Associations between multisite pain, depressive symptoms and disturbed sleep with work ability and health-related quality of life in female health care workers with recurrent non-specific low back pain: a cross-sectional study

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Research

Keywords: Depressive symptom, disturbed sleep, low back pain, quality of life, work ability

Posted Date: December 18th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-119412/v1

Associations between multisite pain, depressive symptoms and disturbed sleep with work ability and health-related quality of life in female health care workers with recurrent non-specific low back pain: a cross-sectional study

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Abstract:

Background: The purpose of this study is to investigate how multisite pain, depressive symptoms and disturbed sleep are associated with health-related quality of life (HRQoL) and work ability index (WAI) in health care workers with recurrent non-specific low back pain (LBP).

Methods: 219 female health care workers suffering from recurrent non-specific LBP were recruited for the study. Multisite pain (three or more pain sites with pain intensity of 4 or more on the numeric rating scale), depressive symptoms [modified Finnish version of the nine-item Patient Health Questionnaire (PHQ–9-mFIN)], disturbed sleep, HRQoL (RAND-36) and WAI short form were assessed by validated questionnaires. A generalized linear mixed model with and without covariates was used for statistical analysis. Statistical significance was set at $p< 0.05$.

Results: Depressive symptoms and disturbed sleep were significantly associated with mental HRQoL and WAI ($p<0.001$). Multisite pain was only significantly associated with physical HRQoL.

Conclusions: In female health care workers with recurrent non-specific LBP and currently able to work, depressive symptoms and disturbed sleep were associated with decreased self-reported work ability. Actions to identify these symptoms may decrease work absenteeism due to LBP.

Trial registration: ClinicalTrials.gov, NCT01465698 November 7, 2011 (prospective)

Keywords: Depressive symptom, disturbed sleep, low back pain, multi-site pain, quality of life, work ability

Background

Low back pain (LBP) is a common and complex health problem worldwide. Moreover, LBP is a leading cause of disability and results in enormous economic burden. Most patients with LBP recover spontaneously, but about 10% will develop chronic LBP (1). Further, an estimated 85-90% of LBP cases are classified as non-specific (2). Non-specific LBP is associated with lower health-related quality of life (HRQoL), increased functional disability and increased time off work (3). The highest prevalence of LBP has been reported among women aged between 40 and 80 years, and frequently causes suffering, an increased number of visits to health care centers and work loss (4-6). In Western countries, long-term musculoskeletal pain is considered to be an increasing public health problem resulting in significant work absenteeism (7).

Nurses have an increased risk for musculoskeletal disorders (MSD), and the most frequently reported MSD is LBP (8). Indeed, the one-year prevalence of LBP among health care workers has been found to be as high as 45 to 77% (9). In nurses, LBP can lead to impaired quality of life, work disability and early exit from the labor market (10). In addition, nurses have a number of personal,

physical and psychosocial risk factors for musculoskeletal pain that include constrained postures, forceful movements, high emotional strain, and pressure caused by staff shortages (11). Health care workers often have to work irregular shifts and, as a result, frequently experience sleep disturbances (12). Work-related psychosocial factors, such as high job demand, low job control and low social support, play an important role in the prevalence and incidence of low back pain in health care workers. Organizational factors also play an important role in the occurrence of MSD. (13). Among health care workers, musculoskeletal disorders are an important risk factor for them to consider changing job or even leaving the nursing profession (14).

LBP is often concurrent with pain from other body sites (2). Multi-site musculoskeletal pain has been associated with a greater negative impact on patients` physical functioning and disability, leading to an increased risk for depressive disorders. Moreover, the reporting of multi-site pain appears to worsen the prognosis – there is an increased likelihood of the problem becoming chronic. Multi-site musculoskeletal pain also increases the risk for poor future self-perceived work ability (15). There is a strong association between number of pain sites and sleep quality as well as psychological distress and overall health (16). The afore mentioned relationships are complex and interactive and might therefore be components of a larger, multi-symptom syndrome. Widespread pain together with insomnia and symptoms of depression pose a significant threat to work ability (17).

Psychosocial factors play an important role in the development of disabling persistent LBP, and depression might have an adverse effect on the prognosis of LBP (18). Patients with chronic LBP have significant impairment of the psychological status and reduced HRQoL (19).

Sleep disturbance is highly prevalent in the general population, especially among women (20). Poor sleep quality is known to cause a wide range of physiological and psychological symptoms. Furthermore, sleep disturbance is a common feature of LBP, and the estimated prevalence of sleep disturbance among patients with LBP is about 59% (21). Insomnia forms a health risk and has been associated with a significant risk for lower QoL (22).

Work ability is defined as how physically and mentally able a worker is to cope with the demands of their work (23). The Work Ability Index (WAI) is an instrument that has been widely used to assess work ability (24)**.** The WAI predicts both register-based disability pension (DP) and long-term sickness absence. The individual's own evaluation of work ability compared with lifetime best work ability (WAS) and workers belief of future work ability (FWA) predict both disability pension and long-term sick leave (>10 days) (25). A previous study has indicated that those female workers who have high WAI scores also have higher quality of life, even after retirement (26). Another study suggests that the beliefs of returning to work, pain intensity and work strain are predictive of work ability among women on sick leave due to long-term LBP (27). In addition, individual factors, such as older age, have been associated with poor work ability (28). In the general working population, poor work ability combined with one or more chronic disease is associated with high risk for long-term sickness absence (29).

The causes of the high prevalence, incidence and recurrence of LBP are multifactorial, and therefore LBP should be understood within a biopsychosocial framework.

Methods

Aim of the study

The aim of this study is to investigate the associations of multisite pain, depressive symptoms and disturbed sleep with quality of life and future work ability in female health care workers with recurrent nonspecific LBP, and to identify those symptoms that are the strongest risk factors for reduced QoL and work ability.

Materials and methods

Study design and participants

This cross-sectional study was part of a randomized controlled trial (the NURSE RCT, clinical trial registration NCT01465698) aimed at reducing pain, movement-control impairment and fear-avoidance beliefs in working female health care workers with recurrent non-specific LBP (NSLBP) (n=219) (45). The NURSE- RCT (30) was conducted in the form of 3 identical, consecutive sub-studies. More precise information on recruitment is available in the protocol article on the NURSE RCT (30,31). The study was approved by the Ethics Committee of Pirkanmaa Hospital District, Finland (ETL code R08157).

The inclusion criteria were women aged 30–55 years; worked at current job for at least 12 months; intensity of LBP of at least 2 on the Numeric Rating Scale (scale 0–10) during the past 4 weeks (30. The exclusion criteria were serious former back injury (fracture, surgery, disc protrusion); chronic LBP defined by a physician or self-report of continuous LBP for 7 months or more (30); disease or symptoms that limit participation in moderate intensity neuromuscular exercise; regular engagement in neuromuscular-type exercise more than once a week; pregnant or recently delivered.

Independent variables were set approximately three same size of groups. Group 1 was multisite pain (NRS 4 or more, pain daily or nearly daily and at least 3 pain sites, n=50). Group 2 was

depressive symptom (PHQ-9-mFIN sum score from 9 questions; points 10 or more, which is categories at least moderate depression, n= 61). Group 3 was disturbed sleep (sum score from 3 questions developed by the Finnish Institute of Occupational Health, points 10 or more, n= 55). (Fig.1-9)

Measurements

Questionnaire data was collected during the baseline measurements. Before the baseline measurements informed consent was obtained in writing from all participants.

