Received: 9 September 2022 | Revised: 24 February 2023 | Accepted: 27 February 2023

DOI: 10.1002/bdm.2323

RESEARCH ARTICLE

WILEY

Relating the visceral factor of pain to domain-specific risk attitudes

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Funding information
The KORA study was initiated and financed by the Helmholtz Zentrum München-German Research Center for Environmental Health, which is funded by the German Federal Ministry of Education and Research (BMBF) and by the State of Bavaria. Furthermore, KORA research was supported within the Munich Center of Health Sciences (MC-Health), Ludwig-Maximilians-Universität, as part of LMUinnovativ. The funders had no role in study design, data collection, data analysis, preparation of the manuscript, or decision to publish.

Abstract

Visceral factors are negative emotions and drive and feeling states that grab people's attention and motivate them to engage in certain behaviors. They can contribute to discrepancies between an individual's long-term self-interest and their actual behavior. One such discrepancy concerns risk-taking in health contexts as well as in a variety of other domains such as financial or career-related decisions. This study examines the relationship between somatic symptoms of pain and domain-specific risk attitudes in participants of a large population-based cohort study. Somatic symptoms refer to back pain; pain in arms, legs, or joints; and headache. We show that the association between pain and risk attitudes is especially robust for the financial and leisure/sports domain across different model specifications. Pain is negatively associated with willingness to take risks in both domains. When controlling for fatigue (another visceral factor), the relationship between pain and risk attitudes persists only in the financial context. However, associations between fatigue and risk attitudes emerge in the general, health, leisure/sports, and career domains. We discuss potential implications of our findings especially in light of financial decision-making.

KEYWORDS
domain-specific willingness to take risks, pain, risk attitudes, visceral factors

1 | INTRODUCTION

People are often required to make decisions while in a variety of emotional, cognitive, or physical states—such as pain. Many adults experience pain on a regular basis with a significant number of individuals suffering from chronic pain (e.g., Breivik et al., 2006; Nahin, 2015; Vowles et al., 2014). This highly prevalent condition may affect everyday decision-making and especially decision-making under risk (Koppel et al., 2017). The goal of the present study is to examine how pain is related to risk attitudes.

Loewenstein (2000) supports the idea that visceral factors can help to explain changes in decision-making under risk. According to Loewenstein, (2000, p. 426), visceral factors can be defined as "negative emotions […], drive states […], and feeling states […] that grab people's attention and motivate them to engage in specific behaviors." In his seminal work, Loewenstein (1996) suggests that visceral factors such as hunger or pain are impermanent states, which vary across time because they are influenced by surrounding circumstances. For example, a broken arm can cause high levels of pain that, however, should disappear once the arm has healed. Due to their momentary nature, visceral factors should not provoke permanent changes in behavior but rather temporary ones (Loewenstein, 1996, 2000). The present study investigates somatic symptoms of pain regarding back pain, pain in arms, legs or joints, and headache. Note that the term "visceral factor of pain" does not refer to visceral pain.

The extent to which visceral factors affect attitudes and behaviors in general depends on their experienced intensity. The greater the intensity of a visceral factor, the more focus and attention is drawn to mitigating this specific visceral factor. At high to extreme levels of intensity, this focus may even result in self-destructive decisions that reflect a gap between an individual's long-term self-interest and their actual behavior (Loewenstein, 1996).

One crucial discrepancy between long-term self-interest and actual behavior concerns decision-making under risk (Loewenstein, 2000). Such decision-making involves a variety of domains, including risky decision-making in health contexts, career choices, or financial decisions. For instance, many people engage in risky health behaviors like tobacco smoking and poor diet (Murray et al., 2020) or decide to become self-employed (Brown et al., 2011), while others do not. In addition, there is high heterogeneity in personal financial planning and savings decisions (Brounen et al., 2016).

The question now is how visceral factors affect decision-making under risk. As discussed, intense visceral factors can cause self-destructive behavior by diverting one's attention to the mitigation of this factor. Self-destructive behavior implies some negative effect such that high levels of a visceral factor impair decision-making under risk. However, it is less clear how this impairment manifests.

Previous literature addressing the impact of visceral factors on decision-making under risk is inconsistent. Diverging results are found for the state of hunger (e.g., De Ridder et al., 2014; Shabat-Simon et al., 2018) and also across different negative emotions like fear and anger (e.g., Habib et al., 2015; Kugler et al., 2012; Lerner & Keltner, 2001) and even within the same negative emotion (e.g., Baumann & DeSteno, 2012).

The current research contributes to previous literature on visceral factors and decision-making under risk. First, in an explorative study, we investigate the relationship between one visceral factor—pain—and risk attitudes. We found only a few studies that have examined this relationship, and again, their evidence is inconsistent. Barnhart et al. (2019) showed that participants who experienced acute pain exhibited higher risk-taking on the Iowa Gambling Task (IGT), in which participants choose between advantageous and disadvantageous card decks (Bechara et al., 1994). In contrast, the experience of pain was associated with less risk-taking on the Balloon Analogue Risk Task (BART; Barnhart et al., 2019), a computer-based task wherein risk-taking is assessed by pumping up a virtual balloon (Lejuez et al., 2002). Furthermore, Koppel et al. (2017) found that acute pain induction increased risk-taking when deciding between a safe and a risky option in a gain frame; however, no differences in risk-taking were observable in a loss frame. Lin et al. (2016) showed that imagined pain relief was correlated with risk preferences in an analgesic decision-making task. In this sense, the utility of imagining a reduction in pain from level 9 to level 6 on an 11-point scale was negatively associated with choosing a risky treatment option.

In the context of chronic pain, which is often defined as pain persisting more than 3 months (Treede et al., 2019), a study by Berger et al. (2014) identified a higher sensitivity to monetary gains for patients with chronic back pain compared with healthy individuals. This implies that patients were willing to take greater risks when a large monetary gain was possible. However, no differences became evident for the sensitivity to losses. Walteros et al. (2011) showed that patients with fibromyalgia, a chronic pain condition, made less advantageous decisions on the IGT compared with healthy controls. These findings were supported by Apkarian et al. (2004) for patients suffering from chronic back pain and chronic complex regional pain syndrome. In addition, chronic pain is often associated with impaired cognitive functioning (see Moriarty et al., 2011), which also plays a role in (risky) decision-making (Del Missier et al., 2012).

Evidence from the field of neuroeconomics supports the notion that pain is associated with decision-making under risk as well. Brain regions such as the prefrontal cortex, the dorsal and ventral striatum, the orbitofrontal cortex, or the insula are activated when making decisions under risk (Christopoulos et al., 2009; Engelmann & Tamir, 2009; Hsu et al., 2005; Kuhnen & Knutson, 2005; Paulus et al., 2003). Some of these regions are also associated with acute and chronic pain (Apkarian et al., 2005; May, 2008).

In addition, another visceral factor—fatigue—is sometimes associated with pain. In this sense, pain is often accompanied by sleep disturbances (e.g., Menefee et al., 2000; Roehrs & Roth, 2005). Thus, we control for fatigue in one of our models to delineate a potential association between fatigue and decision-making under risk. It must be mentioned, though, that the exact nature of the association between pain and fatigue is less clear and likely bidirectional (Roehrs & Roth, 2005).

