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Original article

The societal burden of pain in Germany: Health-related quality-of-life, health status and direct medical costs

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Abstract

Objectives:

The purpose of this paper is to estimate the impact of the severity and frequency of pain on health-related quality-of-life (HRQoL), self-reported health status, and direct medical costs in Germany.

Methods:

Data are from the internet-based 2010 National Health and Wellness Survey (NHWS). Estimates of the impact of pain experience are generated by a series of regression models. In the case of HRQoL the physical and mental summary scores from the SF-12, together with SF-6D utilities, are evaluated within an ordinary least squares framework. Health status is assessed through an ordered logit model. Direct medical costs are estimated through a semi-logarithmic healthcare cost function. Socioeconomic characteristics, health risk behaviors, and the Charlson Comorbidity Index (CCI) are introduced as control variables in all regressions.

Results:

An estimated 23.96% of the adult German population (16.39 million) reported experiencing pain in the last 30 days. Of these 13.16% reported severe pain. The experience of frequent severe and moderate pain has a significant deficit impact on HRQoL. For those experiencing severe daily pain, the deficit in the SF-12 physical component score (PCS) is -17.930 (95% CI: -18.720 to -17.140), the SF-12 mental component score (MCS) is -8.787 (95% CI: -9.857 to -7.716), and SF-6D absolute utilities -0.201 (95% CI: -0.214 to -0.188); with self-reported health status the deficit impact of severe daily pain is also substantial (OR = 29.000; 95% CI: 23.000–36.580). In the case of direct medical costs severe daily pain increases healthcare provider costs by 101.6% and total direct costs by 123.9%.

Limitations:

The NHWS is an internet survey. The principal limitation is that as a self-report there is no separate validation of pain severity or chronicity.

Conclusions:

The experience of pain has a substantial negative impact on HRQoL, health status, and resource utilization in Germany. If pain is considered as a disease in its own right, the experience of chronic pain presents policy-makers with a major challenge.

Introduction

There have been a number of studies which, using nationally representative samples of the German population, have assessed the prevalence and impact of pain as well as considering the determinants of HRQoL. Mielck *et al.*¹ and König *et al.*² reported on the health status of adults in Germany using the EQ-5D

instrument, while Ellert *et al.*³ reported on the results of a national telephone survey to assess the measurement properties of the SF-8 instrument and the principal determinants of health status—to include chronic disease and pain. The impact of pain was also evaluated in an earlier study of the usefulness of the SF-36 instrument⁴. More specifically, Frettlöh *et al.*⁵ assessed the prevalence and correlates of chronic pain in German pain centers, while Friessem *et al.*⁶ provided estimates of the prevalence of chronic pain in primary care. More recently, Müller-Schwefe *et al.*⁷ utilized statutory health insurance fund claim data to assess the impact of back pain on healthcare resource utilization and costs. Predictors of chronic widespread pain and fibromyalgia were considered by Häuser *et al.*⁸, while Beesdo *et al.*⁹, again in a national sample, considered the association of pain with anxiety and depressive disorders. More generally, Wolff *et al.*¹⁰ and Reid *et al.*¹¹ have reported from systematic reviews on the epidemiology of chronic non-cancer pain in Germany.

The purpose of this study is to build upon these earlier assessments, notably those that have utilized generic HRQoL instruments, to evaluate the impact of the severity and frequency of pain experienced on HRQoL, self-reported health status, and healthcare costs in Germany with data from the 2010 NHWS (www.chsinternational.com). The importance of pain, in terms of both its severity and frequency, has been shown to be a major determinant of health-related quality-of-life and healthcare resource utilization in previous studies utilizing the NHWS. A recent study covering five EU countries—the UK, France, Spain, Italy, and Germany—found that pain severity and frequency had the strongest association with HRQoL, traditional provider, visits, and hospitalizations of all variables considered in a comprehensive multivariate modeling framework¹². The NHWS has also supported a separate analysis for Spain to assess the impact of pain severity and frequency on HRQoL, health status, and healthcare resource utilization¹³.

Even with this evidence for the relationship between HRQoL, healthcare resource utilization and pain experience there are still some major gaps in our understanding of the independent impact of pain. Unlike countries such as the US and Australia, there are few estimates in Germany of the national impact of the severity and frequency of pain on health status, HRQoL, and healthcare resource utilization. Estimates of the burden of pain—particularly in the context of health risk factors and comorbidity experience are all the more important given the fact that chronic and recurrent pain is now considered by many to be a disease in its own right and not merely a symptom. Pain is no longer seen as related to an evolving injury but as reflecting pathophysiological changes within the nociceptive system with psychosocial responses that perpetuate the problem¹⁴.

Methods

The focus of the present study is on the quantitative impact of the burden of pain in Germany in terms of its impact on HRQoL, self-reported health status, and healthcare resource utilization. Data are from the 2010 NHWS. This survey is representative of the German population 18 years of age and over. The sample design allows a comparison of those reporting pain with those not reporting pain and hence a quantitative assessment of the burden of pain.

National health and wellness survey

The NHWS is a syndicated, annual, and biannual, internet-based, cross-sectional study of the healthcare attitudes, behaviors, and characteristics of the adult population. It is undertaken in the US, UK, France, Spain, Germany, Italy, urban China, Japan, Brazil, and Russia. Since its inception in 1998, over 1 million survey responses across ~165 conditions have been collected. In addition, several supplementary studies have been conducted in which NHWS respondents were re-contacted and asked further questions. The NHWS has been used to report on the prevalence and correlates of pain experience in Europe as well as its impact on employment status, absenteeism, and presenteeism^{15–18}.

Screening questions

Respondents to the 2010 NHWS who indicated that they had had pain or fibromyalgia in the last 12 months were asked if they had experienced pain in the last month and the condition(s) that had caused pain. If respondents indicated that they had only experienced menstrual pain, migraine, dental pain, or headache in the last month, they were excluded from the pain category. The 2010 NHWS provides details on the health experience of 15,070 respondents in Germany. Of those responding a total of 3498 reported on pain experienced in the last month by severity and frequency. The overall (weighted) prevalence pain reported for the last 30 days in Germany is estimated at 23.96% (16.39 million) (vs unweighted prevalence of 23.12%).

Severity and frequency of pain

Respondents to the NHWS were asked to indicate the severity of pain experienced. Both pain scales and a categorical rating were employed in the survey. For the present analysis the categorical responses of 'mild', 'moderate', or 'severe' are used. This avoids attaching arbitrary cut-offs for a similar categorization to the pain scales—which only refer to current pain and pain experienced in the last week.

Respondents to the NHWS were asked also to report the frequency with which they had problems with pain. Options ranged from daily problems to those experienced once a month or less. For the purposes of this analysis the six categories identified in the NHWS have been collapsed to four: 'daily', '2–4 times a week', '5 or 6 times a week', and 'weekly or less'.