Dependent variables

The RAND 36-Item Health Survey (RAND-36), a validated Finnish questionnaire (32), was used to assess HRQoL. RAND-36 includes four physical and four mental component items (0-100) and physical and mental summary scales (0-100). Higher scores represent better HRQoL (32) The physical components include physical functioning, role physical, bodily pain, general health and physical component summary scale. The mental components include vitality, social functioning, role emotional, mental health and mental component summary scale.

Work ability was assessed using the short form of WAI, which is the sum score (range 3–27) from four question items: (1) Current work ability (0–10), where 0=unable to work and 10=the best possible), (2) Work ability in relation to physical work demands (1–5), (3) Work ability in relation to mental work demands (1–5) (1=very poor, 5=very good), and (4) Personal prognosis for work ability in 2 years' time (1=hardly able to work, 4=not sure, 7=almost certain work ability) (33).

Independent variables

The criteria for multisite pain during the past 4 weeks were as follows: number of pain sites ≥3 (lower back, upper back and neck, shoulders and upper limbs, hips, knees and lower limbs) with daily or nearly daily pain and intensity of pain of at least 4 on the Numeric Rating Scale (0–10) (34).

Depressive symptoms were assessed by a modified Finnish version of the PHQ—9 (51) (PHQ—9-mFIN) during the past week. The questionnaire consisted of the following question items: 1) Lack of enthusiasm for doing anything, 2) Feeling depressed, 3) Have trouble getting to sleep or staying asleep, 4) Feeling low in energy or slowed down, 5) Have a poor appetite, 6) Cry easily or feel like crying, 7) Feeling bored or having little interest in doing things, 8) Feeling lonely, 9) Feeling hopeless about the future. Scoring 0=not at all to 3=nearly every day, the sum score ranging from 9—27 (35).

Disturbed sleep, in terms of tiredness and sleepiness, was assessed as a sum score from three questions developed by the Finnish Institute of Occupational Health (36): scoring from 3 to 13 (3=no sleepiness or tiredness, 13=daily long-term sleepiness or tiredness). Disturbed sleep contained the following items: 1) Feeling of unsatisfactory awakening lasting for at least one month (score range 1-3), 2) Feeling of tiredness in the daytime (score range 1-5) and 3) Feeling of sleepiness in the daytime (score range 1-5).

Statistical analysis

The associations between the main independent variable and the outcomes were estimated and tested with generalized linear models with gamma distribution due to the skewed distribution of the dependent variables. First, all models included only one independent variable at a time. In the second stage, multiple covariates were included in the models. All non-significant covariates

($p>0.20$) were dropped from the models one at a time. For the parameter estimates and p-values, 95% confidence intervals were reported for each model. Independent variables with $p<0.05$ were considered statistically significant. All the analyses were performed using IBM SPSS software (version 24, IBM Corp, Armonk, NY, USA).

Covariates

The covariates included background variables, such as age, civil status, level of education and smoking, work-related factors covering shift work, health-related factors, such as perceived health, cardiovascular and respiratory diseases, blood pressure disease and the use of medication, and fitness including a modified push-up test and six-minute walk test (6MWT) (37), and amount of exercise.

Results

Descriptive data of the study participants

Baseline characteristics of the study participants are presented in Table 1. The mean age of the participants was 46 years. In total, 41% of participants had normal body weight (BMI under 25 kg/m2) and 18% were obese (BMI 30kg/m2 or over). Most of participants (62%) perceived their health to be good or very good, and 70% of participants were working shift work. More than one third (36%) of the study participants experienced LBP daily or on most days of the week. The mean LBP intensity was 36, measured on the 100 mm visual analog scale (VAS). The duration of the LBP symptoms were less than three months for 65%, 3-6 months for 15% and more than 6 months for 21% for of the study population. In total, 41% of participants reported musculoskeletal pain at 4-6 sites.

Table 1. Baseline characteristics of the study sample (*n*=219)

Subject characteristics		Missing
Age, years, mean (SD)	46,4 (6,8)	
Body mass index (BMI), kg/m^2, n, (%)		
Normal weight (≤24.9)	88 (40.7)	2
Overweight (25.0–29.9)	90 (41.7)	
Obese (≥30.0)	38 (17.6)	
Civil status: % single	35,2	
Smoking (n)		
Non-smoker	157 (71.7)	
Smoking regularly / occasionally	62 (28,3%)	
Perceived health (n)		
Below average	1 (0.5)	1
Average	81 (37.2)	
Good	124 (56.9)	
Very good	12 (5.5)	
Profession related characteristics		
Profession		
% nurses` assistant	40,6	
% nurses	46,6	
% other	12,8	
Number of years working in current job, mean (SD)	11.4 (8.8)	2
Shift work, % yes	69,7	1
Subjectively assessed pain characteristics		
LBP intensity (VAS 0–100; past 4 weeks), mean (SD)	36.2 (22.6)	1
LBP intensity (NRS 0-10), mean (SD)	3,55 (2,1)	1
Frequency of LBP at baseline (n)		27
Daily	23 (12)	
Most days of the week	56 (29)	
A few days a week	82 (43)	
Recovered from low back pain episodes	31 (16)	
Duration of symptoms of LBP at baseline, months (n)		
<3	140 (64.5)	
3–6	32 (14.7)	
≥6	45 (20.7)	
Number of musculoskeletal pain sites * (n)		2
0-2 pain sites	60	
3 pain sites	68	
4-6 pain sites	89	
Depressive symptoms and sleep disturbance indices, mean (SD)		
Depressive symptoms**	7,4 (3,77)	2
Disturbed sleep***	7,53 (2,78)	

* Multi-site pain (NRS >=4, pain daily or nearly daily and at least 3 pain sites, n=50)

** Depressive symptoms (sum score from 9 questions; points 0-27, highest quarter of all participants, n=61)

*** Disturbed sleep (sum score from 3 questions developed by the Finnish Institute of Occupational Health; from 3=no tiredness or sleepiness to 13 = long-term, daily tiredness and sleepiness, sum score 10 or over, highest quarter of all participants, n=55)

Health Related Quality of Life and Work Ability

Descriptive data on the outcome measures (HRQoL, work ability) of the study are presented in Table 2. The mean physical and mental scores of the summary scales of RAND-36 were 73 and 77, respectively (0-100 scale). When compared with the normative data of the female Finnish

population (50), these health care workers had lower values for the physical components of RAND-36, especially bodily pain, but the values of the mental components of RAND-36 were higher. The majority of the study participants reported their work ability to be good. However, 12% of the women believed their future work ability to be poor.