Our second goal is to provide evidence on a different measurement approach to assess decision-making under risk—namely, self-reported, domain-specific risk attitudes as a complement to behavioral measures (Dohmen et al., 2011). Although both self-reported and behavioral (e.g., IGT, lottery choices) measures have been linked to risky decision-making, the relationship varies with the type of risk-taking measure (e.g., Brailovskaia et al., 2018; Szrek et al., 2012). Risk attitudes are associated with health behaviors such as problematic alcohol consumption, seat belt nonuse (e.g., Anderson & Mellor, 2008; Szrek et al., 2012), and cigarette smoking (e.g., Anderson & Mellor, 2008; Dieteren et al., 2020). More recently, risk attitudes have been linked to preventive behaviors during the COVID-19 pandemic (e.g., Chan et al., 2020; Keinan et al., 2021). In addition, risk attitudes are related to financial and career decisions such as investments and self-employment (e.g., Brown et al., 2011; Corter & Chen, 2006; Skriabikova et al., 2014). Because previous investigations of pain regularly disregarded self-reported risk attitudes, our research adds an additional perspective on the relationship between this visceral factor and the willingness to take risks. Especially because behavioral measures appear to exhibit poorer psychometric characteristics than self-reported measures (Frey et al., 2017), it is crucial to investigate self-reported risk attitudes in the context of pain. In addition, previous research showed the validity of self-reported measures for risk attitudes (Dohmen et al., 2011; Falk et al., 2022).

Additionally, we differentiate between risk attitudes in six domains of everyday decision-making: general, health, car driving, financial, leisure/sports, and career. Previous research indicates domain-specific variation in risk attitudes (Dohmen et al., 2011; Rolison et al., 2014). Thus, we expect the effects of pain to differ by domain. To our knowledge, no prior studies have taken this into account when considering pain.

To derive predictions for our study, we resort to the elaborations of Loewenstein (1996) and the fear-avoidance (FA) model of pain (Lethem et al., 1983; Vlaeyen & Linton, 2000). Loewenstein (1996) established a link between pain, fear, and avoidance, stating that "fear and pain are both aversive, and both increase the desirability of withdrawal behaviors" (Loewenstein, 1996, p. 272). Conforming to this statement, we draw on the FA model of pain to formulate predictions about the relationship between pain and risk attitudes in the present research. According to the FA model, pain can provoke two behavioral responses: confrontation or avoidance (Vlaeyen & Linton, 2000). When it is interpreted as threatening, pain leads to the development of excessive fear of pain, which results in the avoidance of activities that are likely to worsen pain (Crombez et al., 2012; Vlaeyen & Linton, 2000); this especially concerns physical activities. Although avoidance behaviors are useful in the short-term to prevent further injury and pain, long-term avoidance and inactivity increase the risk of physical and mental impairment, thus increasing the likelihood of further experiences of pain and, ultimately, the development of chronic pain conditions (Crombez et al., 2012; Vlaeyen & Linton, 2000). Empirical evidence is particularly strong in support of a relationship between pain-related fear and avoidance of physical activity (see Vlaeyen & Linton, 2000, for an overview). In addition, pain-related fear has been associated with work loss and sick leave (Gheldof et al., 2005; Grotle et al., 2004). Following the theoretical argumentation of the FA model and empirical evidence, we predict that pain is associated with lower willingness to take risks, especially in the leisure/sports and career domain.

At first glance, previous research on the relationship between pain and decision-making under risk appears to contradict the FA model; however, the characteristics of the applied decision tasks may explain these discrepancies. Pain-related fear also affects cognitive functioning (Vlaeyen & Linton, 2000). Individuals with pain-related fear tend to focus on pain and pain-related information, often at the expense of other tasks and information (Crombez et al., 2012; Vlaeyen & Linton, 2000). Both the IGT and the BART require learning from experience (Mata et al., 2011). Thus, if pain-related fear interferes with the processing of other tasks and information (Crombez et al., 2012; Vlaeyen & Linton, 2000), it is likely that pain impairs learning in the IGT and BART. However, impaired learning has differential effects in both tasks. In the IGT, impaired learning interferes with learning to avoid disadvantageous card decks, leading participants to continue choosing from the disadvantageous, risky decks (Mata et al., 2011). In contrast, learning provokes riskier, more profitable choices in the BART (Mata et al., 2011). Thus, impaired learning due to pain and pain-related fear should lead to more risky decision-making in the IGT but less in the BART. This is supported by the empirical evidence presented in the previous section (Apkarian et al., 2004; Berger et al., 2014; Walteros et al., 2011). In addition, risk preference elicitation via multiple gambles is a rather complex method (Charness et al., 2013). Assuming that complex tasks need more cognitive resources, which are likely consumed by focusing on pain and pain-related information, risky decision-making in multiple gambles may increase under pain. This prediction is supported by evidence from studies involving tasks with multiple gambles (Berger et al., 2014; Koppel et al., 2017). Because self-reported risk attitudes represent rather simple tasks (Charness et al., 2013), we do not expect learning and task complexity to be relevant in the present study.

Although the FA model focuses on pain, some research has also investigated fatigue as a symptom of many painful chronic illnesses. Previous studies found that fatigue was associated with catastrophic thinking about fatigue and fatigue-related fear as well as avoidance behavior (Bol et al., 2010; Wijenberg et al., 2016). In addition, fatigue-avoidance goals were related with activity avoidance (Peñacoba et al., 2021). These findings are in line with the FA model and may suggest a similar mechanism for fatigue in pain-related conditions as for pain itself. Thus, it appears necessary to control for fatigue. Due to the likely bidirectional relationship between pain and fatigue (Roehrs & Roth, 2005), we do not propose any mediating effects.

In summary, we predict that pain is associated with lower willingness to take risks, especially in the leisure/sports and career domain. Further, we control for fatigue as a symptom of many painful chronic illnesses. A similar mechanism as proposed for pain may play a role for fatigue as well.

2 | METHODS

2.1 | Data

Study population

Our analyses used data from the large population-based cohort study KORA (Cooperative Health Research in the Region of Augsburg) FF4. This study is the second 14-year follow-up of the KORA S4 study conducted in the city of Augsburg and two surrounding counties in southern Germany. A total of 4261 participants took part in the S4 baseline study; participants were drawn from the population in a two-stage process (1999–2001). The study design has been described in detail by Holle et al. (2005). The KORA FF4 study was conducted between June 2013 and September 2014; in total, 2279 participants took part. Further information on the sample and research design is again available elsewhere (Kowall et al., 2017). The investigations were carried out in accordance with the Declaration of Helsinki, including written informed consent of all participants. The KORA FF4 study methods were approved by the ethics committee of the Bavarian Chamber of Physicians, Munich (EC no. 06068).

While imputing values for confounders (see below), we excluded participants with missing values for our main variables of interest (i.e., pain and domain-specific risk attitudes (see Dohmen et al., 2017, for a similar approach). This yielded a total of 1729 participants. Most missing values were found for risk attitudes.

In total, 838 of 1729 participants were male. The mean age was 55.45 years (median: 55 years) with an age range of 38 to 73 years. On average, participants received 12.23 years of education (median: 11 years). Most participants indicated a monthly equivalized household income of €1250 to <€1875, followed by a monthly equivalized income of €625 to <€1250 and >= €2500. Participants who had a missing value for risk attitudes or pain were, on average, older than participants with complete information on corresponding characteristics (mean = 75.45 years). Table 1 provides summary statistics for the nonimputed data set.

TABLE 1 Summary statistics for the KORA FF4 data set.

	Overall
Age (mean [SD])	55.45 (9.29)
Age <= 65 years (n [%])	1420 (82.1)
Age > 65 years (n [%])	309 (17.9)
Sex	
Female (n [%])	891 (51.5)
Male (n [%])	838 (48.5)
Education years (mean [SD])	12.23 (2.63)
Education in years	
8 (n [%])	53 (3.1)
10 (n [%])	566 (32.8)
11 (n [%])	279 (16.2)
12 (n [%])	148 (8.6)
13 (n [%])	339 (19.6)
15 (n [%])	13 (0.8)
17 (n [%])	328 (19.0)
Income	
< 625 (n [%])	76 (4.6)
625 to 1249.99 (n [%])	456 (27.8)
1250 to 1874.99 (n [%])	793 (48.3)
1875 to 2499.99 (n [%])	70 (4.3)
>= 2500 (n [%])	248 (15.1)
Observations *n*	**1729**

Note: Age and education in years; equivalized household income in €. Some participants had missing values for education and/or income.