Health-related quality-of-life

Respondents to the 2010 NHWS were asked to complete the SF-12 HRQoL instrument together with a series of questions to identify their use of healthcare resources in the last 6 months: traditional healthcare provider visits, emergency room visits, and hospitalizations. Three dimensions of HRQoL are identified: SF-12 physical and mental summary scores and SF-6D health utilities.

The SF-12 questions are all selected from the SF-36 health survey¹⁹. While it is possible to develop a health profile utilizing the item responses corresponding to these eight concepts, the focus here is on the two summary scores that can be generated from the respective SF-12 item responses. These are (i) the physical component summary (PCS) and (ii) mental component summary (MCS). Details of how the links are established and the scoring algorithms are given in Ware *et al.*¹⁹.

It is worth noting that the SF-12 bodily pain item does not ask respondents to indicate either the severity or the frequency of the pain. Rather, the question asks respondents 'How much did pain interfere with your normal work (including both work outside the home and housework)?', with the response choice (five items) from 'not at all' to 'extremely.'

For the purpose of the present analysis, the PCS and MCS summary scores are utilized as normed scores. This is achieved by transforming the raw scores for the items to a mean of 50 and a standard deviation of 10 for the US population. Normed scores can be calculated for both the eight SF-12 scales as well as for the PCS and MCS summary scores. The appropriateness of using the US as a standard benchmark has been demonstrated for nine European countries (including the five countries in the NHWS)¹⁹.

Items selected from the SF-12 also support the SF-6D scoring algorithm for utilities²⁰. The SF-6D describes 18,000 health states. It comes with a set of preference weights obtained from a sample of the UK general population using the recognized standard gamble valuation technique. The SF-6D index has interval scoring properties and yields summary scores on a 0–1 scale (practically 0.29–1 with a floor effect). The preference weights have recently been revised²¹.

Self-reported health status

The first item of the SF-12 instrument asks respondents to assess their current health status in terms of five categories: excellent, very good, good, fair, poor. This is an important question because it has been used in a large number of population health surveys and analyses over the past 15 years. It has been shown, for example, to be a significant predictor of mortality as well as healthcare expenditures at the respondent level^{22,23}. As well, a major focus has been on the determinants of self-rated health—to include socioeconomic characteristics, health risk behaviors, disease and comorbidity status, and employment.

Healthcare resource utilization and costs

The 2010 NHWS also asks respondents about their use of healthcare resources. Resource utilization is considered in terms of visits or events as they relate to:

- Number of visits in the last 6 months to traditional healthcare providers;
- Emergency room visits in the last 6 months; and
- Number of times hospitalized in the last 6 months.

Traditional healthcare providers include general practitioner/family practitioners, internists, and dentists, as well as more specialized physicians. In the present analysis average cost estimates are applied to each of these events and an estimate of provider visit costs and total direct medical costs generated for each respondent: traditional provider visit €29.34; emergency room visit €157.60; and hospitalization €1022.19²⁴.

Modeling: Choice of independent variables

The choice of independent variables reflects their anticipated impact on HRQoL, self-reported health status, and healthcare resource utilization. All models utilize the same set of independent variables. The variables are considered under the following heads:

- Socio-demographic variables;
- Health risk behaviors; and
- Comorbidity status.

The relationship between age and HRQoL, self-reported health status, and healthcare resource utilization is well established. National population surveys such as the Behavioral Risk Factor Surveillance System (BRFSS) in the US have shown that, on a range of measures, HRQoL and self-reported health status declines with increasing age, while healthcare resource utilization increases. Standardizing for age, therefore, is important in any assessment of the independent impact of pain. The higher reported prevalence of chronic pain among females is well documented, with females at a higher risk of developing several chronic pain disorders^{25,26}. The association of pain and educational level is also well documented.

Blyth *et al.*²⁷ report on pain being significantly associated with lower levels of completed education in Australia, while Callahan and Pincus²⁸ find that poorer clinical status in rheumatoid arthritis is associated with lower levels of educational attainment. The relationship between educational attainment, HRQoL, and healthcare resource utilization is less well established. Educational attainment and its association with income may be expected to result in more risk-adverse behaviors, but the accompanying increased awareness of the value of preventive measures may increase healthcare utilization. HRQoL would be expected to increase with educational attainment and income. Similarly, self-reported health status is also positively associated with higher education, income levels and employment²⁹.

Three health risk behaviors are identified: body mass index (BMI), current smoking, and current alcohol consumption. The NHWS does not allow a more detailed assessment of actual alcohol consumption or number of cigarettes per day and duration of smoking behavior.

The relationship between BMI and HRQoL is well established. A recent paper by Søltoft *et al.*³⁰, utilizing data from the 2003 Health Survey of England, found a significant association between BMI and HRQoL. The study found that, after controlling, among other variables, for gender, age and obesity-related comorbidities, HRQoL was at a maximum with a BMI of 26.0 in men and 24.5 in women. There was a negative association for both underweight and overweight individuals. In the present case, BMI is represented by a series of categorical variables. These capture the standard BMI categories ranging from underweight to morbidly obese. In the regression models, normal weight is the reference category.

The relationship between smoking and HRQoL is more nuanced. Sarna *et al.*³¹, for example, conclude that, among female nurses who have recently smoked, the number of cigarettes per day and the time since quitting were associated with significantly lower PCS and MCS scores from the SF-36. A more recent study based on data from the 2008 BRFSS survey finds that, among adults, only certain HRQoL characteristics are impacted³². These were worse among smokers who unsuccessfully attempted to quit. In contrast, other characteristics were better among former smokers than among those who made no attempt to quit. At best, the expectation here is that smoking is expected to have a negative, but probably small, impact on HRQoL, and a positive impact on resource utilization.

Assessing the impact of alcohol consumption on HRQoL depends on the measures of alcohol consumption used. Evidence to date would suggest a non-linear relationship³³. Moderate drinking is associated with similar or higher HRQoL scores compared to non-drinkers. Substantial HRQoL deficits are associated with higher levels of daily alcohol consumption and binge drinking. The picture is further clouded if former drinkers are

included in the assessment³⁴. Given the NHWS definition of alcohol use, it is difficult to argue for an expected relationship with either HRQoL or resource utilization.

The presence of morbid/co-morbid conditions is captured by the Charlson Comorbidity Index (CCI). The CCI was originally designed as a measure of the risk of 1-year mortality attributable to comorbidity in a longitudinal study of general hospitalized patients³⁵. The CCI contains 19 categories of comorbidity, which are primarily defined using ICD-9-CM diagnoses codes (a few procedure codes are also employed). Each category has an associated weight, taken from the original Charlson paper, which is based on the adjusted risk of 1-year mortality. The overall comorbidity score reflects the cumulative increased likelihood of 1-year mortality; the higher the score, the more severe the burden of comorbidity. In the present analysis it is anticipated that the more co-morbidities reported (the higher the CCI) the greater the deficit impact on HRQoL and the greater the utilization of healthcare resources.