Table 2. Descriptive data for the quality of life and work ability (n=219)

	Mean (SD)	Normal public sample values*	Missing
Quality of life			
RAND-36 sum score	74,0 (10,0)		1
RAND-36 physical component summary (0–100)	72,9 (15,4)		
Bodily pain	63,0 (19,0)	79,2/73,9/74,6	
Physical functioning	85,4 (13,5)	92,1/87,7/83,7	
Role functioning /physical	74,1 (32,5)	83,2/76,9/73,5	
General health	69,0 (16,5)	70,3/65,2/65,4	
RAND-36 mental component summary (0–100)	76,8 (16,8)		
Social functioning	83,7 (19,1)	70,8/74,5/81,7	
Vitality	63,0(18,8)	60,8/65,6/61,5	
Mental health	76,9(14,6)	70,8/74,5/73,1	
Role functioning /emotional	84,4 (28,4)	79,1/76,1/73,1	
Work ability			
Work ability index, short form (score 3–27) mean (SD)	22.1 (2.6)		
Work ability score (WAS) 0-10	7,79 (1,29)		
Future work ability (FWA) (n,%)			
Unlikely (1)	0 (0,0%)		
Not certain (4)	26 (11,9 %)		
Relatively certain (7)	193 (88,1 %)		

*Finnish normal public sample values of females aged 35-44/45-54 years /all (n=1133)

WAI (questionnaire developed by the Finnish Institute of Occupational Health including questions; current work ability compared the lifetime best (0-10), expected work ability in the forthcoming two years (1-7), work ability in relation to the demands of work (2-10)

WAS (current work ability compared with lifetime best, 0= completely unable to work, 10= work ability at its best)

FWA (individual`s own prognosis of his/ her future work ability, poor (1,4) and good (7))

The associations of the physical components of RAND-36 with multisite pain, depressive symptoms and disturbed sleep are presented in Figures 1-4. The bodily pain subscale of RAND-36 was associated with multisite pain when adjusted (p< 0.001), but not with depressive symptoms (p=0.426) or disturbed sleep (p= 0.282) (Fig. 1). The physical functioning subscale of RAND-36 was also associated with multisite pain (p= 0.003), but not with depressive symptoms (p=0,614) or disturbed sleep (p =0,614) (Fig.2). The physical role functioning subscale of RAND-36 was not

associated with multisite pain (p=0.104), depressive symptoms (p=0.620) or disturbed sleep (p=0.127) (Fig. 3). However, the general health subscale of RAND-36 was associated with multisite pain (p=0.008) and depressive symptoms (p =0.006), but not with disturbed sleep (p=0.079) (Fig. 4).

The associations of the mental component of the RAND-36 subscale with multisite pain, depressive symptoms and disturbed sleep are presented in Figures 5-8. The social functioning subscale of RAND-36 was associated with depressive symptoms (p<0.001) and disturbed sleep (p < 0.001), but not with multisite pain (p=0.077). The vitality subscale of RAND-36 was associated with depressive symptoms (p<0.001) and disturbed sleep (p<0.001), but not with multisite pain when adjusted (p=0.193) (Fig. 6). The mental health subscale of RAND-36 was associated with depressive symptoms (p<0.001) and disturbed sleep (p<0.001), but not with multisite pain after adjustments (p=0.142) (Fig.7). The emotional role functioning subscale of RAND-36 was associated with depressive symptoms and with disturbed sleep (p<0.005), but not with multisite pain (p=0.783), and adjustments did not affect the results (Fig.8).

Work ability index (WAI) was associated with depressive symptoms (p=0.007) and disturbed sleep (p<0.001). WAI was not, however, associated with multisite pain when adjusted with age, perceived health and modified push-up test (p=0.155) (Fig.9).

Of the physical components of RAND-36, physical functioning was associated (p< 0.001) with poor future work ability (FWA) after adjustments. The physical role functioning of RAND-36 was also associated with poor FWA (p=0.031) (Table 3). Of the mental components, social functioning was associated with poor FWA (p 0.009). In addition, LBP intensity was associated with poor future work ability (p 0.001) (Table 3).

Table 3 The quality of life and intensity of LBP among those with perceived poor and good future workability

	Poor FWA Mean (SD)	Good FWA Mean (SD)	All n=219) Mean (SD)	Missing	sig (adj)
RAND-36 physical component summary (0–100)	n=25	n=186	n=211	8	
Bodily pain	55,8 (22,5)	63,9 (18,6)	63,0 (19,0)		p 0,183
Physical functioning	72,8 (15,3)	87,1 (12,3)	85,4 (13.5)		p< 0,001
Role functioning /physical	51,0 (43,6)	77,2 (29,5)	74,1(32,5)		p 0,031
General health	59,4 (19,0)	70,3 (15,7)	69,0 (16,4)		p 0,327
RAND-36 mental component summary (0–100)					
Social functioning	71,0 (22,2)	85,4 (18,0)	83,7 (19,1)		p 0,009
Vitality	55,1 (23,2)	64,1 (18,0)	63,0(18,8)		p 0,608
Mental health	68,0 (17,7)	78,1 (13,7)	76,9 (14,6)		p 0,161
Role functioning/ emotional	77,3 (31,5)	84,2(28,0)	83,4 (28,4)		-
Low back pain intensity (VAS 0-100, past 4 weeks)	n=25 50,0 (22,9)	n=193 34,4 (22,0)	n=218 36,2 (22,6)	1	p 0,001

FWA (individuals' own prognosis of their future work ability)

Poor FWA (future work ability; unlikely or not certain)

Good FWA future work ability; relatively certain)

Discussion

The most important findings of this study indicate that recurrent nonspecific LBP combined with depressive symptoms and disturbed sleep have a negative impact on mental HRQoL and work ability in female health care workers. Furthermore, a clinically meaningful intensity of LBP (i.e., VAS ≥ 40 mm) was strongly associated with self-reported future work ability.

In this study, the participants were female health care workers with recurring nonspecific LBP who were still able to work. Among female health care workers, LBP is a common health problem that is accompanied by several individual, physical and psychosocial risk factors, such as high work-related emotional strain (8). The mean intensity of LBP among the female health care workers in the VAS scale was 36 mm, which is close to the clinically meaningful criterion of 40 mm. Most of the women had pain symptoms that had lasted for less than three months and 72% had multisite pain in three or more sites**.** Previous studies have concluded that multisite musculoskeletal pain is a threat to work ability (15) and that widespread pain, insomnia and symptoms of depression together are a serious threat to workability (17). The findings of this present study, however, show

that depressive symptoms and disturbed sleep were more significantly associated with work ability than multisite pain.

Moreover, the majority of the female health care workers reported their work ability and their self-perceived assessment of future work ability (FWA) to be good. However, 12% of the participants were uncertain of their future work ability. Previous studies have shown that poor future work ability predicts long-term sickness absence, disability pension and long-term unemployment (25,38). Furthermore, poor work ability combined with chronic disease is also associated with high risk for long-term sickness absence (29). Patients with LBP are also at risk for poor health-related quality of life (HRQoL) (39). In this study, those participants with poor FWA also had lower HRQoL. In addition, there was a strong association between LBP intensity and poor FWA.

The limitations of the present study include the cross-sectional design and the limited questionnaire used for assessing the quality of sleep. The strengths of the study include the unique study population in terms of non-chronic LBP (i.e., sub-acute or recurrent LBP) with physically strenuous work. Another strength of the study is the use of the modified Finnish version of the nine-item Patient Health Questionnaire, which was recently validated among the present study population (35).

Conculsions

In conclusion, identifying those people with a good or unfavorable prognosis among patients with LBP is an important goal (40). Moreover, recommendations have been made for the use of screening methods in health care to identify those patients in the early stages of LBP with the aim of guiding them to the appropriate treatment to support their staying at work (25). Therefore, the questions relating to depressive symptoms, sleep quality and self-reported future work ability

used in this study might be appropriate tools for identifying patients with poor HRQoL and/or work ability outcome among health care workers with recurrent non-specific LBP. Based on the current results, it would be interesting to define the cut-off points for the psychosocial symptoms of depression and sleep disturbance and to ascertain when they begin to significantly affect HRQoL and work ability. Furthermore, future studies are needed to evaluate the effectiveness of interventions designed to modify psychosocial aspects in LBP patients.