Main variables

Our analyses focused on two variables. While the visceral factor of pain was interpreted as an independent variable, its association with risk attitudes as the dependent variable was examined.

Pain was defined as somatic pain (Cervero & Laird, 1999; Levy et al., 2008) and was assessed by three questions of the Somatic Symptom Scale-8 (Gierk et al., 2014), a short form of the Patient Health Questionnaire for somatic symptoms (Kroenke et al., 2002). Each question was scaled from 1 (="not at all") to 5 (="very much"). Participants indicated their level of pain severity in the last 7 days regarding three types of pain: back pain; pain in arms, legs, or joints; and headaches. All answers were summed up to calculate one overall pain score (cf. Gierk et al., 2014). Thus, a higher overall pain score indicated higher levels of pain. Frequencies for the overall pain score can be found in Figure A1 in Appendix A.

In one model specification, an alternative pain indicator was calculated. Here, the binary variable equaled one if the respondent indicated a pain level higher than three (out of five) in at least one of the three pain variables and zero otherwise. For example, if a respondent indicated a back pain level of four and zero for all other types of pain, the binary pain indicator for this respondent was one. Thus, a value of 1 indicated the presence of stronger pain in at least one pain dimension. Overall, only 267 out of 1729 respondents received a value of 1 for the binary pain indicator. Table A1 in Appendix A shows the frequencies of each pain level by type of pain. Table A2 presents correlations among the different types of pain.

To assess risk attitudes, we used the measure by Dohmen et al. (2011), which is well-established and widely applied (see, e.g., Dohmen et al., 2016; Frey et al., 2017; Szrek et al., 2012). This measure consists of a set of questions that ask participants how much risk they are willing to take in general or in specific domains.[1] Overall, six domains were included: general, health, car driving, financial, leisure/sports, and career. Participants specified their risk attitudes on

[1]The exact German wording for general risk attitudes was: "Sind Sie im Allgemeinen ein risikobereiter Mensch oder versuchen Sie, Risiken zu vermeiden?".
The exact German wording for domain-specific risk attitudes was: "Wie risikobereit sind Sie… bei Ihrer Gesundheit?; beim Autofahren?; bei Geldanlagen?; bei Freizeit und Sport?; bei Ihrer beruflichen Karriere?"

a scale from 0 (="not willing to take risks") to 10 (="very willing to take risks"). Frequencies of risk attitudes for all domains can be found in Appendix A (Figures A2 to A7).

Control variables

We used a set of control variables that have previously been associated with risk attitudes and pain. These included equivalized household income, height, age, sex, and education (e.g., Andersson et al., 1993; Dionne et al., 2001; Dohmen et al., 2011; Heuch et al., 2015). In addition, body mass index (BMI, defined as kg/m^2) (e.g., Anderson & Mellor, 2008; Heuch et al., 2010) and several medications related to pain were taken into account. These included corticoids, antiepileptics, opioids, and nonsteroidal anti-inflammatory drugs (NSAIDs) in two classifications. The measurement of the control variables included can be found in Appendix A (Table A3).

Additionally, in one model specification, we controlled for fatigue, which was assessed by two questions of the Somatic Symptom Scale-8 (Gierk et al., 2014). Participants stated their level of fatigue in the last 7 days in terms of feeling tired or having low energy and trouble sleeping. The questions were again scaled from 1 (="not at all") to 5 (="very much") and summed up to an overall fatigue score. In this model, we also included medications related to fatigue. These were zopiclone and benzodiazepines in two classifications.

2.2 | Statistical approach

To analyze the data, we used linear regressions. Risk attitudes were regressed on the pain score and the respective set of control variables. Because our study is explorative in nature, we also report associations that are significant at the 10% level; however, our interpretations focus on the associations that are significant at conventional levels of 5% and 1%. We imputed missing values in the data set via multiple imputation. We used the Amelia (Honaker et al., 2011) and Zelig (Choirat et al., 2020; Imai et al., 2008) packages in R (R Core Team, 2021) for this approach.

Our multiple-imputation approach built five imputation models to approximate the missing values. Analyses were applied to each data set, and the results were merged afterwards. Missing values were "filled in with a distribution of imputations" (Honaker et al., 2011, p. 3).

In our main analysis, we estimated three models for the visceral factor of pain. The first model regressed risk attitudes on the pain score and the sociodemographic control variables as well as BMI (model (1)). The second model matched the first but also included pain medication (model (2)). We both excluded and included medication because the association between pain and pain medication is self-evident, but we do not know about the association with risk attitudes.

In the third model, we used the new binary pain indicator as the main independent variable, instead of the overall pain score. This model also included all control variables (model (3)).

2.2.1 | Robustness checks

As a robustness check, we estimated two additional models. The fourth model used the original pain score but included all control variables as well as fatigue (model (4)). Note that medication for both pain and fatigue was also included in this model.

In addition, we estimated a fifth model that contained only complete cases ($n = 1553$) and thus excluded respondents who had a missing value in at least one of the control variables. This model controlled for pain medication but not fatigue (model (5)).

3 | RESULTS

3.1 | Pain and risk attitudes

Table 2 shows the results of the linear regression with regression coefficients for risk attitudes by domain and pain without medication (model (1)). The results for model (2), which includes medication, can be found in Appendix A (Table A4). For simplicity's sake, significant regression coefficients are indicated at common significance levels (0.01, 0.05) in the tables. In addition, due to the explorative nature of our study, we also report regression coefficients significant at the 10% level. In the text, exact *p*-values are given.

For general risk attitudes, pain was not related to the willingness to take risks in model (1) ($p = 0.241$). In contrast, pain showed a negative relationship with willingness to take risks in model (2). A one-unit increase in pain was associated with a decrease in risk attitudes of 0.048 points ($p = 0.078$) on the risk attitude scale (see Section 2.1). However, this association was significant only at the 10% level.

Pain was also not associated with health risk attitudes. This held both for model (1) ($p = 0.145$) and model (2) ($p = 0.152$). Furthermore, it was not associated with driving risk attitudes in model (1), either ($p = 0.219$). However, in model (2), a one-unit increase in pain is related to a decrease in risk attitudes of 0.050 points ($p = 0.085$). Note that this relationship was again significant only at the 10% level.

In the financial context, pain was negatively related to risk attitudes. A one-unit increase in pain was associated with reductions in risk attitudes of 0.054 points ($p = 0.031$) in model (1) and 0.070 points ($p = 0.010$) in model (2).

This negative relationship also held for risk attitudes in the leisure/sports domain. Pain was linked to a decrease of 0.064 points ($p = 0.015$) in model (1) and 0.072 points ($p = 0.011$) in model (2). Again, this implied a lower willingness to take risks under higher levels of pain. Finally, pain did not have a significant relationship with career risk attitudes (model (1): $p = 0.829$; model (2): $p = 0.539$).

Table 3 illustrates the results for model (3). Recall that model (3) used a binary pain indicator. In this model specification, pain was associated with risk attitudes for only two domains: financial and leisure/sports. In the financial domain, the presence of pain was related to a decrease in risk attitudes of 0.293 points ($p = 0.050$). This coefficient was significant at the 10% level. For leisure/sports risk

TABLE 2 Linear regression with imputed values: Risk attitudes by domain (model (1): Pain score).

