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Experimental Research Article

High-impact chronic pain: evaluation of risk factors and predictors

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ABSTRACT

Background: The concept of high-impact chronic pain (HICP) has been proposed for patients with chronic pain who have significant limitations in work, social life, and personal care. Recognition of HICP and being able to distinguish patients with HICP from other chronic pain patients who do not have life interference allows the necessary measures to be taken in order to restore the physical and emotional functioning of the affected persons. The aim was to reveal the risk factors and predictors associated with HICP.

Methods: Patients with chronic pain without life interference (grade 1 and 2) and patients with HICP were compared. Significant data were evaluated with regression analysis to reveal the associated risk factors. Receiving operating characteristic (ROC) analysis was used to evaluate predictors and present cutoff scores.

Results: One thousand and six patients completed the study. From pain related cognitive processes, fear of pain (odds ratio [OR], 0.92; 95% confidence interval [CI], 0.87–0.98; $P = 0.007$) and helplessness (OR, 1.06; 95% CI, 1.01–1.12; $P = 0.018$) were found to be risk factors associated with HICP. Predictors of HICP were evaluated by ROC analysis. The highest discrimination value was found for pain intensity (cut-off score > 6.5; 83.8% sensitive; 68.7% specific; area under the curve = 0.823; $P < 0.001$).

Conclusions: This is the first study in our geography to evaluate HICP with measurement tools that evaluate all dimensions of pain. Moreover, it is the first study in the literature to evaluate predictors and cut-off scores using ROC analysis for HICP.

Keywords: Anxiety; Chronic Pain; Emotions; Pain; Pain Measurement; Prevalence; Quality of Life; Risk Factors; ROC Curve; Surveys and Questionnaires.

INTRODUCTION

Chronic pain is defined as “pain that persists beyond the expected period of recovery” and should be considered a disease that serves no useful purpose [1,2]. It is a worldwide problem that poses significant economic and

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social challenges to health systems and society, and a significant physical and mental burden for those affected. Population-based studies have reported that chronic pain is common in adults, and its prevalence is reported to be between 11% and 40% [3–5]. Epidemiological studies have shown that chronic pain increases with age, is reported more by females than males, and also that pain-intensity and pain-related disabilities are more frequent in females [6,7]. Individuals with lower socioeconomic status have higher levels of pain-related disability, and quality of life (QoL) has been found to be more affected [8].

Duration-related expressions of chronic pain are insufficient to indicate areas such as limitation of activities. The concept of high-impact chronic pain (HICP) is recommended to be able to appropriately identify those with a significant level of restriction in daily living activities (work, social, and/or personal care activities) [9,10]. Patients with HICP have been reported to experience more mental health problems, cognitive disorders, and personal care difficulties, and to use more healthcare services than patients with chronic pain not accompanied by activity restrictions [10]. The importance of identifying HICP and developing treatment strategies must be emphasized because these types of important limitations create a highly significant burden not only for the patient, but also for their families, society, and the healthcare system [9].

To the best of the authors' knowledge, the HICP concept has not yet been evaluated in this region in respect of prevalence, etiological risk factors, or treatment approaches. This study aims to examine the concept of HICP with a real patient-focused approach. Moreover, for HICP patients, it is aimed to evaluate the associated risk factors and predictors in all areas related to chronic pain, including demographic characteristics, pain components, activity limitations, and cognitive dimensions. The ability to differentiate individuals with limitations in the main areas of life from those with other chronic pain, and determination of the associated risk factors, will contribute to the development of preventative approaches by healthcare providers and the development of strategies to be able to restore the physical and emotional functioning of the individual.

MATERIALS AND METHODS

1. Participants

The study was conducted between September 1, 2021 and May 31, 2022 at four separate clinics (neurology, algology, physical therapy-rehabilitation, brain and nerve neurosurgery) in two separate centers (Istanbul Bagcılar Training and Research Hospital, and Istanbul Bakırkoy Sadi Konuk Training and Research Hospital). According to 2021 data, the population of the Istanbul Bagcılar district was 744,351 and the population of the Istanbul Bakırkoy district was 228,759. The Bagcılar region is a district where people with lower socioeconomic and educational levels live and has received heavy immigration from other cities. In contrast, the Bakirkoy region has residents of a moderate and upper level for the same demographic data. Thus, a sample was formed with different cultural and socioeconomic levels.