List of abbreviations: HRQoL (health-related quality of life), WAI (work ability index), LBP (low back pain), PHQ-9-mFIN (modified 9-item Patient Health Questionnaire), RAND-36 (RAND-36 item health survey), FWA (future work ability), WAS (work ability score), BMI (body mass index), VAS (visual analogue scale), NRS (numeric rating scale)

Declarations

Ethics approval and consent to participate: The Ethics Committee of Pirkanmaa Hospital District (ETL code R08157) approved the study protocol. The participants recruited to the study received a written information letter clarifying the aims of the study, including risks and benefits. The participants provided their written consent to participate at the first study appointment. We also obtained consent for data sharing and the risk of identification is low.

Consent for publication: Not applicable.

Availability of data and material: The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests: The authors declare that they have no competing interest.

Funding: The study was funded by The Social Insurance Institution of Finland (37/26/ 2011 and 31/26/2015; Pirkanmaa Hospital District, Tampere, Finland (9K127 and 9M099). The funders had

no role in the study design, collection, analysis or interpretation of the data, writing of the report, or decision to submit the article for publication.

Authors' contributions: All authors read, commented and accepted the final version of the manuscript. TV: literature search, study design, data interpretation, writing, tables, figures; JHS: study design, data interpretation, writing; KT: data analysis and interpretation, writing; JP: study design; MK: Project planning, data analysis, manuscript writing.

Acknowledgements: The authors thank the participants of the NURSE-study at the following clinics in the city of Tampere, Finland: Rauhaniemi Hospital unit and Koukkuniemi Home for the Elderly, Kauppi Hospital, Hatanpää Hospital (surgery, infectious, medical and general practice wards) and Park Hospital (geriatrics); Home Services; Physiotherapy Clinic and Tampere University Hospital (12 clinics with 40 wards).

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Figures

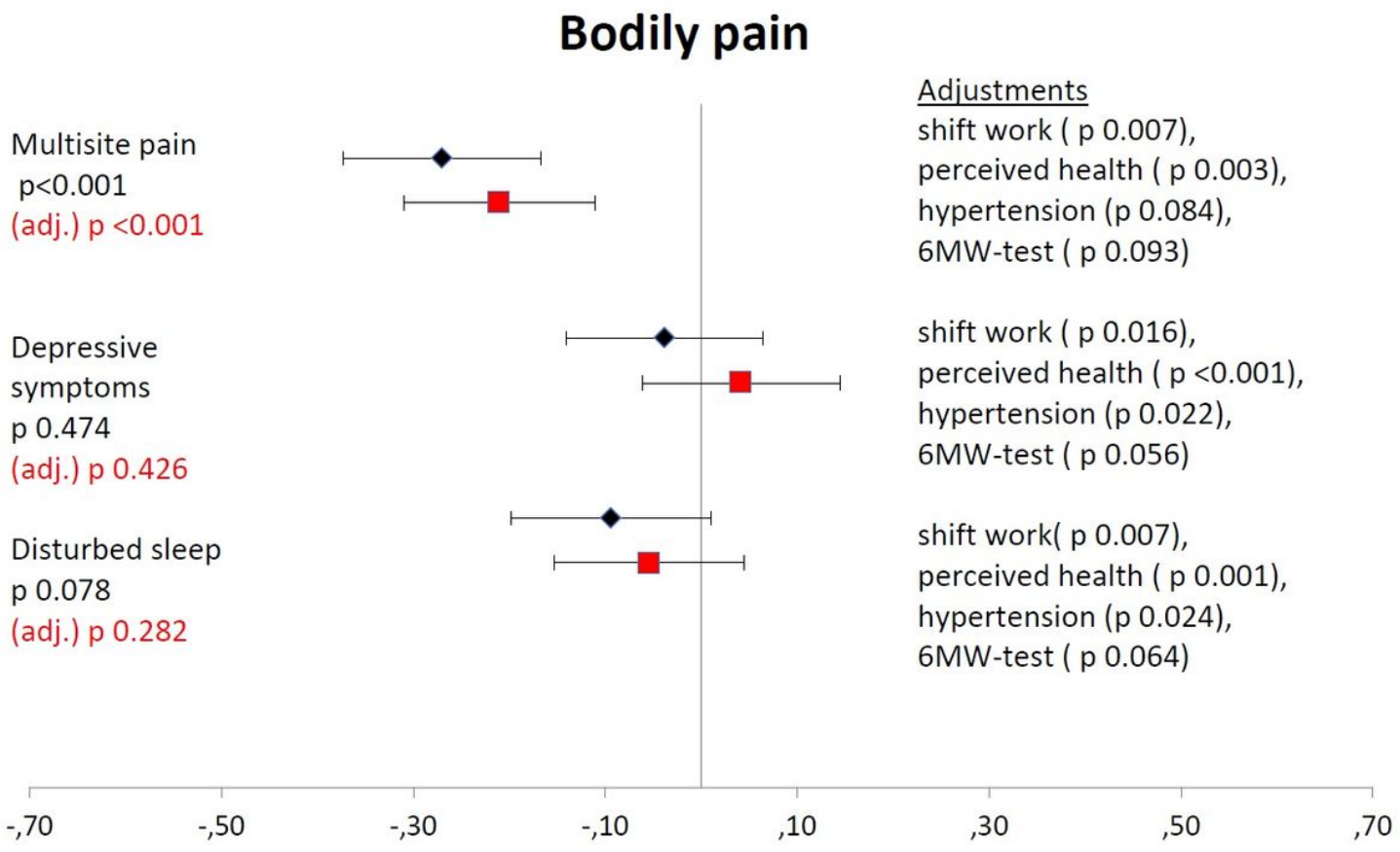

Figure 1

Associations between bodily pain subscale of RAND-36 and multisite pain, depressive symptoms and disturbed sleep (x-axis: 95% confidence interval)