Regression model estimation

In the case of both PCS and MCS, the distribution of scores indicated that an ordinary least squares (OLS) estimator was appropriate. In the case of the SF-6D health utility scores, with the possibility of a ceiling effect, both OLS and Tobit estimators were considered. As there was no discernible difference between the two, the OLS was utilized. For the self-reported health status model an ordered logit estimator was appropriate with results expressed as odds ratios. A semi-logarithmic health cost function is estimated by OLS for traditional provider and total direct medical costs. All models are estimated: (i) for persons reporting severity of pain (Model 1); and (ii) for persons reporting severity and frequency of pain as dependent variables (Model 2). In both cases the no pain respondents are the reference category. All models were estimated using the STATA v.11 statistical package. Regressions are estimated with unweighted data³⁶.

Results

Pain severity and frequency

Combining frequency with severity yields a number of ranked combinations from 'severe pain and daily frequency' to 'mild pain', with no frequency reported or, in the no pain comparison, those reporting no pain. These are detailed in Table 1. As can be seen, the majority of respondents (61.32%) reported having had moderate pain in the last 30 days; only 12.51% reported having had severe pain. As far as pain frequency is concerned, almost half of the respondents (44.16%) reported experiencing pain on a

Table 1. Reported pain severity and frequency of pain, Germany, 2010.

Pain dimension	Unweighted estimates		Weighted estimates	
	Respondents	Distribution (%)	Respondents	Distribution (%)
<i>Pain level</i>				
Mild	974	27.56	4,287,259	26.16
Moderate	2095	59.28	10,048,240	61.32
Severe	465	13.16	2,050,277	12.51
<i>Pain frequency</i>				
Daily	1424	40.29	7,235,234	44.16
4–6 times a week	436	12.34	2,016,621	12.31
2–3 times a week	717	20.29	3,182,122	19.42
Weekly or less	957	27.08	3,951,799	24.12
<i>Pain level and frequency</i>				
Severe daily pain	348	9.85	1,606,507	9.80
Severe and 4–6 times per week	39	1.1	154,565	0.94
Severe and 2–3 times per week	36	1.02	133,397	0.81
Severe and weekly or less	42	1.19	155,808	0.95
Moderate daily pain	910	25.75	4,832,068	29.49
Moderate and 4–6 times a week	306	8.66	1,422,136	8.68
Moderate and 2–3 times per week	448	12.68	2,019,941	12.33
Moderate and weekly or less	431	12.2	1,774,095	10.83
Mild daily pain	166	4.7	796,659	4.86
Mild and 2–6 times per week	324	9.17	1,468,704	8.96
Mild and weekly or less	484	13.7	2,021,896	12.34
Total	3534	100.00	16,385,776	100.00

Note: Estimates are weighted by age and gender

Source: NHWS, 2010.

daily basis; with 9.80% reporting severe daily pain and 29.49% moderate daily pain.

Respondent characteristics

Respondent characteristics for the chronic pain and reference no pain population are given in Table 2. Females were more likely to report pain than males (61.50% vs 38.50%; $p < 0.05$); persons with a lower socioeconomic status were more likely to report pain; and persons reporting pain were more likely to be obese or morbidly obese (Table 2).

Health-related quality-of-life

The distribution of the normed SF-12 PCS and MCS scores are given for the pain and no pain populations for Germany in Table 3. In the case of the PCS average score, there was a substantial difference between the score for the two populations (no pain 49.90 vs pain 40.52; $p < 0.05$). The difference for the MCS score is less marked (no pain 47.91 vs pain 43.35; $p < 0.05$). For persons who reported severe pain the PCS and MCS scores are considerably lower (31.07 and 38.31, respectively; $p < 0.05$).

Estimated SF-6D preference scores or health utilities for the pain and no pain populations are also presented in Table 3. The average utility score for the no pain

population was 0.75. This contrasts to the lower score of 0.64 for the pain population ($p < 0.05$). The difference was even more marked for those experiencing severe pain with a score of 0.54 ($p < 0.05$).

Self-reported health status

The distribution of self-reported health status responses by pain severity and frequency is given in Table 4. These results show: (i) the more severe the pain experienced, the more adverse the distribution of self-reported health status; and (ii) the no pain group reported a more favorable health status profile than those experiencing pain. In the pain group, for example, only 0.68% reported excellent health compared to 7.18% in the no pain group ($p < 0.05$).

Healthcare resource utilization and costs

The distribution of visits reported for the no pain and pain populations are summarized in Table 5. Comparing the pain and no pain populations, the former reported 10.37 provider visits against 5.11 for the latter group. The severe pain population reported 15.97 visits—over 50% higher than the average for all those reporting pain. In the case of emergency room visits, persons with pain reported over twice as many visits as those without pain (0.20 vs 0.09; $p < 0.05$). A similar pattern is found for hospitalizations.

Table 2. Respondent characteristics, Germany, 2010.

Independent variables	No pain distribution (%)	Pain distribution (%)	Pain prevalence (%)
<i>Socio-demographic variables</i>			
Age: 18–39 years	33.88	25.21	18.99
Age: 40–59 years	36.93	42.88	26.78
Age: 60 years and older	29.19	31.90	25.62
Gender: female	48.04	61.50	28.74
Gender: male	51.96	38.50	18.92
Education: University or higher	4.94	29.69	29.69
Education: High school completed	51.10	26.44	26.44
Education: Other	43.97	20.08	20.08
Income: Under €20,000	21.47	27.18	28.50
Income: €20,000–€39,999	40.81	42.69	24.78
Income: €40,000 and above	19.41	15.90	20.51
Income reporting declined	18.30	14.24	19.68
<i>Health risk behaviors</i>			
BMI: Underweight	2.10	1.57	19.07
BMI: Normal weight	35.88	27.60	19.51
BMI: Overweight	38.51	36.57	23.02
BMI: Obese	18.82	27.36	31.41
BMI: Morbidly obese	2.32	4.78	39.42
BMI: reporting declined	2.37	2.11	21.88
Current smoker	25.53	29.45	26.66
Alcohol user	5.64	6.53	26.72
<i>Morbidity/comorbidity status</i>			
Charlson Comorbidity Index (SD)	0.274 (0.712)	0.571 (1.039)	n/a

SD, standard deviation; all estimates weighted by age and gender; n/a, not applicable.

Source: NHWS, 2010.

Table 3. Health-related quality-of-life, persons reporting pain by pain severity and no pain, Germany, 2010.

HRQoL	Persons reporting no pain (SD)	Persons reporting pain (SD)	Persons reporting mild pain (SD)	Persons reporting moderate pain (SD)	Persons reporting severe pain (SD)
SF-12 PCS	49.90 (8.19)	40.52 (10.23)	47.47 (7.45)	39.48 (9.28)	31.07 (10.08)
SF-12 MCS	47.91 (10.16)	43.35 (10.90)	46.26 (9.85)	43.13 (10.88)	38.31 (11.10)
SF-6D utilities	0.75 (0.13)	0.64 (0.12)	0.71 (0.11)	0.63 (0.10)	0.54 (0.10)

Note: estimates weighted by age and gender; SD, standard deviation.