	General	Health	Driving	Financial	Leisure/sports	Career
(Intercept)	0.660	3.915*	0.798	2.217	7.345**	0.516
	[1.781]	[1.785]	[1.898]	[1.767]	[1.835]	[2.063]
Pain	-0.030	0.037	-0.033	-0.054*	-0.064*	-0.006
	[0.025]	[0.025]	[0.027]	[0.025]	[0.026]	[0.029]
BMI	0.005	0.030**	0.012	-0.007	-0.039**	0.007
	[0.010]	[0.010]	[0.011]	[0.010]	[0.011]	[0.012]
Income	0.208**	0.070	0.117*	0.249**	0.226**	0.308**
	[0.054]	[0.052]	[0.055]	[0.052]	[0.055]	[0.060]
Height	0.023**	-0.003	0.027**	0.010	0.008	0.023*
	[0.008]	[0.008]	[0.009]	[0.008]	[0.009]	[0.010]
Age	0.002	-0.022**	-0.040**	-0.013*	-0.048**	-0.028**
	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.007]
Sex	-0.735**	-0.700**	-0.370*	-0.901**	-1.033**	-0.542**
	[0.155]	[0.156]	[0.165]	[0.154]	[0.160]	[0.180]
Education	0.030	0.064**	-0.005	0.042*	0.011	0.062*
	[0.021]	[0.021]	[0.023]	[0.021]	[0.022]	[0.025]

Note: Regression coefficients; standard errors in brackets.
Abbreviation: BMI, body mass index.
†$p < 0.1$, *$p < 0.05$, and **$p < 0.01$.

attitudes, the presence of pain was associated with a reduction in risk attitudes of 0.441 points ($p = 0.005$).

3.2 | Robustness checks

As a first robustness check, model (4) is estimated. This model contained the original pain score and all control variables and also the fatigue score and fatigue medication. Regression results are reported in Appendix A (Table A5).

In these regression models, pain was associated with risk attitudes only in the financial domain. A one-unit increase in pain is related to a decrease of 0.061 points ($p = 0.040$) in risk attitudes. Except for the driving and financial domains, only fatigue showed a statistically significant association with risk attitudes in all other domains. Fatigue was significantly related to general, health, leisure/sports, and career risk attitudes. A one-unit increase in fatigue was associated with a decrease of 0.130 points ($p = 0.001$) in general risk attitudes. In the health domain, a one-unit increase in fatigue was related to an increase in risk attitudes of 0.082 points ($p = 0.032$). Remarkably, the health domain was the only one showing a positive relationship between fatigue and risk attitudes. In the leisure/sports context, a one-unit increase in fatigue is related to a decrease of 0.104 points ($p = 0.009$) in risk attitudes. For career risk attitudes, a one-unit increase in fatigue was associated with a decrease of 0.099 points ($p = 0.025$). To summarize, it appears that associations between fatigue and risk attitudes replaced the significant associations with pain in the general domain (see model (2)) and the leisure/sports domain (see models (1) to (2)). It must be noted, though, that, according to Cohen (1988), the correlation between pain and fatigue was moderate to high with r = 0.460 ($p < 0.001$; see Appendix Table A7). Implications of this finding are explored in Section 4.

Finally, results focusing only on complete cases (model (5)) are considered (Table A6). In the context of general risk attitudes, pain was negatively associated with risk proclivity. A one-unit increase in pain is related to a decrease in risk attitudes of 0.052 points ($p = 0.075$). The coefficient was significant only at the 10% level. In the health domain, pain did not show a positive link with risk attitudes ($p = 0.232$). With respect to car driving, pain had a negative relationship with risk attitudes. A one-unit increase in pain was associated with a reduction in risk attitudes of 0.076 points ($p = 0.015$). In the financial context, a one-unit increase in pain was associated with a reduction in risk attitudes of 0.089 points ($p = 0.002$). In the leisure/sports domain, pain exhibited a negative relationship with risk attitudes as well. A one-unit increase in pain related to a decrease in risk attitudes of 0.084 points ($p = 0.005$). Finally, pain did not have a negative association with career risk attitudes.

Thus, results of model (5) confirmed–and in many cases, even emphasized–significant associations observed in models (1) to (4). Table 4 gives an overview of all five models and the identified relationships between pain and risk attitudes by domain.

Although our results showed associations between pain and willingness to take risks in several domains, the magnitude of these associations must be taken into account. For pain, risk attitudes changed by between 0.048 and 0.072 points in models (1) and (2), by between 0.293 and 0.441 points in model (3), and by between 0.052 and 0.089 points in model (5). In model (4), risk attitudes changed by

TABLE 3 Linear regression with imputed values: Risk attitudes by domain (model (3): Binary pain indicator and medication).

	General	Health	Driving	Financial	Leisure/sports	Career
(Intercept)	0.399	4.143*	0.467	1.906	6.943**	0.450
	[1.779]	[1.785]	[1.897]	[1.766]	[1.831]	[2.054]
Pain	-0.182	0.044	-0.181	-0.293†	-0.441**	-0.102
	[0.151]	[0.152]	[0.161]	[0.150]	[0.156]	[0.175]
BMI	0.003	0.032**	0.011	-0.009	-0.038**	0.009
	[0.010]	[0.010]	[0.011]	[0.010]	[0.011]	[0.012]
Income	0.213**	0.063	0.121*	0.253**	0.230**	0.306**
	[0.054]	[0.052]	[0.055]	[0.052]	[0.055]	[0.060]
Height	0.023**	-0.004	0.028**	0.010	0.009	0.023*
	[0.008]	[0.008]	[0.009]	[0.008]	[0.009]	[0.010]
Age	0.002	-0.021**	-0.040**	-0.013*	-0.047**	-0.026**
	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.007]
Sex	-0.766**	-0.692**	-0.392*	-0.938**	-1.065**	-0.592**
	[0.156]	[0.156]	[0.166]	[0.154]	[0.160]	[0.180]
Education	0.032	0.063**	-0.003	0.045*	0.015	0.063*
	[0.021]	[0.021]	[0.023]	[0.021]	[0.022]	[0.025]
Corticoids	0.386	-0.679	0.491	-0.070	0.342	-0.623
	[0.557]	[0.559]	[0.594]	[0.553]	[0.574]	[0.644]
Antiepileptics	0.121	-0.202	-0.246	0.192	-0.730	-0.837
	[0.471]	[0.474]	[0.502]	[0.468]	[0.486]	[0.544]
Opioids	-0.029	0.050	0.085	-0.463	-0.071	-0.387
	[0.594]	[0.596]	[0.633]	[0.589]	[0.613]	[0.687]
NSAID1	0.300†	0.087	0.229	0.246	0.271†	0.540**
	[0.154]	[0.154]	[0.164]	[0.152]	[0.158]	[0.177]
NSAID2	0.082	0.014	0.193	0.250	-0.065	-0.176
	[0.324]	[0.326]	[0.345]	[0.321]	[0.334]	[0.374]

Note: Regression coefficients; standard errors in brackets.
Abbreviations: BMI, body mass index; NSAID, nonsteroidal anti-inflammatory drug.
†p < 0.1 *p < 0.05, and **p < 0.01.

TABLE 4 Relationship between risk attitudes and pain by domain for models (1) to (5).

Risk domain	(1)	(2)	(3)	(4)	(5)
General	-	-†	-	-	-†
Health	+	+	+	+	+
Car driving	-	-†	-	-	-*
Financial	-*	-**	-†	-*	-**
Leisure/sports	-*	-*	-**	-	-**
Career	-	-	-	+	-

Note: (1) Imputed values without medication. (2) Imputed values with medication. (3) Imputed values with binary pain indicator with medication. (4) Imputed values controlling for medication and fatigue. (5) Only complete cases with medication.
†p < 0.1, *p < 0.05, and **p < 0.01.