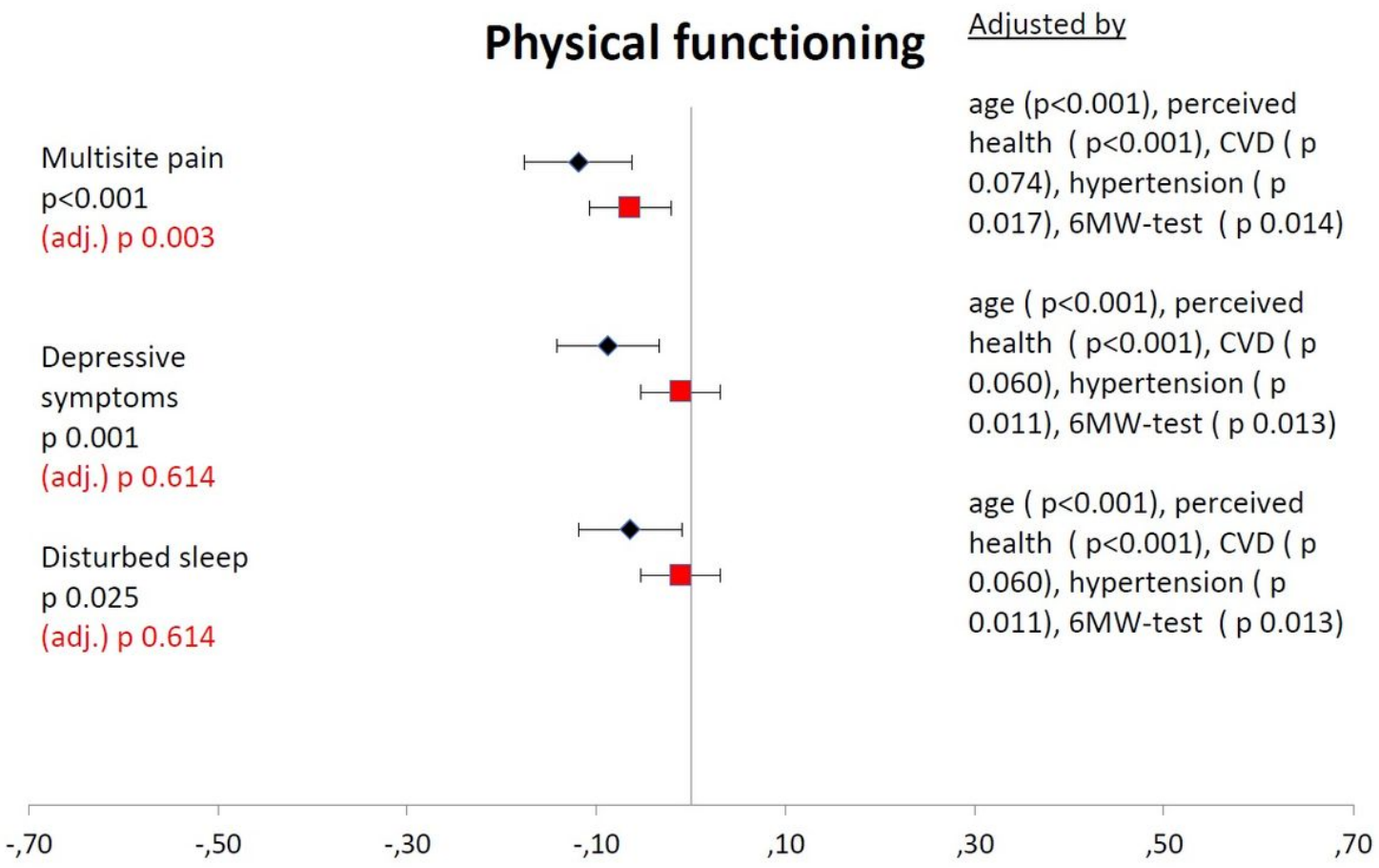

Figure 2

Associations between physical functioning subscale of RAND-36 and multisite pain, depressive symptoms and disturbed sleep (x-axis: 95% confidence interval)

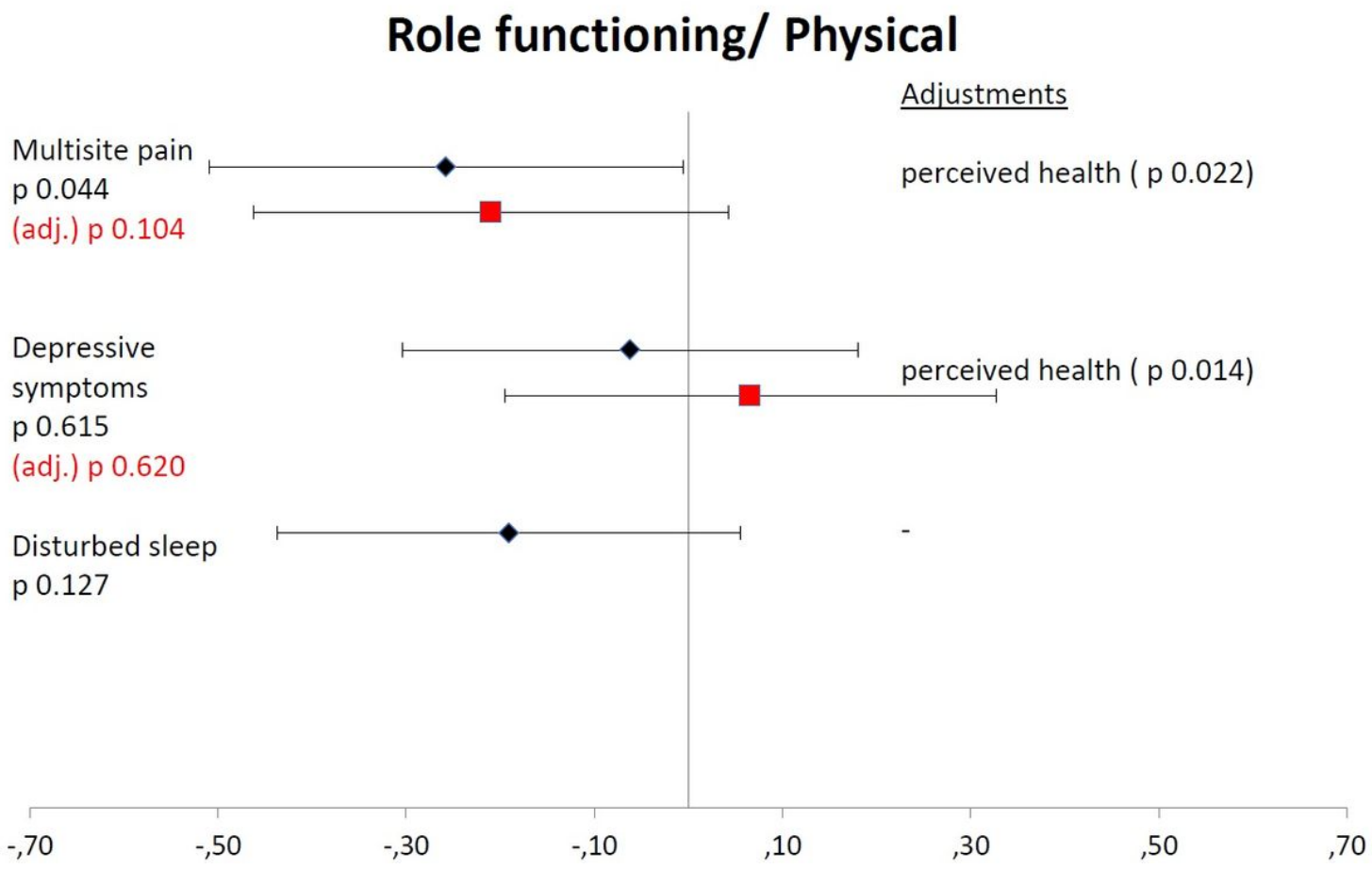

Figure 3

Associations between physical role functioning subscale of RAND-36 and multisite pain, depressive symptoms and disturbed sleep (x-axis: 95% confidence interval)