Patients who had been suffering from pain for at least six months or more and who had presented to different pain disciplines in order to get help for the treatment of this pain were invited sequentially in accordance with the outpatient study order. Those over the age of 18 who could read and write and approved the participation in the study in writing were accepted. Cancer patients, those with significant cognitive and psychiatric disorders (determined from medical records or patient statements), those with pain complaints of less than six months, and those with very severe pain that would require surgical or interventional procedures, and those who did not want to participate in this study were not included.

Approval for the study was granted by the Non-Interventional Clinical Research Ethics Committee of Istanbul Medipol University (number: E-10840098-772.02-3629, decision no: 779).

2. Sociodemographic data form

The data form was created with reference to recommendations. A record was made for each participant of age, sex, height, weight, employment status, education level, mean family income, marital status, the presence of additional systemic disease, and smoking habits.

3. Measures

Specific evaluation tools are required to clarify the multidimensional nature, emotional and cognitive components, and psychological dimensions of chronic pain. The

scales used in this study were selected according to these recommendations.

1) Graded Chronic Pain Scale-Revised (GCPS-R)

The GCPS-R was selected for grading patients with chronic pain and for diagnosis of HICP. The scale has been recently revised. The revised scale comprises six items, and the severity of chronic pain is categorized by scale into three grades: mild chronic pain (grade 1); bothersome chronic pain (grade 2); and HICP (grade 3). A scale of three items of pain, enjoyment, and general activities was added to the new scale [11]. The scale was adapted to the Turkish language [12].

2) Pain intensity

In this study, pain intensity was evaluated with the numeric rating scale.

3) Pain-related catastrophizing processes

The pain catastrophizing scale was used in this study to evaluate the coping strategies of patients with chronic pain. The scale consists of 13 items and is scored according to a 5-point (0–4) Likert-type scale, and the total score ranges from 0–52 points. There are three subscales: rumination is related to the relative inability to prevent thoughts about pain during or afterward by predicting a painful episode, magnification is related to the tendency to exaggerate the threat of pain, and helplessness is related to feeling helpless in the context of pain [13].

4) Pain-related anxiety

The Pain Anxiety Symptom Scale was used to evaluate pain-related anxiety. This scale is formed of four subscales: cognitive anxiety, escape-avoidance behaviors, fear of pain, and physiological symptoms of anxiety. A higher score indicates greater pain-related anxiety [14].

5) Pain beliefs

The Pain Beliefs Questionnaire is comprised of 12 items, eight related to organic beliefs and four to psychological beliefs. Organic beliefs reveal the organic nature of pain, and psychological beliefs reveal that pain is under the control of psychological factors [15]. A 6-point (0–5) Likert response was used in the original scale, but for ease of understanding in the current study, 5-point (0–4) Likert responses were used.

6) Pain-related disability

The Pain Disability Questionnaire (PDQ) was used to evaluate pain-related disability. This is a scale of 15 items, nine related to physical function and six to psychosocial disability. There is a 10 cm visual analog scale for each item. The total points range from 0–150 with confirmed threshold values of 0–70 (mild/moderate), 71–100 (severe), and 101–150 (very severe) [16]. In the patient population with headaches, the Headache Impact Test was used to evaluate the pain-related disability. This scale measures the negative effect of headaches on social functionality, role functionality, vitality, cognitive functionality, and psychological problems [17].

7) Emotional functioning

The Hospital Anxiety and Depression Scale was used to measure anxiety and depression. The scale of 14 items, seven related to anxiety and seven to depression, is scored with 4-point (0–3) Likert-type responses. The total scores for anxiety and depression are evaluated as 8–10 points: mild, 11–15 points: moderate, and 16–21 points: severe [18].