0.061 points. These magnitudes translate to a percentage change of 0.44% to 0.65% (models (1) and (2)) and 2.66% to 4.01% (model (3)), respectively, on the risk attitudes scale. The percentage change ranges from 0.47% to 0.81% in the robustness check of model (5). In model (4), the percentage change amounts to 0.55%. The relationships between fatigue and domain-specific risk attitudes were slightly stronger in comparison (model (4)). Risk attitudes changed by between 0.082 points in the health domain and 0.130 points in the general domain. This refers to percentage changes between 0.75% and 1.18%.

4 | DISCUSSION

Most of the previous literature suggests that there is no universal effect of intensely experienced visceral factors on decision-making under risk. Our findings support these observations, as pain was associated with willingness to take risks only in some domains. In an explorative study, we provide evidence that pain is especially associated with risk attitudes in the financial and leisure/sports domains. In these domains, increasing pain levels were found to be related to lower risk attitudes (i.e., greater risk aversion). We observed a similar relationship in single models for the general domain and the driving domain (models (2) and (5)). In contrast, no association was found for the health and career domains in any model (see Table 4 in the results section for an overview). The absence of a correlation between pain levels and risk attitudes in the health domain (see Table A7) was a first indicator of the insignificant relationships found in our regression models.

Overall, we found partial support for the proposition by Loewenstein (2000) that visceral factors are associated with decision-making under risk. In addition, we found evidence for our prediction based on the FA model of lower risk attitudes in relation to pain in the leisure/sports domain but not in the career domain. Because pain accompanies many diseases, such as cancer (e.g., Cleeland et al., 1994), chronic obstructive pulmonary disease (e.g., van Isselt et al., 2014), and diabetes (e.g., Krein et al., 2005), an association between pain and risk attitudes especially in the health domain would have been plausible as well. The rather robust relationship between pain and financial risk attitudes could be explained by potential worries about future disposable income. Pain is associated with absence from work (e.g., Jacob et al., 2022; Martocchio et al., 2000) as well as financial worries and stressors (Brennan, 2020; Weissman et al., 2022). If individuals with high pain perceived a potential pain-related negative impact on their future ability to work and worry about their financial situation, they might be unwilling to take more risk in this domain. This argumentation is supported by the FA model, which predicts that pain and pain-related fear are relevant in the work context. Empirical evidence strengthened this assertion by associating pain-related fear with work loss and sick leave (Gheldof et al., 2005; Grotle et al., 2004). In addition, in unreported analyses, we found that the associations between pain and risk attitudes in the financial domain are found only in the age group 65 years and younger but not in the age group above 65 years. For our cohort, 65 years was the official retirement age; thus, it appears that the relationship between pain and financial risk attitudes is especially relevant in working-age individuals. This lends further support to our argument that pain may be related to financial risk attitudes via working ability and financial worries. It must be kept in mind, though, that the majority of our sample was younger than 65 years. In addition, this argument implies a causal connection that we were unable to investigate in our data. Furthermore, future research needs to assess the usefulness of this proposed mechanism. Detailed results are available upon request.

However, when controlling for fatigue, the relationship between pain and risk attitudes persisted only in the financial domain but not in the leisure/sports domain. The interpretation of this missing link is not straightforward. Two explanations are possible from a methodological perspective. First, it may be that the significant association between pain and risk attitudes was confounded by associated fatigue levels. Recall that models (1), (2), (3), and (5) did not consider fatigue. A second explanation could be that pain does in fact have a relationship with leisure/sports risk attitudes but that accounting for fatigue conceals it. These issues could potentially be resolved in future research with other statistical methods, such as an instrumental variable approach.

Apart from the methodological considerations, the missing relationship between pain and leisure/sports risk attitudes may hint at fatigue as a potential pathway through which pain affects risk attitudes in this context. It is important to note that the moderate to high correlation coefficient suggests some shared properties between those visceral factors that could be associated with risk attitudes via fatigue. In this sense, it is possible that fatigue serves as a mediator for the relationship between pain and risk attitudes. However, although pain and fatigue are linked, their relationship is complex and likely bidirectional (Roehrs & Roth, 2005). Thus, any interpretations remain rather uncertain, especially because an association between pain and risk attitudes persists in the financial domain.

Interestingly, fatigue was associated with risk attitudes in several domains. Fatigue had a negative association with general, leisure/sports, and career risk attitudes while showing a positive one with health risk attitudes. These findings could hint at fatigue as being the more relevant visceral factor in the context of domain-specific risk attitudes. An exception may be the financial domain because the link between pain and risk attitudes remained even after controlling for fatigue. These associations support the domain-specific perspective of risk attitudes for fatigue as well. In addition, the findings in the general, leisure/sports, and career domains are in line with the FA model as well as a similar mechanism for fatigue as for pain. We proposed that pain is related to lower risk attitudes following from pain-related fear and pain avoidance behavior, especially in the leisure/sports and career domains. Incidental findings from previous research support a similar argumentation for fatigue (Bol et al., 2010; Wijenberg et al., 2016). However, the positive relationship in the health domain contradicts this. It may be that fatigued individuals are willing to take more health-related risks to prevent further deterioration of their condition due to inactivity.

Considering the magnitudes of the identified associations, both visceral factors (i.e., pain and fatigue) were related to only rather small changes in risk attitudes. When using a different composition of the pain score, the association increased. This appears plausible because the adjusted binary pain indicator takes the value of one only for very high levels of experienced pain. Thus, the presence of pain (pain indicator = 1) reflects considerably higher pain levels. This should also be associated with a higher change in risk attitudes. However, pain showed a significant negative relationship only with financial and leisure/sports risk attitudes. Because previous research did not rely on self-reported, domain-specific risk attitudes to investigate the relationship between pain and decision-making under risk, it is difficult to compare our results and effect sizes to existing literature. Nevertheless, the intuition behind our results can be compared with findings from previous research. We find partial support for the FA model with lower willingness to take risks in the presence of pain. As discussed in Section 1, previous research can also be explained with respect to this model. Task characteristics for risk elicitation may, however, play a role in this context.

The present research also has limitations. First, the Somatic Symptom Scale-8 allows for no explicit distinction between acute and chronic pain. Thus, it remains unclear whether participants experienced pain (or fatigue in model (4)) before the 7 days that were used as a time frame in the survey. In addition, we cannot completely rule out that some participants suffered from short-term pain or fatigue only on the study day when taking the survey.

Second, the results of model (4) suggest that fatigue, including pain-related fatigue, may be more strongly related to risk attitudes than pain itself. However, as already discussed, the complexity and potential bidirectionality of the pain–fatigue relationship limits the conclusions regarding this finding. Experimental approaches in future research could prove useful to shed more light on the relationship between pain, fatigue, and domain-specific risk attitudes. Third, it was not possible to assess affect as a potential mediator between pain and self-reported risk attitudes in our study. The FA model suggests that negative affect may be a relevant variable to consider (e.g., in relation to negative thoughts about pain) (Vlaeyen & Linton, 2000). Future studies should take this potential mechanism into account. Fourth, although previous studies showed the usefulness of self-reported measures to assess risk attitudes (Dohmen et al., 2011; Frey et al., 2017), it remains likely that response bias played a role in the present study. Fifth, due to the limited amount of research, we cannot directly compare our results to previous ones. Thus, future research is needed to replicate our findings.

Another issue for future research concerns the cross-sectional nature of our data. Longitudinal observations would be helpful to investigate the change in risk attitudes when pain levels change. Furthermore, the link between visceral factors and real-world behavior needs to be addressed. Prior research has often focused on either the impact of specific variables on risk attitudes (e.g., Shabat-Simon et al., 2018) or the relationship between risk attitudes and real-world behavior, such as unhealthy behavior or financial investments (e.g., Szrek et al., 2012). In a more holistic approach, these two approaches should be combined to understand the complete chain of events (see; Dohmen et al., 2011). This makes it possible to answer the question of how pain—and a potential association with fatigue—is reflected not only in adjusted risk attitudes but also in potential behavior change.