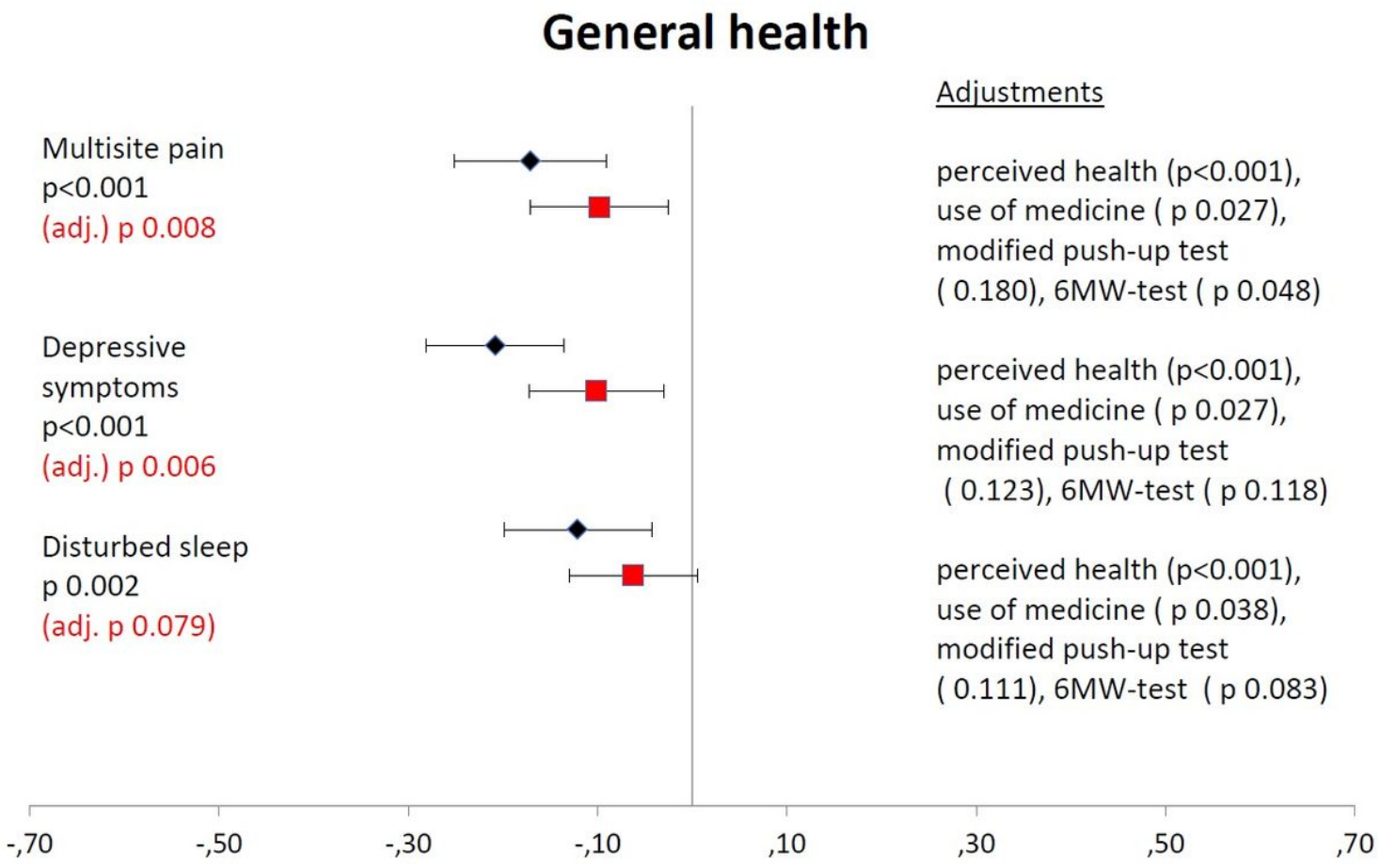

Figure 4

Associations between general health subscale of RAND-36 and multisite pain, depressive symptoms and disturbed sleep (x-axis: 95% confidence interval)

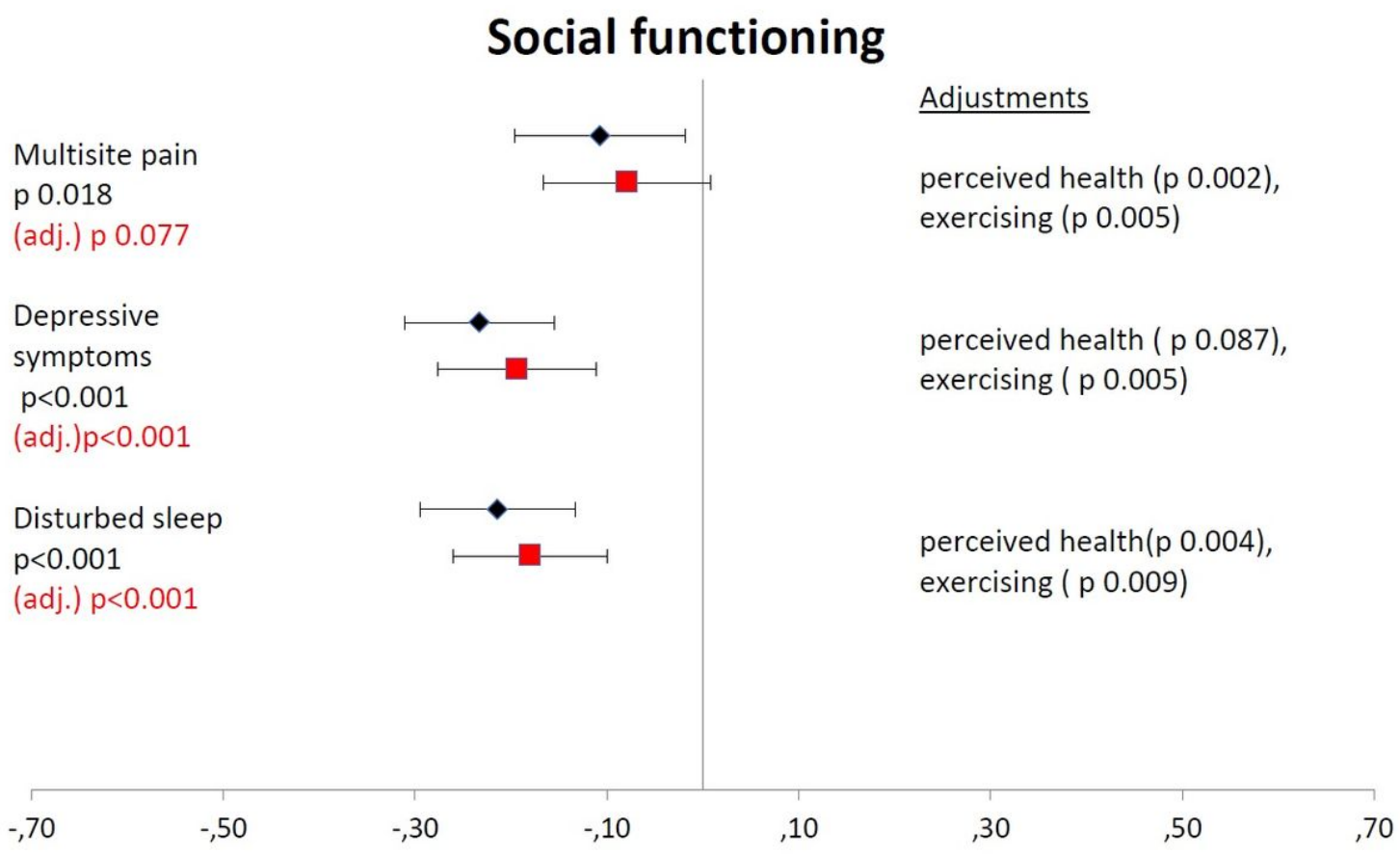

Figure 5

Associations between social functioning subscale of RAND-36 and multisite pain, depressive symptoms and disturbed sleep (x-axis: 95% confidence interval)

