in participants that reported any pain together with the MDD prevalence in chronic pain as reported in the literature [10], this indirectly indicates that more severe/chronic cases of pain are associated with higher prevalence rates of depression than in pain of any type. Those prevalence rates were higher in participants with somatic disorder as compared to those without somatic disorder, which is not surprising in light of the previously reported evidence that somatic disorders are related to increased rates of MDD and pain [5,12]. However, since in this study increased rates of MDD in participants with comorbid pain either with or without somatic disorders was observed, pain might be an indicator of, or at least be associated with, the development of somatic illness. In addition, since pain without somatic disorder was associated with MDD, it can be hypothesised that pain might be an early sign of MDD even without somatic disorders. This warrants further clarification in prospective studies. However, the cross-sectional design of the study does not allow conclusions about the time sequence or causality between pain and MDD.

In our study, a large range of pain locations did not affect the association between pain and MDD stratified for somatic disorders. This finding is somewhat surprising, since previous studies in the general population have reported an association between specific pain locations, such as headache [8,30] or back pain [13,31] and depression; Those studies, however, focused only on chronic pain conditions, whereas our study considered any type of pain including acute and chronic pain conditions. The findings of our study highlight that pain, even in non-chronic forms, is associated with depression.

4.2. Comorbidity of MDD, pain and somatic disorders

In this study, the presence of both pain and somatic disorders was associated with a significantly increased prevalence MDD, when compared to persons with either pain or somatic disorders alone. These findings are in support of one previously published paper stratifying for somatic disorders which showed a logical increased association between pain and MDD in participants with comorbid somatic disorders as compared to those without somatic disorders [12].

Interestingly, we found no relationship between the number of somatic disorders present and the prevalence of depression. This would indicate that the effects of pain on the prevalence of MDD are not fully explained by somatic disorders alone. In our study, pain by itself was associated with depression even in the absence on any underlying somatic disorder. This suggests that MDD may amplify both medically explained and unexplained pain symptoms. The interplay between pain symptoms and physical illness is complex. The presence of a somatic disorder does not prove that pain symptoms are due to the disorder, nor does the absence of a diagnosable somatic disorder always exclude a hidden medical causation of pain symptoms. In some cases it is possible that pain or depressive symptoms may subsequently precipitate medical illness. Longitudinal studies partly support the view that somatic disorders and pain can trigger each other, and the pathophysiology of both the emotional and vegetative symptoms as well as the painful physical symptoms may be regulated by specific pathways for serotonin and norepinephrine in the brain and spinal cord [21,29,33].

4.3. General functioning and MDD and Pain

In this study, general functioning, as expressed by mental and physical summary scores, was logically decreased in all participants with single or combined MDD, somatic disorders and pain. This finding supports previous studies reporting a larger clinical burden and poorer functioning in patients with MDD and comorbid disabling pain [1,28]. These results underscore the importance routinely assessing pain symptoms in the clinical evaluation of participants both with or without depression [20].

In specific terms, while pain and MDD had only a small effect on the physical well-being domain, they markedly affected mental well-being. It may therefore be appropriate to place greater emphasis on the mental rather than the physical well-being domain in the context of pain and comorbid MDD.

An interesting finding of this study is that absolute numbers of pain location but not the pain location itself affects general functioning. Increasing numbers of pain locations were related to both poorer physical and mental well-being. If the number of pain locations is regarded as an indicator of the severity of pain, then our results are in keeping with previous research showing that increased pain severity is related to poorer satisfaction [2] and general functioning [18] in clinical samples. There is however, insufficient data in the general population currently available for comparisons.

Physical functioning was affected by the number of pain locations similarly across all single and combined groups of MDD and somatic disorders. These findings indicate that the number of pain locations is a major contributor to decreased physical functioning in both single MDD and MDD with comorbid somatic disorders. Thus, pain may simply be a marker or epiphenomenon of a reduction in physical functioning for persons with physical illness or depression. In contrast, the number of pain locations affected mental-well being mainly in participants with MDD plus comorbid somatic disorders, suggesting that mental well-being is a function of pain in the comorbid medically and mentally affected cases.

5. Limitations

The limitations of our study are discussed as following. The cross-sectional design allows no causal conclusion of the directions of the association between single and combined categories of pain, MDD and somatic disorders. Prospective studies which explore the temporal associations between the development of pain, MDD and somatic disorders are required.

In this study pain was not assessed for duration, chronicity or severity, which warrants a careful interpretation of the results, especially if it is to be compared to data for chronic pain. On the other hand, this implies that our results do not apply to specific subtypes of pain, but perhaps can be generalized more easily to community or clinical samples. Since our data also allowed for the assessment of the number of pain locations, which has not been performed in previous analyses, we generated a measure that was related to reduced general functioning and physical and mental well-being. Although the data fitted the goal of this analysis as we were interested in the role of any pain in MDD and somatic disorders regardless of pain severity, this measure requires replication in similar studies. The results indicate that pain of any type, be it chronic or acute and in any location, is associated with both MDD and somatic disorders in comparable ways and through similar mechanisms. A third limitation was that pain symptoms were assessed through self-report, potentially limiting the reliability and validity of the data. This is a common problem in such large scale studies, especially since more objective measures of pain symptomatology are both difficult to administer and of uncertain validity.

In conclusion, this study showed that the presence of any pain symptoms increased MDD prevalence, independent of associated somatic disorders or specific pain locations. The impact of pain on physical and mental general functioning was affected by the number of pain locations rather than the specific location of pain. In addition, decreased general functioning was associated with any type of pain and not necessarily restricted to chronic pain conditions. Clinical practice should pay attention to pain symptoms of any type as an indicator of depression or somatic disorder rather than focussing on chronic pain only.

Conflict of interest

Authors declare no conflict of interest.

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