Source: NHWS, 2010.

Table 4. Self-reported health status, persons reporting pain by pain severity and no pain, Germany, 2010.

Self-reported health status	Persons reporting no pain (%)	Persons reporting pain (%)	Persons reporting mild pain (%)	Persons reporting moderate pain (%)	Persons reporting severe pain (%)
Excellent	7.18	0.68	1.17	0.49	0.57
Very good	31.96	11.21	23.91	7.35	3.57
Good	47.26	44.56	56.96	44.02	21.22
Fair	12.09	36.34	16.51	43.52	42.63
Poor	1.50	7.21	1.45	4.61	32.01

Note: Estimates weighted by age and gender.

Source: NHWS, 2010.

Persons with pain reported an average of 0.21 hospitalizations compared to 0.09 for those without pain ($p < 0.05$).

The experience of pain adds substantially to direct medical costs (Table 5). Overall, persons in the no pain group

were estimated to have incurred €258.956 in direct medical costs. This is in contrast to €551.55 for those in the pain group ($p < 0.05$) and €1029.75 for those who reported severe pain.

Table 5. Healthcare resource utilization and direct medical costs, persons reporting pain by pain severity and no pain, Germany, 2010.

Healthcare resource utilization	Persons reporting no pain	Persons reporting pain	Persons reporting mild pain	Persons reporting moderate pain	Persons reporting severe pain
Traditional provider visits (SD)	5.11 (6.69)	10.37 (10.74)	6.52 (7.03)	10.88 (10.99)	15.97 (12.73)
Emergency room visits (SD)	0.09 (0.48)	0.20 (0.72)	0.12 (0.49)	0.19 (0.63)	0.43 (1.30)
Hospitalizations (SD)	0.09 (0.57)	0.21 (0.73)	0.10 (0.42)	0.20 (0.58)	0.48 (1.47)
<i>Direct medical mean costs (SD) (€)</i>					
Traditional provider visits	149.84 (196.31)	304.36 (315.02)	191.14 (206.37)	319.16 (322.47)	468.56 (373.55)
Emergency room visits	14.65 (75.71)	31.82 (113.71)	18.18 (76.45)	30.19 (98.54)	68.37 (204.43)
Hospitalizations	94.46 (579.30)	215.36 (747.14)	101.70 (432.76)	207.24 (591.56)	492.82 (1500.10)
Total costs	258.96 (687.43)	551.55 (948.24)	311.03 (560.96)	556.59 (789.49)	1029.75 (1767.38)
<i>Direct medical median costs (25–75th quartile range) (€)</i>					
Traditional provider visits	88.02 (29.34–176.04)	205.38 (117.36–410.76)	117.36 (58.68–234.72)	234.72 (117.36–410.76)	381.42 (205.38–616.14)
Median direct cost	88.02 (29.34–205.38)	234.72 (117.36–557.46)	146.70 (58.68–293.40)	264.06 (117.36–568.36)	498.78 (234.72–1355.83)

Note: Estimates weighted by age and gender; SD, standard deviation; costs are estimated for those reporting costs only for that category; all costs are in Euros. Source: NHWS, 2010.

Regression results: Health-related quality-of-life

Pain severity and frequency are the most important variables in all three HRQoL models (Table 6). In all models there is a well-defined gradient: the more severe and frequent pain experienced the greater the deficit impact on HRQoL. The deficit associated with severe pain in the PCS Model 1 is -15.510 (95% CI: -16.200 to -14.810), which increases to -17.930 (95% CI: -18.720 to -17.140) in Model 2 for severe daily pain. The deficit for moderate pain falls to -7.879 (95% CI: -8.232 to -7.527) and for moderate daily pain -10.690 (95% CI: -11.200 to -10.190). The deficits associated with mild pain and mild daily pain are also statistically significant. With the exception of age greater than 60 years and persons reporting being obese or morbidly obese, the contribution of pain to a PCS deficit is greater (often substantially greater) than the other independent variables identified in the analysis. Even so, this should not be taken as necessarily implying that the deficit is greater than for other chronic disease states not separately identified.

The deficits associated with pain severity and frequency are substantially lower, yet still significant, in the case of MCS (Table 7). Again, there is a well-defined pain gradient. The deficit associated with severe pain (Model 1) is -8.231 (95% CI: -9.1563 to -7.299) and -8.787 (95% CI: -9.857 to -7.716) with severe daily pain. This deficit falls to -4.143 (95% CI: -4.614 to -3.671) for moderate pain and -4.551 (95% CI: -5.233 to -3.868) for moderate daily pain. Again, with the exception of age greater than 60 years and persons reporting being obese or morbidly obese, the contribution of pain to a MCS deficit is

greater (often substantially greater) than the other independent variables identified here.

Given the importance attached to absolute utility scores in the population health literature it is worth emphasizing the sheer magnitude of the utility deficits associated with severe pain (-0.180 ; 95% CI: -0.192 to -0.169) and severe daily pain (-0.201 ; 95% CI: -0.214 to -0.188) (Table 8). Given the utility estimated for the pain population (0.663), these are substantial reductions in HRQoL. Again there is evidence for a gradient in utility deficits with a figure of -0.100 (95% CI: -0.105 to -0.094) for moderate pain and -0.158 (95% CI: 0.196 to -0.120) for moderate daily pain. For the more severe and more frequent pain categories the utility deficits are more substantial than for any other variables in the two models.

Regression results: Self-reported health status

The impact of pain severity and frequency for self-reported health status mirrors that for the HRQoL results (Table 9). Given the ranking of health status, an odds ratio > 1 indicates a reduction in health status. The results for both Model 1 and Model 2 clearly support the previous findings of a gradient in pain deficits. The more severe and frequent the pain experience, the more adverse is the impact on health status ranking. Severe pain enters with an odds ratio of 17.260 (95% CI: 14.160–21.040) and moderate pain with 4.135 (95% CI: 3.763–4.543). Severe daily pain is associated with an odds ratio of 29.000 (95% CI: 23.000–36.580), while moderate daily pain has an odds ratio of 5.964 (95% CI: 5.207–6.830). Odds ratios for the pain categories are uniformly significant at the 5% level

Table 6. Regression results: SF-12 Physical component score, Germany, 2010.