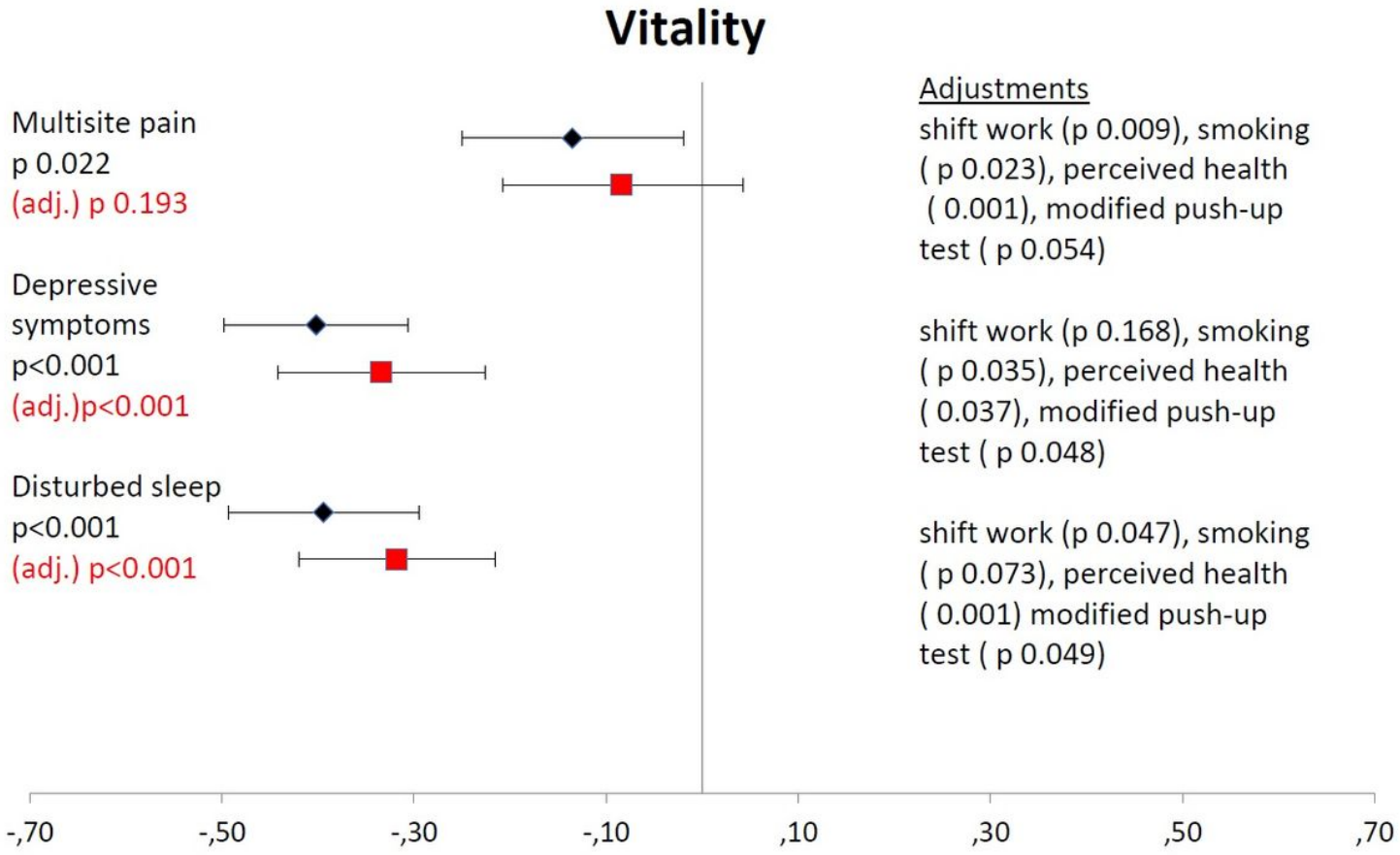

Figure 6

Associations between vitally subscale of RAND-36 and multisite pain, depressive symptoms, and disturbed sleep (x-axis: 95% confidence interval)

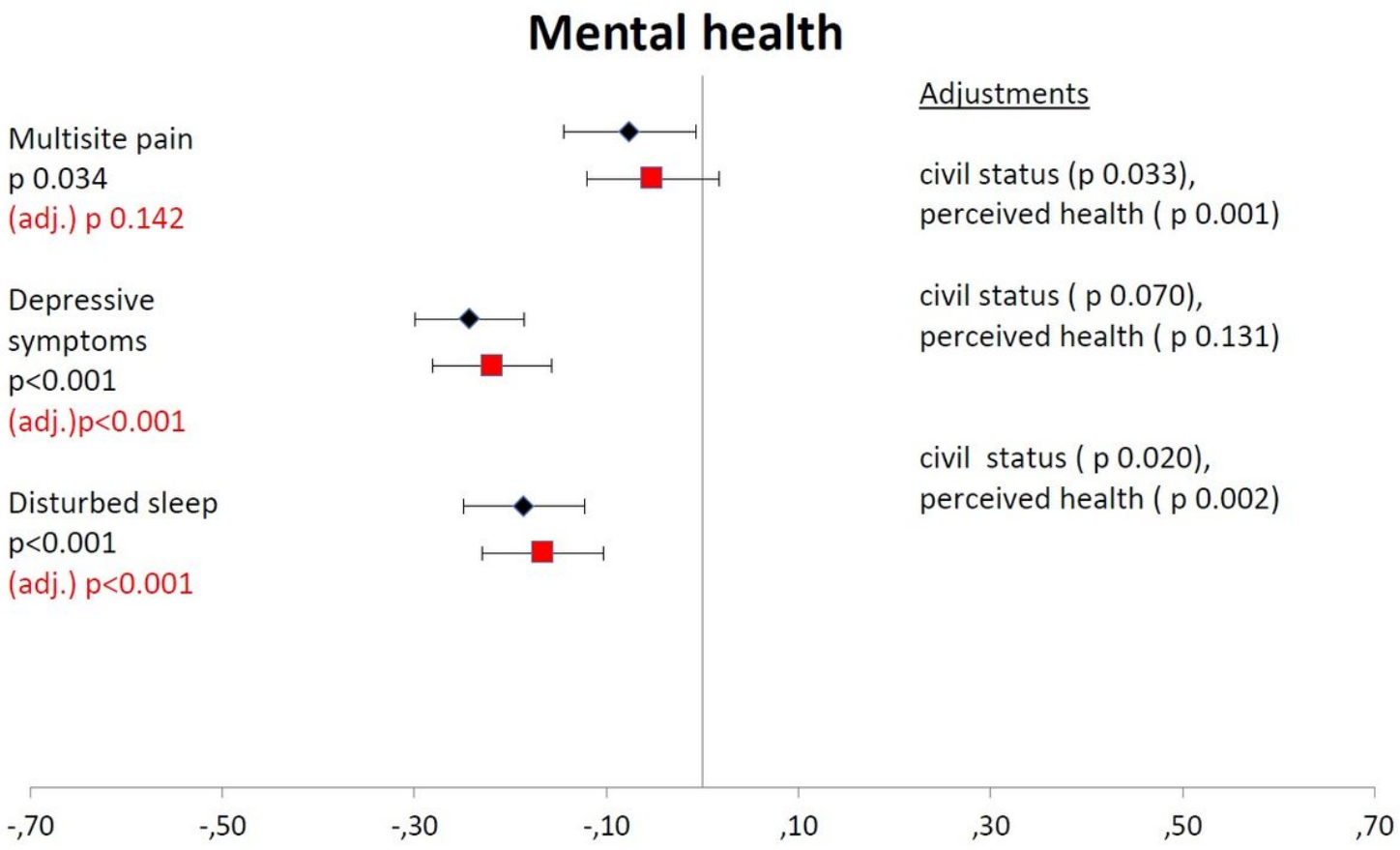

Figure 7

Associations between mental health subscale of RAND-36 and multisite pain, depressive symptoms and disturbed sleep (x-axis: 95% confidence interval)