8) Health-related quality-of-life (HRQoL)

HRQoL was evaluated with two separate scales. The Pittsburgh Sleep Quality Index evaluates sleep quality and disorders in the last four weeks. The total score ranges from 0–21, and a global score of ≥ 5 reflects a specific and sensitive measurement of poor sleep quality [19]. The second scale used was the Short-Form-36 (SF-36), which consists of eight subscales: physical functioning (PF); bodily pain (BP); physical role (PR); emotional role (ER); mental health (MH); social functioning (SF); vitality (VT); general health (GH). The scale does not provide a single total score, but separate total points are given for each sub-scale. The sub-scales evaluate health between 0 and 100 where 0 indicates poor health and 100 good health [20].

4. Neurological evaluation

The head and/or face pain and neuropathic pain subgroups of the study sample were formed of patients invited from the neurology polyclinic. A specialist according to the recommendations of the International Headache

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Society [21] made the diagnosis of primary headache.

5. Psychiatric evaluation

A psychiatrist according to the Diagnostic and Statistical Handbook of Mental Disorders, Fifth Edition [22] conducted interviews, and psychiatric disorders accompanying chronic pain were evaluated.

6. Data analysis

Statistical analyses were performed using the IBM SPSS Statistics software 25 (IBM Co., Armonk, NY). Categorical measurements were summarized as numbers (N) and percent (%), and continuous measurements as mean ± standard deviation (SD) (median and minimum [min]–maximum [max] where necessary). In the comparisons of categorical variables, the chi-square (χ^2) test or Fisher's test statistic were used. In the comparisons of continuous measurements between groups, the Student's *t*-test was applied to parameters that showed normal distribution, and the Mann–Whitney *U*-test was used when the parameters did not show normal distribution. The Logistic Regression Analysis Back-Wald method was used as a multivariate analysis method. In all tests, the level of statistical significance was set at $P < 0.050$. Receiver operating characteristic (ROC) analysis was used to calculate cutoff points for the evaluation tools and to determine predictors in patients with HCIP. For ROC analysis, an area under the curve (AUC) value of 0.5 shows no predictive ability, whereas a value of 1.0 indicates perfect discrimination. AUC value 0.6–0.69 corresponds to poor accuracy; AUC value 0.7–0.79 corresponds to fair accuracy; 0.8–0.89 corresponds to good accuracy; 0.9–1.0 corresponds to excellent accuracy [23].

RESULTS

A total of 1,613 patients who presented at the polyclinics defined in the methods section were invited to the study and 1,368 of them agreed to participate in the study. One hundred fifty-five of the participants could not fill out the questionnaires as requested. Although the patients who had been suffering from pain for 6 months or longer and therefore applied to the hospital for help were included in the study, 207 participants were determined to have no chronic pain (grade 0) according to the GCPS-R scoring algorithm. Since the study plan included the comparison of non-HICP (grade 1 and grade 2) and HICP groups, participants who met grade 0 were excluded from the sample, and as a result, 1,006 patients (aged 18–75; 741 females [73.7%]; 265 males [26.3%]) completed the study. Five hundred ninety-one (58.7%) participants had HICP and 415 (41.3%) participants had non-HICP.

In the evaluation of the demographic data, the mean age was calculated to be 45.3 ± 13.2 years in the HCIP group and 40.1 ± 12.5 years in the non-HCIP group. The HCIP patients were predominantly female (74.6%), housewives (47.7%), married (74.1%), and had a primary school level of education (31.8%). Obesity was seen at a higher rate in the HCIP group (31.1%; $P = 0.016$). The average family income for patients with HICP was calculated as 3,500 Turkish Lira (TL) (700–40,000 TL range) and this was below the minimum wage in Turkey at the time of the study. Although the proportion of female participants was higher in the HICP and non-HICP groups (74.6% and 73.3%, respectively), the proportion of housewives was higher in patients with HICP (47.7%), while the proportion of full-time employees was higher in patients non-HICP (47.2%). The most common comorbidity in HCIP patients was hypertension (20.3%; $P = 0.001$). In the comparisons of the two groups, no statistically significant difference was determined in respect to sex, the presence of coronary artery disease, and smoking status ($P > 0.050$), and the difference between the groups in respect to all the other demographic variables were statistically significant ($P < 0.050$) (**Table 1**). As a result of the logistic regression analysis to determine dependent and independent factors associated with HICP, leaving work because of pain (odds ratio [OR], 3.81; 95% confidence interval [CI], 1.04–15.43; $P = 0.049$), and never working (OR, 5.70; 95% CI: 1.03–31.49; $P = 0.046$) were seen to be significant risk factors from the demographic data.