	Model 1: Pain severity		Model 2: Pain severity and frequency	
	Coefficient	95% CI	Coefficient	95% CI
<i>Independent variables</i>				
Pain level reported in last month ^A				
Mild	−2.258	−2.743 to −1.774		
Moderate	−7.879	−8.232 to −7.527		
Severe	−15.510	−16.200 to −14.810		
Pain level and frequency ^A				
Severe daily pain			−17.930	−18.720 to −17.140
Severe pain 4–6 times a week			−12.450	−14.740 to −10.160
Severe pain 2–3 times a week			−7.796	−10.180 to −5.410
Severe pain weekly or less			−6.178	−8.386 to −3.971
Moderate daily pain			−10.690	−11.200 to −10.190
Moderate pain 4–6 times a week			−8.257	−9.088 to −7.425
Moderate pain 2–3 times a week			−6.570	−7.260 to −5.879
Moderate pain weekly or less			−3.432	−4.134 to −2.729
Mild daily pain			−4.004	−5.122 to −2.886
Mild pain 2–6 times a week			−3.347	−4.152 to −2.543
Mild pain weekly or less			−0.931	−1.594 to −0.267
<i>Socio-demographic variables</i>				
Age: 40–59 years ¹	−2.892	−3.172 to −2.612	−2.625	−2.902 to −2.348
Age: 60 years and older ¹	−5.143	−5.489 to −4.796	−4.738	−5.082 to −4.395
Gender: male ²	0.898	0.648 to 1.148	0.835	0.589 to 1.082
Education: High school completed ³	0.451	−0.101 to 1.002	0.467	−0.076 to 1.010
Education: University or higher ³	1.781	1.216 to 2.346	1.758	1.202 to 2.315
Income: €20,000–€39,999 ⁴	0.853	0.538 to 1.169	0.752	0.441 to 1.063
Income: €40,000 and above ⁴	1.604	1.224 to 1.985	1.444	1.069 to 1.818
Income reporting declined ⁴	1.261	0.875 to 1.646	1.137	0.756 to 1.517
<i>Health risk behaviors</i>				
BMI: Underweight ⁵	−1.084	−1.895 to −0.274	−1.096	−1.895 to −0.298
BMI: Overweight ⁵	−0.612	−0.901 to −0.324	−0.540	−0.824 to −0.255
BMI: Obese ⁵	−2.892	−3.233 to −2.552	−2.814	−3.149 to −2.478
BMI: Morbidly obese ⁵	−6.022	−6.735 to −5.308	−5.899	−6.602 to −5.196
BMI: Declined to answer ⁵	−3.588	−4.367 to −2.810	−3.468	−4.235 to −2.702
Current smoker ⁶	−0.049	−0.321 to 0.224	−0.075	−0.343 to 0.193
Alcohol user ⁷	−0.619	−1.149 to −0.089	−0.575	−1.097 to −0.053
<i>Morbidity/comorbidity status</i>				
Charlson Comorbidity Index	−2.345	−2.499 to −2.191	−2.266	−2.418 to −2.114
Constant	51.810	51.210 to 52.420	51.690	51.100 to 52.290
n	15,070		15,070	
Adj R ²	0.374		0.393	

Reference categories: ^A no pain reported in last month; ¹ age 18–39 years; ² females; ³ not completed high school; ⁴ income under €20,000; ⁵ BMI normal weight; ⁶ non-smoker; ⁷ non-drinker.

and > 1. The pain odds ratios are greater (in absolute value) than those for the majority of the socio-demographic, health risk behavior and comorbidity variables which were expected to impact self-reported health status.

Regression results: Direct medical costs

In the case of traditional provider costs (Table 10), severe pain increases these costs compared to the reference group by 93.5% (0.935; 95% CI: 0.855–1.016) (Model 1). The corresponding figure for severe daily pain in Model 2 is an increase of 101.6% (1.016; 95% CI: 0.924–1.108). The impact for those who reported moderate pain is substantially less at 51.7% (0.517; 95% CI: 0.475–0.558) (Model 1).

The impact of severe pain on total direct medical costs—traditional provider visits plus emergency room visits and hospitalizations—is somewhat greater (Table 11). The cost difference for severe pain in Model 1 compared to the reference group 117.7% (1.177; 95% CI: 1.076–1.279). Severe daily pain in Model 2 is associated with a cost difference of 123.9% (1.239; 95% CI: 1.124–1.355).

Discussion

Estimates of the prevalence of pain at the national level for Germany vary widely. Häuser *et al.*⁸ estimated the prevalence of chronic widespread pain at 8.6% and fibromyalgia

Table 7. Regression results: SF-12 Mental component score, Germany, 2010.

	Model 1: Pain severity		Model 2: Pain severity and frequency	
	Coefficient	95% CI	Coefficient	95% CI
<i>Independent variables</i>				
Pain level reported in last month ^A				
Mild	−1.232	−1.880 to −0.585		
Moderate	−4.143	−4.614 to −3.671		
Severe	−8.231	−9.163 to −7.299		
Pain level and frequency ^A				
Severe daily pain			−8.787	−9.857 to −7.716
Severe pain 4–6 times a week			−9.068	−12.180 to −5.960
Severe pain 2–3 times a week			−6.885	−10.120 to −3.648
Severe pain weekly or less			−4.399	−7.393 to −1.404
Moderate daily pain			−4.551	−5.233 to −3.868
Moderate pain 4–6 times a week			−5.088	−6.216 to −3.960
Moderate pain 2–3 times a week			−4.554	−5.490 to −3.617
Moderate pain weekly or less			−2.302	−3.255 to −1.349
Mild daily pain			0.163	−1.353 to 1.679
Mild pain 2–6 times a week			−2.740	−3.832 to −1.649
Mild pain weekly or less			−0.703	−1.603 to 0.197
<i>Socio-demographic variables</i>				
Age: 40–59 years ¹	2.262	1.888 to 2.637	2.333	1.957 to 2.708
Age: 60 years and older ¹	5.825	5.362 to 6.288	5.908	5.442 to 6.374
Gender: male ²	1.431	1.097 to 1.765	1.413	1.079 to 1.747
Education: High school completed ³	2.348	1.611 to 3.086	2.337	1.600 to 3.074
Education: University or higher ³	2.703	1.948 to 3.459	2.676	1.921 to 3.431
Income: €20,000–€39,999 ⁴	1.596	1.175 to 2.018	1.582	1.160 to 2.004
Income: €40,000 and above ⁴	2.809	2.301 to 3.317	2.753	2.245 to 3.261
Income reporting declined ⁴	2.887	2.371 to 3.403	2.848	2.332 to 3.364
<i>Health risk behaviors</i>				
BMI: Underweight ⁵	−3.185	−4.269 to −2.101	−3.148	−4.231 to −2.065
BMI: Overweight ⁵	0.163	−0.223 to 0.549	0.188	−0.197 to 0.574
BMI: Obese ⁵	−0.529	−0.984 to −0.074	−0.499	−0.954 to −0.045
BMI: Morbidly obese ⁵	−0.751	−1.705 to 0.203	−0.722	−1.675 to 0.232
BMI: Declined to answer ⁵	−0.295	−1.336 to 0.746	−0.240	−1.280 to 0.801
Current smoker ⁶	−0.358	−0.721 to 0.006	−0.366	−0.730 to −0.003
Alcohol user ⁷	−1.024	−1.732 to −0.315	−1.011	−1.719 to −0.303
<i>Morbidity/comorbidity status</i>				
Charlson Comorbidity Index	−1.416	−1.622 to −1.210	−1.394	−1.600 to −1.188
Constant	41.240	40.430 to 42.040	41.220	40.410 to 42.030
n	15,070		15,070	
Adj R ²	0.121		0.123	

Reference categories: ^A no pain reported in last month; ¹ age 18–39 years; ² females; ³ not completed high school; ⁴ income under €20,000; ⁵ BMI normal weight; ⁶ non-smoker; ⁷ non-drinker.

at 3.8%; more recently, estimates based on systematic reviews yielded a national prevalence estimate of chronic pain of 17%¹⁰ and an estimate of 19% for the 1-month prevalence of moderate-to-severe non-cancer pain by Reid *et al.*¹¹. In the present study the weighted prevalence of chronic pain experienced in the last 30 days was estimated to be 23.96%. These estimates of the prevalence of chronic pain in Germany are somewhat higher than previous estimates based on systematic reviews, although once the category mild is excluded from the present estimate, it is not inconsistent with the estimate of Reid *et al.*^{10,11}.