5 | CONCLUSION

The present study adds to the seminal work of Loewenstein, (1996), (2000) by considering the relationship between the visceral factor of pain and risk attitudes in different contexts. We show that pain exhibits a negative association with willingness to take risks in the financial and leisure/sports domains. Additionally, we show that the association between pain and leisure/sports risk attitudes disappears when including the visceral factor of fatigue as an additional control. We discuss these findings in light of the FA model of pain. The domain-specific association between pain and risk attitudes has important implications, especially in contexts of financial decision-making, and may encourage future research efforts.

ACKNOWLEDGMENTS

The authors would like to thank the team at the KORA study center for organizing and conducting the data collection and all volunteers for participating in this study. Open Access funding enabled and organized by Projekt DEAL.

CONFLICT OF INTEREST STATEMENT

The authors declare no competing interests.

DATA AVAILABILITY STATEMENT

KORA data used in this study can be applied for via the digital application tool KORA.PASST as part of a project agreement (https://www.helmholtz-munich.de/epi/research/cohorts/kora-cohort/data-use-and-access-via-korapasst/index.html).

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How to cite this article: König, A. N., Linkohr, B., Peters, A., Ladwig, K.-H., Laxy, M., & Schwettmann, L. (2023). Relating the visceral factor of pain to domain-specific risk attitudes. *Journal of Behavioral Decision Making*, *36*(4), e2323. https://doi.org/10.1002/bdm.2323

APPENDIX A

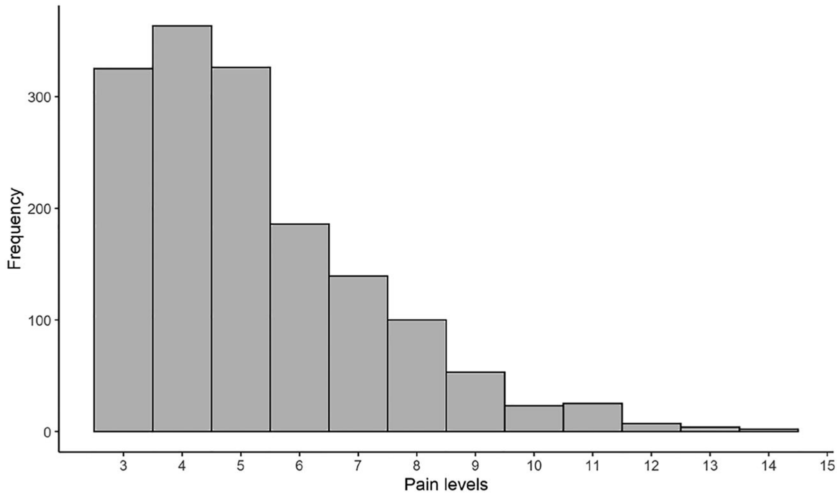

FIGURE A1 Frequencies of pain levels for overall pain score.

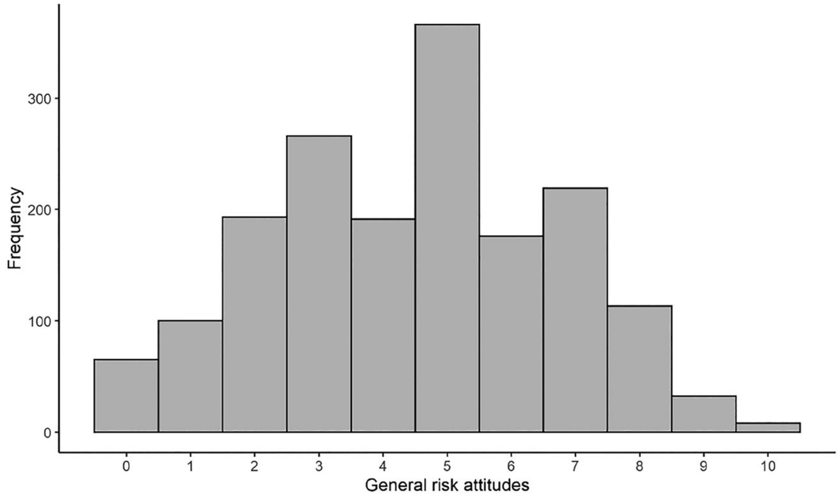

FIGURE A2 Frequencies of general risk attitudes.

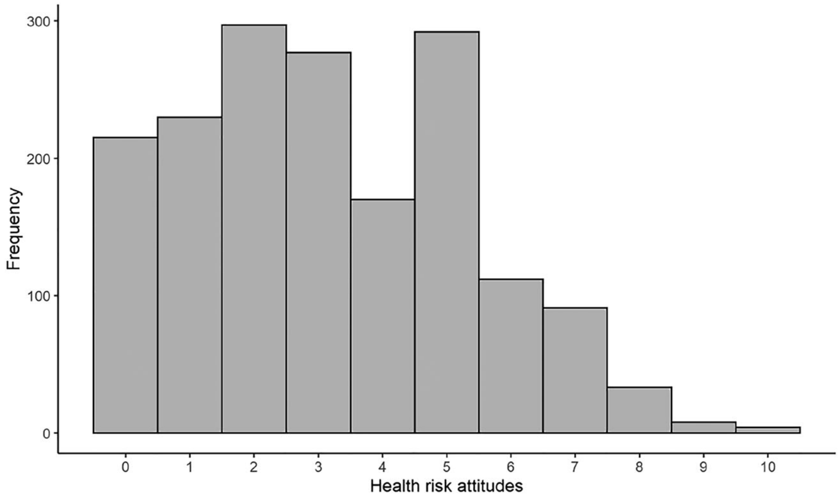

FIGURE A3 Frequencies of health risk attitudes.

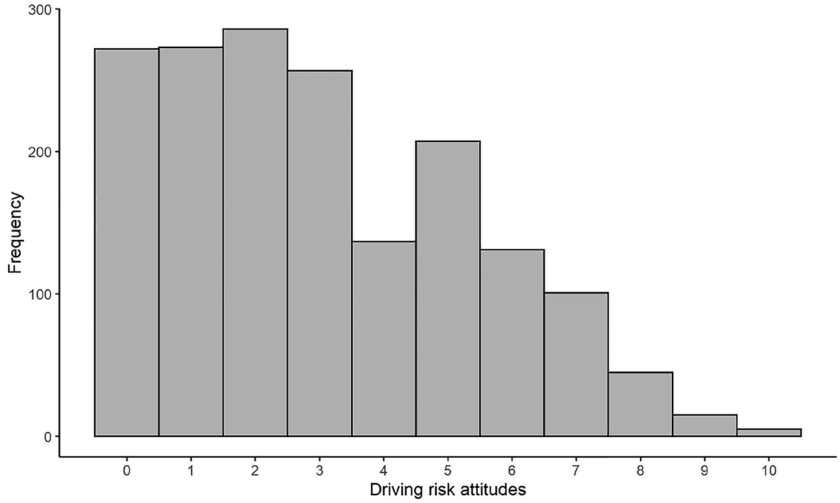

FIGURE A4 Frequencies of driving risk attitudes.