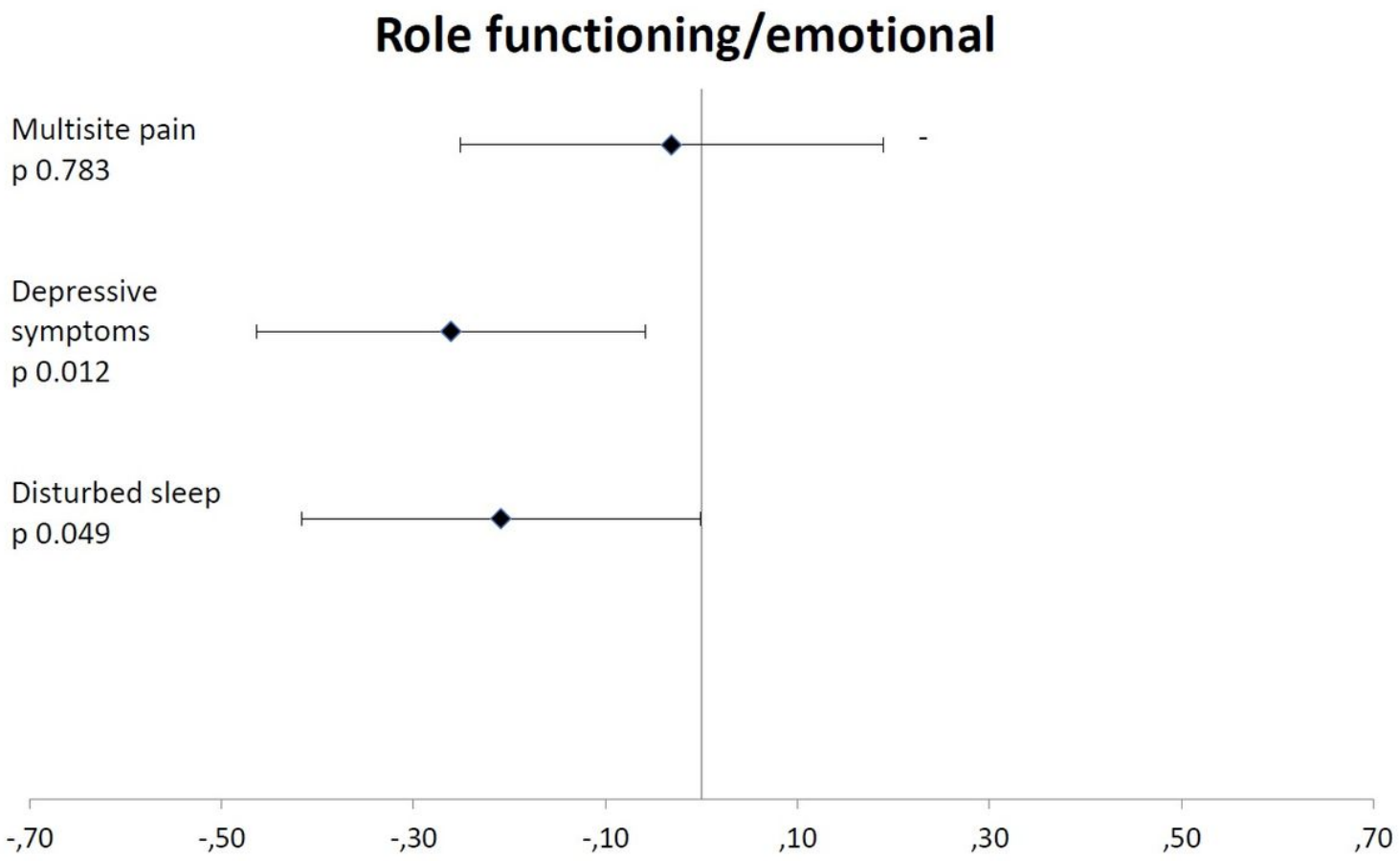

Figure 8

Associations between emotional role functioning subscale of RAND-36 and multisite pain, depressive symptoms and disturbed sleep (x-axis: 95% confidence interval)

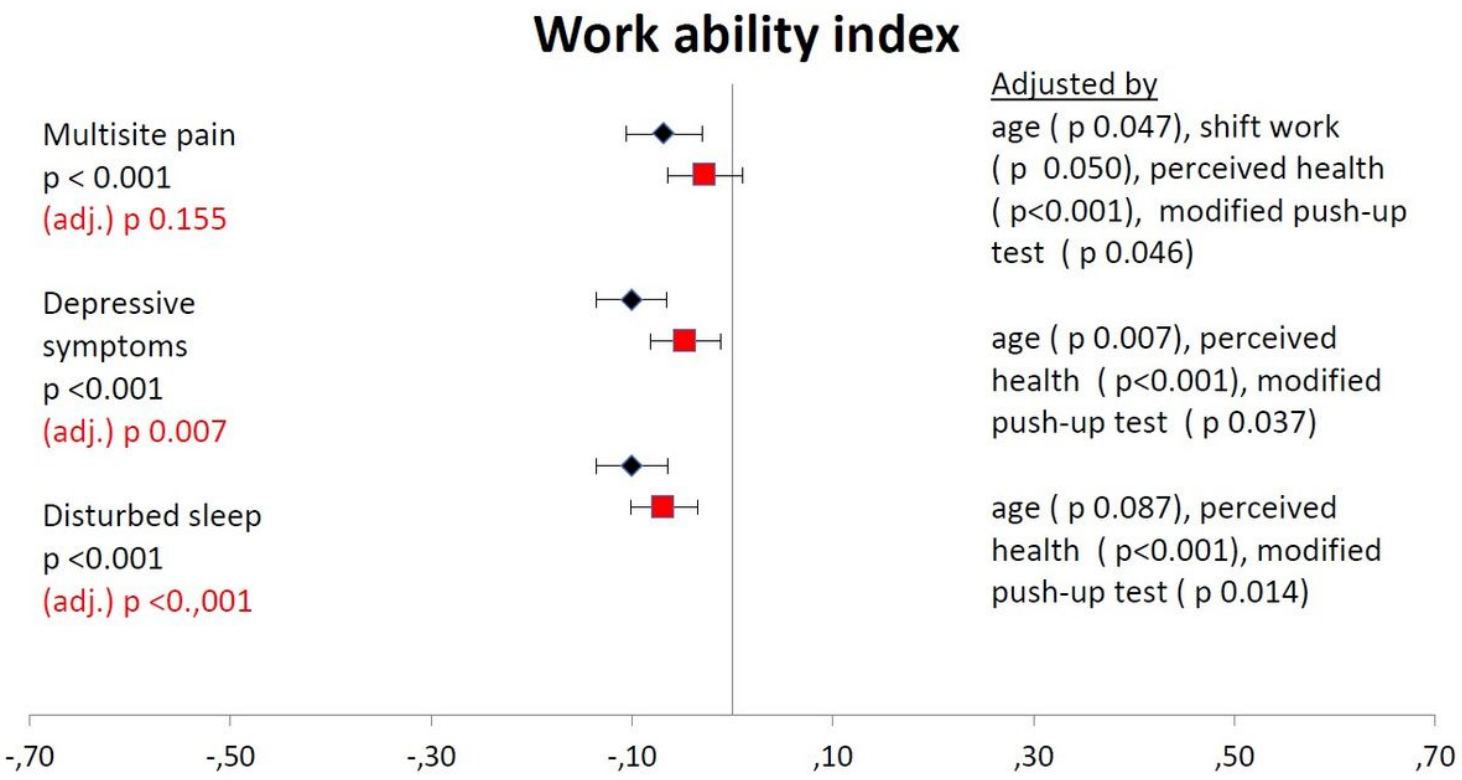

Figure 9

Associations between work ability index and multisite pain, depressive symptoms and disturbed sleep (x-axis: 95% confidence interval)