What is important in the present study, however, is that the pain prevalence profile is drawn from a national population health survey—a survey which yields consistent

estimates across five countries and which can track existing prevalence profiles annually.

At the same time, it should be noted that existing pain prevalence studies, both for Germany and the wider pan-European environment, typically lack a no-pain control group (e.g., Breivik *et al.*³⁷) and often fail to extend the assessment to a rigorous quantitative assessment of the contribution of pain. To this extent, studies based on the NHWS have the potential to provide a unique insight into the burden of pain in the community and its quantitative impact vis à vis other disease states.

What is probably more important than an overall estimate of the prevalence of pain in Germany is the severity and frequency of the experience of pain. This has not been

Table 8. Regression results: SF-6D utilities, Germany, 2010.

	Model 1: Pain severity		Model 2: Pain severity and frequency	
	Coefficient	95% CI	Coefficient	95% CI
<i>Independent variables</i>				
Pain level reported in last month ^A				
Mild	−0.035	−0.042 to −0.027		
Moderate	−0.100	−0.105 to −0.094		
Severe	−0.180	−0.192 to −0.169		
Pain level and frequency ^A				
Severe daily pain			−0.201	−0.214 to −0.188
Severe pain 4–6 times a week			−0.158	−0.196 to −0.120
Severe pain 2–3 times a week			−0.118	−0.157 to −0.078
Severe pain weekly or less			−0.097	−0.133 to −0.060
Moderate daily pain			−0.122	−0.130 to −0.114
Moderate pain 4–6 times a week			−0.107	−0.121 to −0.094
Moderate pain 2–3 times a week			−0.095	−0.106 to −0.083
Moderate pain weekly or less			−0.056	−0.067 to −0.044
Mild daily pain			−0.030	−0.048 to −0.012
Mild pain 2–6 times a week			−0.056	−0.070 to −0.043
Mild pain weekly or less			−0.022	−0.033 to −0.011
<i>Socio-demographic variables</i>				
Age: 40–59 years ¹	0.006	0.001 to 0.010	0.008	0.003 to 0.013
Age: 60 years and older ¹	0.021	0.015 to 0.027	0.024	0.019 to 0.030
Gender: male ²	0.023	0.019 to 0.027	0.022	0.018 to 0.026
Education: High school completed ³	0.018	0.009 to 0.027	0.018	0.009 to 0.027
Education: University or higher ³	0.026	0.017 to 0.035	0.026	0.017 to 0.035
Income: €20,000–€39,999 ⁴	0.019	0.014 to 0.024	0.018	0.013 to 0.023
Income: €40,000 and above ⁴	0.038	0.032 to 0.044	0.036	0.030 to 0.042
Income reporting declined ⁴	0.037	0.030 to 0.043	0.035	0.029 to 0.042
<i>Health risk behaviors</i>				
BMI: Underweight ⁵	−0.039	−0.052 to −0.026	−0.039	−0.052 to −0.026
BMI: Overweight ⁵	0.000	−0.004 to 0.005	0.001	−0.004 to 0.006
BMI: Obese ⁵	−0.018	−0.024 to −0.013	−0.018	−0.023 to −0.012
BMI: Morbidly obese ⁵	−0.039	−0.050 to −0.027	−0.038	−0.049 to −0.026
BMI: Declined to answer ⁵	−0.018	−0.031 to −0.006	−0.017	−0.030 to −0.005
Current smoker ⁶	−0.002	−0.007 to 0.002	−0.003	−0.007 to 0.002
Alcohol user ⁷	−0.014	−0.023 to −0.006	−0.014	−0.023 to −0.006
Morbidity/comorbidity status				
Charlson Comorbidity Index	−0.026	−0.028 to −0.023	−0.025	−0.028 to −0.023
Constant	0.704	0.695 to 0.714	0.704	0.694 to 0.713
n	15,070		15,070	
Adj R ²	0.205		0.212	

Reference categories: ^A no pain reported in last month; ¹ age 18–39 years; ² females; ³ not completed high school; ⁴ income under €20,000; ⁵ BMI normal weight; ⁶ non-smoker; ⁷ non-drinker.

explored before. Among those who reported pain in the last 30 days, 13.16% reported severe pain and 9.85% reported severe pain on a daily basis. Overall, 40.29% of respondents reported daily pain. This represents a substantial burden on the German health system and the German economy. While the present study has not explored the implications of pain severity and frequency for labor force experience, absenteeism, and presenteeism, analyses utilizing the 2010 NHWS for the five countries covered together and for Spain individually point to there being a substantial deficit impact for these aspects of employment experience^{17,18}.

The claim that the experience of pain, notably chronic severe pain, has a negative impact on HRQoL is a

recurring one in the pain literature. Even so, it is perhaps surprising that the pain experience variables dominate the models presented here. This is perhaps an even more substantive finding given the exclusion of acute pain categories from the pain population defined in the present analysis. It is worth noting that the results presented here for the 2010 NHWS replicate in large part the results reported at a more aggregative level for the five countries using the 2008 NHWS; in terms of both the prevalence of pain reported by severity and frequency and in terms of the dominant role played by pain variables as determinants of HRQoL, health status, and healthcare resource utilization. Again, this is the first time a comprehensive assessment of the association of pain severity and frequency with

Table 9. Regression results: Self-reported health status, Germany, 2010.