In the evaluation of the pain characteristics, the mean duration of pain was determined to be 24 months (range, 6–420 months) in the HCIP group and 12 months (range, 6–120 months) in the non-HCIP group. Widespread body pain was more common in HCIP patients (19.1%; $P < 0.001$). In the time pain modeling, HICP patients reported more continuous and/or constant pain (64.5%; $P < 0.001$). Patients with HICP reported that their pain aroused and/or affected sleep quality more than non-HICP patients (68.5%; $P < 0.001$). The evaluations of the pain characteristics of the HCIP and non-HCIP groups are shown in **Table 2**. A statistically significant difference was determined between the groups ($P < 0.050$). As expected, the HICP patients had a greater pain burden. As a result of the regression analysis, pain intensity (OR, 1.69; 95% CI, 1.47–1.94; $P < 0.001$), pain frequency (OR, 0.99; 95% CI,

Table 1. Demographic characteristics of the study participants

Variable	Non-HICP (grade[a] 1 and 2) (n = 415)	HICP (grade 3) (n = 591)	*P* value
Age (yr)	40.1 ± 12.5	45.3 ± 13.2	< 0.001
BMI[b]	26.7 ± 5.3	27.8 ± 5.3	0.001
Obesity[c]	100 (24.1)	184 (31.1)	0.016
Sex			0.424
Female	300 (72.3)	441 (74.6)	
Male	115 (27.7)	150 (25.4)	
Working status			< 0.001
Housewife	120 (28.9)	282 (47.7)	
Working full time	196 (47.2)	150 (25.4)	
Working part time	7 (1.7)	8 (1.4)	
Resigned from his job	22 (5.3)	55 (9.3)	
Never worked	10 (2.4)	15 (2.5)	
Retired	37 (8.9)	67 (11.3)	
Student	23 (5.5)	14 (2.4)	
Education level			0.019
Course	11 (2.7)	22 (3.7)	
Primary school	100 (24.1)	188 (31.8)	
Middle school	39 (9.4)	65 (11.0)	
High school	225 (54.2)	276 (46.7)	
University	40 (9.6)	40 (6.8)	
Average family income (TL[d]), (range)	4,250 (1,000–45,000)	3,500 (700–40,000)	< 0.001
Marital status			< 0.001
Single	122 (29.4)	84 (14.2)	
Married	258 (62.2)	438 (74.1)	
Widow	14 (3.4)	33 (5.6)	
Divorced	20 (4.8)	36 (6.1)	
Living together	1 (0.2)	0	
Chronic diseases			
DM	34 (8.2)	86 (14.6)	0.002
HT	48 (11.6)	120 (20.3)	0.001
TD	44 (10.6)	90 (15.2)	0.038
CAD	15 (3.6)	36 (6.1)	0.082
Others	64 (15.4)	124 (21.0)	0.027
Smoking			
Yes	141 (34.0)	234 (39.6)	0.074

Values are presented as mean ± standard deviation or number (%).

HICP: high-impact chronic pain, BMI: body mass index, TL: Turkish Lira, DM: diabetes mellitus, HT: hypertension, TD: thyroid dysfunction, CAD: coronary artery disease.

[a]Grading was obtained from the graded chronic pain scale revised (GCPS-R) scoring algorithm, grade 1: mild chronic pain; grade 2: bothersome chronic pain; grade 3: HICP.

[b]BMI calculated using the formula kg/m^2.

[c]BMI > 30.

[d]The minimum wage for the period during which the study is performed = 4,250 TL ($326.9), $1 = 13 TL.