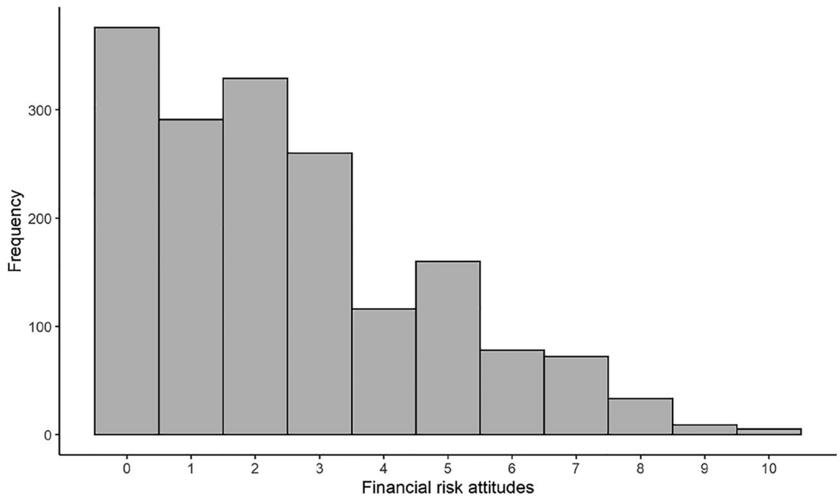

FIGURE A5 Frequencies of financial risk attitudes.

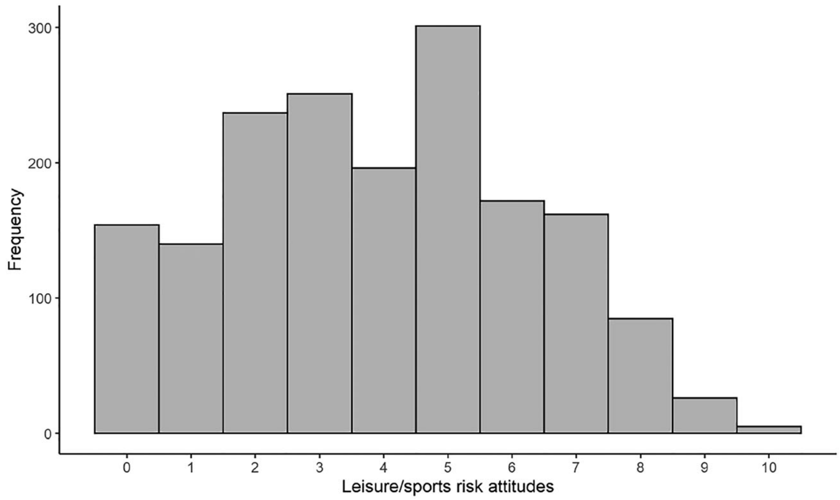

FIGURE A6 Frequencies of leisure/sports risk attitudes.

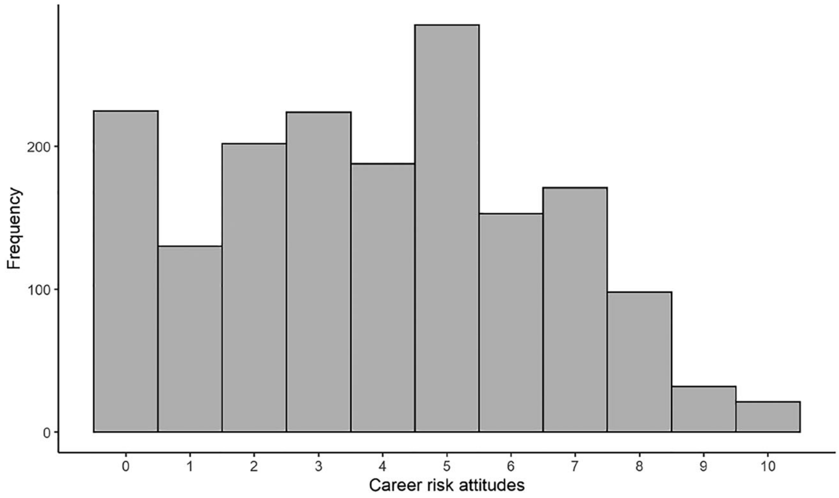

FIGURE A7 Frequencies of career risk attitudes.

TABLE A1 Frequencies of pain levels by type of pain.

Pain levels	1	2	3	4	5
Back pain	782	525	285	100	37
Pain in arms, legs, or joints	801	451	335	114	28
Headache	1144	384	133	57	11

Note: From 1 (="not at all") to 5 (="very much").

TABLE A2 Pearson correlation coefficients among types of pain.

	Back pain	Pain in arms, legs, or joints	Headache
Back pain	1		
Pain in arms, legs or joints	0.422**	1	
Headache	0.254**	0.171**	1

†$p < 0.1$, *$p < 0.05$, and **$p < 0.01$.

TABLE A3 Control variables and their measurement.

Visceral factor	Variable	Measurement
	Income	1 = < €625; 2 = €625 to €1249.99; 3 = €1250 to €1874.99; 4 = €1875 to €2499.99; 5 = >= €2500
	Height	cm
	Age	Years
	Sex	Male = 1, female = 2
	Education	8, 10, 11, 12, 13, 15, 17 years
	BMI	Body mass index (kg/m^2), continuous
Pain	Corticoids	Regular systemic intake of corticoids, 0 = no, 1 = yes
Pain	Opioids	Intake of strong opioids, 0 = no, 1 = yes
Pain	NSAID (classification 1)	Intake if needed: NSAID incl. ASS100 and 300 respectively (ATC= N02BA0, N02B, N02AA64 - N02AA69, M01A but not M01AX, M01BA, R05XA), 0 = no, 1 = yes
Pain	NSAID (classification 2)	Regular intake: NSAID (ATC= N02AA64 - N02AA69, N02B, M01A but not M01AX, M01BA, R05XA), 0 = no, 1 = yes
Pain	Antiepileptics	Intake of antiepileptics (N03 but exclusion of primidone and clonazepam) (ATC= N03AA03, N03AE 01), 0 = no, 1 = yes
Fatigue	Fatigue score	Sum of individual scores indicated in two fatigue variables (each scaled from 1 (="not at all") to 5 (="very much"))

TABLE A3 (Continued)

Visceral factor	Variable	Measurement
Fatigue	Zopiclone	Intake of zopiclone/zolpidem, 0 = no, 1 = yes
Fatigue	Benzodiazepine (classification 1)	Intake of benzodiazepines as anxiolytics (ATC = N05BA), 0 = no, 1 = yes
Fatigue	Benzodiazepine (classification 2)	Intake of benzodiazepines as sleeping drug (ATC = N05CD), 0 = no, 1 = yes

Abbreviation: NSAID, nonsteroidal anti-inflammatory drug.

TABLE A4 Linear regression with imputed values: Risk attitudes by domain and pain (model (2): Pain and medication).

	General	Health	Driving	Financial	Leisure/sports	Career
(Intercept)	0.618	3.962*	0.696	2.225	7.268**	0.538
	[1.783]	[1.788]	[1.900]	[1.769]	[1.837]	[2.059]
Pain	-0.048†	0.039	-0.050†	-0.070**	-0.072*	-0.019
	[0.027]	[0.027]	[0.029]	[0.027]	[0.028]	[0.031]
BMI	0.004	0.031**	0.012	-0.008	-0.038**	0.009
	[0.010]	[0.010]	[0.011]	[0.010]	[0.011]	[0.012]
Income	0.208**	0.068	0.116*	0.246**	0.224**	0.304**
	[0.054]	[0.053]	[0.055]	[0.052]	[0.055]	[0.060]
Height	0.023**	-0.003	0.028**	0.010	0.008	0.023*
	[0.008]	[0.008]	[0.009]	[0.008]	[0.009]	[0.010]
Age	0.003	-0.022**	-0.039**	-0.012*	-0.047**	-0.026**
	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.007]
Sex	-0.752**	-0.707**	-0.377*	-0.919**	-1.051**	-0.588**
	[0.156]	[0.156]	[0.166]	[0.155]	[0.161]	[0.180]
Education	0.030	0.064**	-0.005	0.043*	0.012	0.062*
	[0.021]	[0.021]	[0.023]	[0.021]	[0.022]	[0.025]
Corticoids	0.387	-0.699	0.494	-0.072	0.314	-0.627
	[0.557]	[0.559]	[0.593]	[0.553]	[0.574]	[0.643]
Antiepileptics	0.139	-0.238	-0.226	0.213	-0.737	-0.835
	[0.471]	[0.474]	[0.502]	[0.467]	[0.486]	[0.544]
Opioids	0.003	-0.013	0.121	-0.427	-0.083	-0.384
	[0.594]	[0.596]	[0.633]	[0.589]	[0.614]	[0.687]
NSAID1	0.333*	0.038	0.266	0.288†	0.285†	0.547**
	[0.155]	[0.156]	[0.166]	[0.154]	[0.161]	[0.180]
NSAID2	0.121	-0.055	0.237	0.296	-0.067	-0.170
	[0.325]	[0.326]	[0.346]	[0.322]	[0.335]	[0.375]

Note: Regression coefficients; standard errors in brackets.
Abbreviations: BMI, body mass index; NSAID, nonsteroidal anti-inflammatory drug.
†$p < 0.1$, *$p < 0.05$, and **$p < 0.01$.