	Model 1: Pain severity		Model 2: Pain severity and frequency	
	Odds ratio	95% CI	Odds ratio	95% CI
<i>Independent variables</i>				
Pain level reported in last month ^A				
Mild	1.672	1.478 to 1.891		
Moderate	4.135	3.763 to 4.543		
Severe	17.260	14.160 to 21.040		
Pain level and frequency ^A				
Severe daily pain			29.000	23.000 to 36.580
Severe pain 4–6 times a week			10.820	5.815 to 20.130
Severe pain 2–3 times a week			4.481	2.393 to 8.391
Severe pain weekly or less			2.904	1.602 to 5.265
Moderate daily pain			5.964	5.207 to 6.830
Moderate pain 4–6 times a week			5.206	4.186 to 6.473
Moderate pain 2–3 times a week			3.948	3.296 to 4.729
Moderate pain weekly or less			1.981	1.650 to 2.378
Mild daily pain			2.381	1.788 to 3.171
Mild pain 2–6 times a week			2.434	1.973 to 3.003
Mild pain weekly or less			1.168	0.986 to 1.384
<i>Socio-demographic variables</i>				
Age: 40–59 years ¹	2.074	1.927 to 2.232	1.994	1.853 to 2.147
Age: 60 years and older ¹	2.869	2.619 to 3.143	2.710	2.472 to 2.970
Gender: male ²	0.805	0.754 to 0.859	0.814	0.763 to 0.868
Education: High school completed ³	0.863	0.745 to 1.001	0.859	0.741 to 0.996
Education: University or higher ³	0.671	0.577 to 0.781	0.672	0.577 to 0.781
Income: €20,000–€39,999 ⁴	0.773	0.712 to 0.840	0.781	0.719 to 0.848
Income: €40,000 and above ⁴	0.610	0.553 to 0.673	0.624	0.565 to 0.689
Income reporting declined ⁴	0.657	0.594 to 0.726	0.667	0.603 to 0.737
<i>Health risk behaviors</i>				
BMI: Underweight ⁵	1.508	1.221 to 1.864	1.506	1.218 to 1.862
BMI: Overweight ⁵	1.270	1.179 to 1.368	1.251	1.162 to 1.348
BMI: Obese ⁵	2.310	2.113 to 2.526	2.291	2.095 to 2.505
BMI: Morbidly obese ⁵	3.585	2.972 to 4.325	3.564	2.952 to 4.304
BMI: Declined to answer ⁵	2.161	1.759 to 2.655	2.130	1.733 to 2.617
Current smoker ⁶	1.107	1.031 to 1.187	1.109	1.034 to 1.190
Alcohol user ⁷	1.270	1.106 to 1.458	1.260	1.096 to 1.447
<i>Morbidity/comorbidity status</i>				
Charlson Comorbidity Index	1.773	1.695 to 1.854	1.763	1.685 to 1.844
<i>n</i>	15,070		15,070	
Log pseudo likelihood	−16,814.0		−16,710.0	
Pseudo <i>R</i> ²	0.128		0.133	

Reference categories: ^A no pain reported in last month; ¹ age 18–39 years; ² females; ³ not completed high school; ⁴ income under £20,000; ⁵ BMI normal weight; ⁶ BMI normal weight; ⁷ non-smoker; ⁸ non-drinker.

HRQoL utilizing the SF-12 and SF-6D, together with the deficit association with health status, has been undertaken for Germany. The regression results point to a substantial deficit effect with SF-6D utilities for severe daily pain estimated at −0.201 (95% CI: −0.201 to −0.188). This is not only clinically significant, but is substantially greater than deficits typically found for the SF-6D in other major disease states³⁸.

The contribution made by the 2010 NHWS is that it is a national population survey that captures a range of HRQoL measures but also healthcare resource utilization. Although not reported on here, the NHWS also captures employment status, absenteeism, and presenteeism as other dimensions of the burden of pain. That the findings

reported in this paper replicate those for the assessment of the association of pain with HRQoL deficits and healthcare resource utilization should come as no surprise as the EU analysis is based upon pain estimates from the 2008 NHWS. Even so, the similarity in the findings as to the dominant role of pain in HRQoL deficits and healthcare resource utilization gives added credibility to the present results.

A key finding from the present analysis is the dominant impact of pain severity and frequency. The contribution of pain to HRQoL deficits and lower self-reported health status far outweighs the contribution of socio-demographic, health risk factors, and the presence of high risk health states. In all of the models estimated, pain variables,

Table 10. Regression results: Traditional provider costs, Germany, 2010.

	Model 1: Pain severity		Model 2: Pain severity and frequency	
	Coefficient	95% CI	Coefficient	95% CI
<i>Independent variables</i>				
Pain level reported in last month ^A				
Mild	0.201	0.143 to 0.259		
Moderate	0.517	0.475 to 0.558		
Severe	0.935	0.855 to 1.016		
Pain level and frequency ^A				
Severe daily pain			1.016	0.924 to 1.108
Severe pain 4–6 times a week			0.975	0.707 to 1.243
Severe pain 2–3 times a week			0.615	0.336 to 0.894
Severe pain weekly or less			0.583	0.329 to 0.838
Moderate daily pain			0.637	0.577 to 0.696
Moderate pain 4–6 times a week			0.602	0.504 to 0.700
Moderate pain 2–3 times a week			0.522	0.441 to 0.604
Moderate pain weekly or less			0.210	0.126 to 0.294
Mild daily pain			0.213	0.081 to 0.344
Mild pain 2–6 times a week			0.423	0.325 to 0.520
Mild pain weekly or less			0.051	–0.029 to 0.131
<i>Socio-demographic variables</i>				
Age: 40–59 years ¹	0.141	0.106 to 0.175	0.124	0.090 to 0.159
Age: 60 years and older ¹	0.289	0.247 to 0.331	0.266	0.224 to 0.308
Gender: male ²	–0.182	–0.213 to –0.152	–0.177	–0.208 to –0.146
Education: High school completed ³	–0.084	–0.154 to –0.014	–0.084	–0.154 to –0.015
Education: University or higher ³	–0.110	–0.181 to –0.038	–0.107	–0.178 to –0.036
Income: €20,000–€39,999 ⁴	–0.092	–0.131 to –0.053	–0.087	–0.125 to –0.048
Income: €40,000 and above ⁴	–0.093	–0.139 to –0.046	–0.081	–0.128 to –0.035
Income reporting declined	–0.154	–0.201 to –0.106	–0.144	–0.192 to –0.097
<i>Health risk behaviors</i>				
BMI: Underweight ⁵	0.056	–0.044 to 0.156	0.054	–0.046 to 0.154
BMI: Overweight ⁵	0.066	0.030 to 0.101	0.061	0.025 to 0.096
BMI: Obese ⁵	0.161	0.119 to 0.202	0.155	0.114 to 0.196
BMI: Morbidly obese ⁵	0.266	0.182 to 0.351	0.262	0.178 to 0.346
BMI: Declined to answer ⁵	–0.036	–0.134 to 0.064	–0.041	–0.139 to 0.058
Current smoker ⁶	–0.056	–0.089 to –0.022	–0.054	–0.087 to –0.020
Alcohol user ⁷	–0.020	–0.085 to 0.045	–0.022	–0.087 to 0.042
<i>Morbidity/comorbidity status</i>				
Charlson Comorbidity Index	0.208	0.190 to 0.226	0.204	0.186 to 0.222
Constant	4.789	4.713 to 4.866	4.795	4.719 to 4.871
n	13,118		13,118	
Adj R ²	0.174		0.181	

Reference categories: ^A no pain reported in last month; ¹ age 18–39 years; ² females; ³ not completed high school; ⁴ income under €20,000; ⁵ BMI normal weight; ⁶ non-smoker; ⁷ non-drinker.

notably those for severe and frequent pain, are consistently those with the greatest deficit impact on HRQoL. In the case of self-reported health status, the modeled results demonstrate that the experience of pain is the most strongly associated characteristic reported. This has not been evaluated before in the population health literature in terms of pain severity and frequency. It is noteworthy that the association of severe and frequent pain on health status is greater than that attributable to health risk behaviors. One implication here is that a focus on pain management may yield greater benefits than programs that are focused on modifying such behaviors. Even so, as the analysis has not been extended to include specific chronic disease states, the results should not be interpreted as

assuming that pain is necessarily dominant and may best be considered as a correlate of such chronic diseases.