0.98–1.00; $P = 0.023$), and pain-related disability (OR, 1.01; 95% CI, 1.01–1.02; $P = 0.002$) were shown as modifiable risk factors for patients with HCIP. A statistically significant difference was determined between the groups in respect to physical health and sleep quality ($P < 0.001$) (**Table 2**). As expected, HRQoL and sleep quality were more affected in patients with HICP. Because of regression analysis, PR from scales assessing HRQoL was found to be significant for patients with HICP (OR, 0.99; 95% CI: 0.99–1.00; $P = 0.010$).

The inclusion of psychosocial factors in the concept of pain helps to explain the limited relationship between organic pathology and pain severity [24]. The mean anxiety score was calculated as 9 (range, 0–21) (borderline

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Table 2. Pain characteristics, physical health, and sleep quality of the study participants

Variable	Non-HICP (grade[a] 1 and 2) (n = 415)	HICP (grade 3) (n = 591)	*P* value
Pain duration (mo)	12 (6–120)	24 (6–420)	0.002
Pain location			
Head and/or face, or mouth region	164 (39.5)	156 (26.4)	< 0.001
Cervical (with and without upper extremity radiation) region	134 (32.3)	228 (38.6)	0.045
Upper shoulder or upper limbs	94 (22.7)	181 (30.6)	0.005
Back	99 (23.9)	166 (28.1)	0.146
Back pain with radiation	158 (38.1)	357 (60.4)	< 0.001
Leg(s)	29 (7.0)	50 (8.5)	0.408
Knee(s)	79 (19.0)	154 (26.1)	0.010
Hip(s)	69 (16.6)	158 (26.7)	0.001
Dorsal region	100 (24.1)	172 (29.1)	0.084
Abdomen region	12 (2.9)	27 (4.6)	0.189
Chest region	11 (2.7)	35 (5.9)	0.014
Anal, perineal, or genital region	39 (9.4)	109 (18.4)	< 0.001
Widespread body and joint pain (more than three sites)	44 (10.6)	113 (19.1)	< 0.001
Time - pain relationship			< 0.001
Continuous, continuous-constant	150 (36.1)	381 (64.5)	
Rhythmic, periodic, intermittent	177 (42.7)	166 (28.1)	
Short instant transient	88 (21.2)	44 (7.4)	
Does the pain wake you from sleep? - Does it affect your sleep quality? Yes	182 (43.9)	405 (68.5)	< 0.001
Have you been operated before for pain? Yes	67 (16.1)	132 (22.3)	0.016
Previous pain treatments			
Medication	229 (55.2)	418 (70.7)	< 0.001
Exercise	106 (25.5)	192 (32.5)	0.021
Physiotherapy	120 (28.9)	267 (45.2)	< 0.001
Nerve block and/or epidural injection	20 (4.8)	69 (11.7)	< 0.001
I did not receive treatment	66 (15.9)	75 (12.7)	0.166
Spinal cord stimulation	3 (0.7)	4 (0.7)	> 0.999
Prp, ozone, btx, *etc*.	10 (2.4)	16 (2.7)	0.842
Other	6 (1.4)	15 (2.5)	0.269
Pain intensity[b]	6 (1–10)	8 (2–10)	< 0.001
Pain disability[c]	51 (0–135)	97 (0–150)	< 0.001
Pain disability[d]	52 (6–65)	59 (8–66)	< 0.001
Pain frequency[e]	45 (0-100)	22 (0–100)	< 0.001
Physical functioning (SF-36)	70 (0–100)	45 (0–100)	< 0.001
Role function physical aspect (SF-36)	50 (0–100)	25 (0–100)	< 0.001
General health (SF-36)	55 (5–90)	40 (0–95)	< 0.001
Sleep quality[f]	48 (14–233)	59 (11–234)	< 0.001

Values are presented as mean (range), number (%), or median (minimum–maximum).

HICP: high-impact chronic pain, SF-36: Short-Form-36, Prp: platelet rich plasma, btx: botulinum toxin.