TABLE A5 Linear regression with imputed values: Risk attitudes by domain and pain (model (4): Controlling for fatigue).

	General	Health	Driving	Financial	Leisure/sports	Career
(Intercept)	0.819	3.836*	0.662	2.267	7.387**	0.735
	[1.776]	[1.790]	[1.902]	[1.773]	[1.837]	[2.060]
Pain	-0.007	0.013	-0.037	-0.061*	-0.039	0.012
	[0.030]	[0.030]	[0.032]	[0.030]	[0.031]	[0.035]
Fatigue	-0.130**	0.082*	-0.044	-0.028	-0.104**	-0.099*
	[0.038]	[0.039]	[0.041]	[0.038]	[0.040]	[0.044]
BMI	0.005	0.030**	0.012	-0.007	-0.037**	0.010
	[0.010]	[0.010]	[0.011]	[0.010]	[0.011]	[0.012]
Income	0.206**	0.072	0.117*	0.246**	0.221**	0.300**
	[0.054]	[0.053]	[0.055]	[0.052]	[0.055]	[0.060]
Height	0.023**	-0.003	0.028**	0.010	0.008	0.022*
	[0.008]	[0.008]	[0.009]	[0.008]	[0.009]	[0.010]
Age	0.003	-0.021**	-0.039**	-0.012*	-0.047**	-0.026**
	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.007]
Sex	-0.691**	-0.745**	-0.348*	-0.905**	-0.999**	-0.544**
	[0.156]	[0.157]	[0.167]	[0.156]	[0.161]	[0.181]
Education	0.034	0.064**	-0.002	0.044*	0.014	0.064**
	[0.021]	[0.021]	[0.023]	[0.021]	[0.022]	[0.025]
Corticoids	0.444	-0.697	0.463	-0.053	0.309	-0.569
	[0.556]	[0.561]	[0.595]	[0.555]	[0.576]	[0.645]
Antiepileptics	0.126	-0.228	-0.277	0.210	-0.767	-0.826
	[0.470]	[0.475]	[0.503]	[0.469]	[0.487]	[0.545]
Opioids	0.096	0.050	0.219	-0.379	-0.079	-0.364
	[0.595]	[0.600]	[0.637]	[0.594]	[0.617]	[0.691]
NSAID1	0.292†	0.055	0.246	0.277†	0.257	0.518**
	[0.155]	[0.156]	[0.166]	[0.155]	[0.161]	[0.180]
NSAID2	0.158	-0.068	0.261	0.307	-0.041	-0.150
	[0.323]	[0.326]	[0.346]	[0.322]	[0.334]	[0.375]
Zopiclon	-0.454	-0.462	0.587	-0.252	0.521	-0.555
	[0.811]	[0.820]	[0.868]	[0.809]	[0.840]	[0.941]
Benzodiazepine1	-1.724	-0.933	-1.425	-0.830	-0.098	-0.576
	[1.074]	[1.085]	[1.150]	[1.072]	[1.111]	[1.246]
Benzodiazepine2	-3.006*	0.468	-2.733*	-1.174	-1.970	-2.141
	[1.226]	[1.238]	[1.312]	[1.223]	[1.269]	[1.423]

Note: Regression coefficients; standard errors in brackets.
Abbreviations: BMI, body mass index; NSAID, nonsteroidal anti-inflammatory drug.
†$p < 0.1$, *$p < 0.05$, and **$p < 0.01$.

TABLE A6 Linear regression with complete cases: Risk attitudes by domain and pain (model (5)).

	General	Health	Driving	Financial	Leisure/sports	Career
(Intercept)	0.442	4.349*	0.889	1.673	7.069**	0.111
	[1.850]	[1.863]	[1.979]	[1.842]	[1.910]	[2.146]
Pain	-0.052†	0.035	-0.076*	-0.089**	-0.084**	-0.042
	[0.029]	[0.029]	[0.031]	[0.029]	[0.030]	[0.034]
BMI	-0.00007	0.030**	0.010	-0.013	-0.046**	0.006
	[0.011]	[0.011]	[0.012]	[0.011]	[0.011]	[0.012]
Income	0.199**	0.085	0.091	0.258**	0.222**	0.314**
	[0.054]	[0.055]	[0.058]	[0.054]	[0.056]	[0.063]
Height	0.024**	-0.005	0.027**	0.014	0.010	0.025*
	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.010]
Age	0.004	-0.023**	-0.038**	-0.011†	-0.044**	-0.023**
	[0.006]	[0.006]	[0.007]	[0.006]	[0.007]	[0.007]
Sex	-0.710**	-0.706**	-0.408*	-0.853**	-0.988**	-0.572**
	[0.162]	[0.164]	[0.174]	[0.162]	[0.168]	[0.188]
Education	0.031	0.057*	0.002	0.039†	0.008	0.060*
	[0.022]	[0.022]	[0.024]	[0.022]	[0.023]	[0.026]
Corticoids	0.737	-0.526	0.848	0.216	0.672	-0.249
	[0.574]	[0.578]	[0.614]	[0.572]	[0.593]	[0.666]
Antiepileptics	0.725	-0.250	-0.227	-0.261	-0.413	-0.581
	[0.524]	[0.528]	[0.561]	[0.522]	[0.541]	[0.608]
Opioids	-0.531	0.017	0.459	0.035	0.219	0.027
	[0.663]	[0.668]	[0.710]	[0.661]	[0.685]	[0.770]
NSAID1	0.410*	0.039	0.384*	0.276†	0.349*	0.642**
	[0.164]	[0.165]	[0.176]	[0.164]	[0.170]	[0.191]
NSAID2	0.089	0.131	0.243	0.248	-0.117	-0.212
	[0.351]	[0.353]	[0.375]	[0.349]	[0.362]	[0.407]

Note: Regression coefficients; standard errors in brackets.
Abbreviation: BMI, body mass index.
†$p < 0.1$, *$p < 0.05$, and **$p < 0.01$.

TABLE A7 Pearson correlation coefficients among risk attitudes by domain, pain, and fatigue.

	General	Health	Driving	Financial	Leisure/sports	Career	Pain	Fatigue
General	1							
Health	0.397**	1						
Driving	0.438**	0.449**	1					
Financial	0.459**	0.404**	0.437**	1				
Leisure/sports	0.603**	0.442**	0.486**	0.459**	1			
Career	0.592**	0.405**	0.457**	0.437**	0.573**	1		
Pain	−0.087**	−0.001	−0.077**	−0.119**	−0.139**	−0.067**	1	
Fatigue	−0.153**	0.018	−0.082**	−0.111**	−0.151**	−0.111**	0.460**	1

†$p < 0.1$, *$p < 0.05$, and **$p < 0.01$.