The pain experience variables also have the strongest association with direct medical costs. The experience of severe pain more than doubled total direct medical costs in the past 6 months; the impact of severe daily pain is even larger. Again, this is perhaps not a surprising result; but it is the sheer magnitude of the effect which stands out. There is a greater incidence of traditional healthcare provider visits, emergency room visits, and hospitalizations compared to more traditional factors such as age, economic status, and health risk behaviors. This once again gives support to the potential role of pain management programs in a more efficient allocation of healthcare resources.

Table 11. Regression results: Total healthcare costs, Germany, 2010.

	Model 1: Pain severity		Model 2: Pain severity and frequency	
	Coefficient	95% CI	Coefficient	95% CI
<i>Independent variables</i>				
Pain level reported in last month ^A				
Mild	0.216	0.143 to 0.289		
Moderate	0.589	0.537 to 0.641		
Severe	1.177	1.076 to 1.279		
Pain level and frequency ^A				
Severe daily pain			1.239	1.124 to 1.355
Severe pain 4–6 times a week			1.160	0.824 to 1.497
Severe pain 2–3 times a week			1.193	0.843 to 1.544
Severe pain weekly or less			0.790	0.470 to 1.110
Moderate daily pain			0.743	0.669 to 0.818
Moderate pain 4–6 times a week			0.632	0.509 to 0.756
Moderate pain 2–3 times a week			0.614	0.511 to 0.716
Moderate pain weekly or less			0.230	0.125 to 0.336
Mild daily pain			0.197	0.032 to 0.363
Mild pain 2–6 times a week			0.489	0.366 to 0.612
Mild pain weekly or less			0.054	–0.046 to 0.155
<i>Socio-demographic variables</i>				
Age: 40–59 years ¹	0.077	0.033 to 0.120	0.064	0.020 to 0.107
Age: 60 years and older ¹	0.233	0.181 to 0.286	0.212	0.159 to 0.265
Gender: male ²	–0.149	–0.188 to –0.111	–0.146	–0.184 to –0.107
Education: High school completed ³	–0.160	–0.247 to –0.072	–0.143	–0.231 to –0.056
Education: University or higher ³	–0.219	–0.309 to –0.130	–0.199	–0.288 to –0.109
Income: €20,000–€39,999 ⁴	–0.133	–0.181 to –0.084	–0.129	–0.177 to –0.080
Income: €40,000 and above ⁴	–0.121	–0.179 to –0.062	–0.113	–0.171 to –0.054
Income reporting declined	–0.233	–0.293 to –0.173	–0.226	–0.286 to –0.166
<i>Health risk behaviors</i>				
BMI: Underweight ⁵	0.099	–0.027 to 0.225	0.100	–0.025 to 0.225
BMI: Overweight ⁵	0.088	0.043 to 0.132	0.085	0.040 to 0.129
BMI: Obese ⁵	0.157	0.105 to 0.209	0.154	0.102 to 0.205
BMI: Morbidly obese ⁵	0.283	0.177 to 0.389	0.283	0.177 to 0.388
BMI: Declined to answer ⁵	–0.035	–0.159 to 0.089	–0.059	–0.183 to 0.065
Current smoker ⁶	–0.086	–0.128 to –0.044	–0.080	–0.122 to –0.038
Alcohol user ⁷	0.025	–0.056 to 0.106	0.024	–0.057 to 0.105
<i>Morbidity/comorbidity status</i>				
Charlson Comorbidity Index	0.280	0.257 to 0.302	0.276	0.253 to 0.298
Constant	5.080	4.985 to 5.176	5.063	4.967 to 5.158
<i>n</i>	13,156		13,118	
Adj <i>R</i> ²	0.158		0.166	

Reference categories: ^A no pain reported in last month; ¹ age 18–39 years; ² females; ³ not completed high school; ⁴ income under €20,000; ⁵ BMI normal weight; ⁶ non-smoker; ⁷ non-drinker.

From a policy perspective, it would seem to be essential to consider pain as a disease in its own right. Global and national burden of disease studies, for example, that fail to recognize the prevalence of pain in the community and fail to include pain as a disease category, may be excluding a key element of the measurable burden of disease in generating estimates, for example, of disability adjusted life years. The fact that pain is often associated with other chronic disease states also raises the question of the importance of a multidisciplinary approach to the management of pain to include, for example, depression, insomnia, and anxiety disorders as well as chronic diseases with severe physical dimensions such as arthritis and diabetes.

Limitations of the analysis

There are a number of limitations to the present study. First, the NHWS is an internet-based survey and may not be representative of the German population—particularly if there are potential biases in the extent to which internet access is available. Even so, almost 80% of the German population has internet access (<http://www.internetworldstats.com/eu/de.htm>). Second, respondents are asked to report their experience of pain. There is no separate clinical confirmation of the presence of pain and reported conditions and attributes that may be associated with pain experience. Nor is there a separate confirmation of pain chronicity. This is outside the scope of the study

but could be addressed through the application of pain chronicity algorithms. Third, the study is focused on the experience of pain. Apart from excluding a number of obvious acute pain categories, there is no attempt to apply an arbitrary distinction between acute and chronic pain or between, for example, primarily neuropathic and primarily nociceptive pain. Nor is it possible to assess pain chronicity. Finally, the analysis does not attempt to capture specific chronic disease states which may be associated with pain or states which may have a significant deficit impact on outcomes such as HRQoL.

Conclusions

The experience of pain, in particular severe daily pain, has a substantial negative impact on HRQoL, self-reported health status, and healthcare resource utilization in Germany. This supports previous assessments utilizing the NHWS. As a measure of health status, the experience of pain clearly has an impact that outstrips other potential determinants of HRQoL, health status, and resource utilization outcomes—notably the presence of comorbidities and BMI. Whether or not pain is considered as a disease in its own right, the experience of chronic pain, as defined here, presents policy-makers with a major challenge. Pain not only represents a major health problem but also a challenge in microeconomic policy. If pain is considered a disease in its own right then this needs to be factored into community estimates of disability as a measure of disease burden. Programs to relieve the burden of pain in the community clearly have the potential for substantial benefits whether expressed in HRQoL or health status terms, or as initiatives with a resource sparing objective. At the same time, it is important to emphasize the importance of multi-disciplinary programs in treating pain both as a disease in its own right and as a significant and often overlooked comorbidity in chronic disease.

Transparency

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Declaration of financial/other interests

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