[a]Grading was obtained from the graded chronic pain scale revised (GCPS-R) scoring algorithm, grade 1: mild chronic pain; grade 2: bothersome chronic pain; grade 3: HICP.

[b]Pain intensity was calculated by the numeric rating scale (NRS).

[c]Pain related disability was calculated by the pain disability questionnaire (PDQ).

[d]Pain related disability was calculated by the headache impact test (HIT-6) for headache group.

[e]Pain frequency was calculated by the SF-36 bodily pain (BP) subscale.

[f]Sleep quality was calculated by the Pittsburgh Sleep Quality Index (PSQI).

Table 3. The mean (min–max) values of the scales used in the study for assessing the neuropsychological properties and mental health

Scale	Non-HICP (grade[a] 1 and 2) (n = 415)	HICP (grade 3) (n = 591)	*P* value
PCS			
Rumination	7 (0–16)	12 (0–16)	< 0.001
Magnification	4 (0–12)	7 (0–12)	< 0.001
Helplessness	9 (0–24)	15 (0–24)	< 0.001
Total	20 (3–52)	33 (0–52)	< 0.001
PASS-20			
Cognitive	10 (0–20)	14 (0–20)	< 0.001
Fear	7 (0–20)	12 (0–20)	< 0.001
Physiological anxiety	3 (0–20)	5 (0–20)	< 0.001
Escape avoidance	10 (0–20)	13 (0–20)	< 0.001
Total	33 (0–74)	45 (0–80)	< 0.001
PBQ			
Total	11 (2–22)	11 (4–24)	0.154
HAD-A			
Total	6 (0–19)	9 (0–21)	< 0.001
HAD-D			
Total	6 (0–18)	8 (0–20)	< 0.001
Mental health (SF-36)	21.4 (0–41)	18.4 (0–44)	< 0.001
Social functioning (SF-36)	62 (12–100)	50 (0–100)	< 0.001
Role function emotional aspect (SF-36)	66 (0–100)	33 (0–100)	< 0.001
Vitality (SF-36)	22 (0–51)	17 (0–53)	< 0.001

min: minimum, max: maximum, HICP: high-impact chronic pain, PCS: pain catastrophizing scale, PASS-20: pain anxiety symptom scale, PBQ: pain beliefs questionnaire, HAD-A: hospital anxiety and depression scale-anxiety, HAD-D: hospital anxiety and depression scale-anxiety, SF-36: Short-Form-36.
[a]Grading was obtained from the graded chronic pain scale revised (GCPS-R) scoring algorithm, grade 1: mild chronic pain; grade 2: bothersome chronic pain; grade 3: HICP.

anxiety) and the mean depression score as 8 (range, 0–20) (borderline depression) in the HICP group, and the difference between the two groups in respect to anxiety-depression was statistically significant (*P* < 0.001). In the evaluation of pain-related cognitive processes, a statistically significant difference was determined between the HICP and non-HICP groups in both the pain-related anxiety total and sub-scale scores and in the measurement tools that evaluated catastrophizing thoughts (*P* < 0.001). A statistically significant difference was determined between the groups in respect to the SF-36 scores evaluating mental health (*P* < 0.001) (**Table 3**). No difference was found between the groups in respect to pain beliefs (*P* > 0.050). According to the logistic regression analysis results, the fear of pain (OR, 0.92; 95% CI, 0.87–0.98; *P* = 0.007) and helplessness (OR, 1.06; 95% CI, 1.01–1.12; *P* = 0.018) from pain-related cognitive processes were found to be risk factors associated with HICP (**Table 4**).

ROC analysis results are given in **Table 5**. Accordingly, the pain-intensity from pain related processes provided good distinguishing power (cut-off score > 6.5; 83.8% sensitive; 68.7% specific; AUC = 0.823; standard error [SE] = 0.02; *P* < 0.001) and, for pain-related disability, was shown to have acceptable separation power (cut-off score > 73.5; 71.3% sensitive; 71.7% specificity; AUC = 0.795; SE = 0.02; *P* < 0.001). The results for mental health with systemic anxiety and depression had poor accuracy (AUC, 0.6–0.69). For pain-related anxiety, which is one of the pain-related cognitive processes, acceptable discrimination power (AUC value 0.7–0.79; *P* < 0.001) was found in all subscales and total scores except psychological anxiety (AUC value 0.6–0.69). Pain-related anxiety (total) assessment was calculated as 69.0% sensitive, 68.4% specificity (AUC = 0.732; SE = 0.02; *P* < 0.001), with a cut-off score of > 11.5. All subscales and the total scores had acceptable discriminatory power (AUC value between 0.7 and 0.79; *P* < 0.001), except for magnification (AUC value between 0.6 and 0.69) from catastrophizing thoughts. A cutoff value of > 25.5 for the total points of pain catastrophization was found to have 66.7% sensitivity and 66.4% specificity (AUC = 0.729; SE = 0.02; *P* < 0.001). There was no cutoff value for psychogenic beliefs from the pain beliefs, and the results were not significant (*P* = 0.160). In the HRQoL, PF and PR were found to have significant differentiating

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Table 4. Logistic regression modeling to identify factors associated with high-impact chronic pain (HICP)

Factors associated with HICP	*P* value	OR	95% CI for OR	
			Lower	Upper
Step 1				
Age	0.125	1.02	1.00	1.04
Obesity	0.706	1.09	0.70	1.71
Working status (reference student)	0.037			
Housewife	0.034	3.77	1.11	12.87
Working full time	0.208	2.13	0.66	6.88
Resigned from his job (because of pain)	0.022	6.01	1.30	27.83
Never worked	0.042	6.91	1.07	44.25
Retired	0.091	3.39	0.82	14.00
Pain location				
Head and/or face, or mouth region	0.570	0.85	0.49	1.49
Cervical (with and without upper extremity radiation) region	0.615	0.89	0.57	1.40
Upper shoulder or upper limbs	0.266	0.77	0.49	1.22
Back pain with radiation	0.529	1.15	0.75	1.77
Knee(s)	0.115	1.50	0.91	2.50
Hip(s)	0.749	0.92	0.55	1.53
Chest region	0.596	0.75	0.25	2.21
Anal, perineal, or genital region	0.188	0.67	0.37	1.22
Widespread body and joint pain (more than three sites)	0.477	0.70	0.27	1.86
Age	0.266	1.38	0.78	2.43
Pain duration (mo)	0.129	1.00	1.00	1.01
Pain intensity[a]				
Total	< 0.001	1.67	1.45	1.94
Pain disability[b]				
Total	0.006	1.01	1.00	1.02
Pain frequency[c]				
Total	0.066	0.99	0.98	1.00
Pain-related anxiety[d]				
Cognitive	0.228	1.04	0.98	1.10
Escape-avoidance	0.788	1.01	0.95	1.07
Fear	0.068	0.94	0.08	1.01
Physiological_anxiety	0.208	0.96	0.91	1.02
Catastrophizing thoughts[e]				
Helplessness	0.018	1.08	1.01	1.16
Rumination	0.475	0.97	0.90	1.05
Magnification	0.603	0.97	0.86	1.09
Pain beliefs[f]				
Organic (PBQ)	0.945	1.00	0.96	1.04
Psychological (PBQ)	0.544	1.02	0.97	1.07
Anxiety[g]	0.853	1.01	0.95	1.07
Depression[h]	0.562	0.98	0.92	1.05
Sleep quality[j]	0.514	1.00	1.00	1.01
Physical health[J]				
Physical functioning	0.612	1.00	0.99	1.01
Physical role	0.031	0.99	0.98	1.00
General health	0.714	1.00	0.98	1.01
Mental health[k]				
Emotional role (SF-36)	0.366	1.00	0.99	1.00
Vitality (SF-36)	0.354	0.99	0.97	1.01
Mental health (SF-36)	0.176	1.02	0.99	1.05
Social functioning (SF-36)	0.240	1.01	1.00	1.02
Constant	0.001	0.01		

Table 4. Continued

Factors associated with HICP	*P* value	OR	95% CI for OR	
			Lower	Upper
Step 2				
Age	0.098	1.02	1.00	1.03
Working status (reference student)	0.051			
Housewife	0.063	2.88	0.94	8.79
Working full time	0.348	1.67	0.57	4.85
Resigned from his job (because of pain)	0.049	3.81	1.04	15.43
Never worked	0.046	5.70	1.03	31.49
Retired	0.191	2.39	0.65	8.83
Pain intensity[a]				
Total	< 0.001	1.69	1.47	1.94
Pain disability[b]				
Total	0.002	1.01	1.01	1.02
Pain frequency[b]				
Total	0.023	0.99	0.98	1.00
Fear	0.007	0.92	0.87	0.98
Helplessness	0.018	1.06	1.01	1.12
Physical role	0.010	0.99	0.99	1.00
Constant	< 0.001	0.01		

OR: odds ratio, CI: confidence interval.
[a]Pain intensity was calculated by the numeric rating scale (NRS).
[b]Pain disability was calculated by the pain disability questionnaire (PDQ).
[c]Pain frequency was calculated by the SF-36 bodily pain (BP) subscale.
[d]Pain related anxiety was evaluated with the pain anxiety symptom scale (PASS-20).
[e]Catastrophizing thoughts were evaluated with the pain catastrophizing scale (PCS).
[f]Pain beliefs were assessed by the pain beliefs questionnaire (PBQ).
[g]Anxiety was assessed by the hospital anxiety and depression scale-anxiety (HAD-A).
[h]Depression was assessed by the hospital anxiety and depression scale-depression (HAD-D).
[i]Sleep quality was assessed by the Pittsburgh Sleep Quality Index (PSQI).
[j]Physical health was evaluated with the Short-Form-36 (SF-36).
[k]Mental health was evaluated with the SF-36.

power (AUC, 0.7–0.79).

DISCUSSION

The aim of this study was to reveal the prevalence, associated risk factors, and predictors of HICP in the chronic pain patient population.

1. Prevalence and demographic characteristics

A duration-based definition of chronic pain alone is not sufficient to explain areas such as activity restriction or life interventions. The concept of HICP has been recently proposed, which is characterized by more severe pain, increased mental health problems, cognitive impairment, and restriction in at least one significant activity [4,9–11,25]. Although the patients in the study were those with complaints of pain ongoing for at least 6 months, 207 (17.1%) of the first 1,213 participants were determined not to have chronic pain according to the GCPS-R, and so they were not included. This finding supports the view that the definition of chronic pain based only on duration is deficient.

The experience of chronic pain and HICP increase along with age, and older age is a risk factor for the progression of disability [6,26]. Contrary to previous studies [10,27], the mean age of HICP patients was higher than non-HICP patients in the current study, however age was not a risk factor for HICP according to regression analysis results. The prevalence of chronic pain experienced and reported by females is greater than males [7,28]. Similarly, in the current study, there was a higher ratio of females in both the HICP and non-HICP groups, but there was no

Table 5. Receiver operating characteristic (ROC) analysis of the scales used in the study for high-impact chronic pain (HICP)

Pain characteristics, pain related cognitive processes, and quality of life	Cut off value	AUC (SE)	Sensitivity %/ specificity %	*P* value	95% CI AUC	
					Lower bound	Upper bound
Pain intensity[a]						
Total	> 6.5	0.823 (0.02)	83.8/68.7	< 0.001	0.79	0.85
Pain disability[b]						
Total	> 73.5	0.795 (0.02)	71.3/71.7	< 0.001	0.76	0.83
Pain related anxiety[c]						
Cognitive	> 11.5	0.732 (0.02)	72.0/66.3	< 0.001	0.70	0.76
Escape-avoidance	> 11.5	0.706 (0.02)	66.7/64.5	< 0.001	0.67	0.74
Fear	> 9.5	0.706 (0.02)	64.0/66.7	< 0.001	0.67	0.74
Physiological anxiety	> 3.5	0.618 (0.02)	60.0/59.0	< 0.001	0.58	0.65
Total	> 11.5	0.732 (0.02)	69.0/68.4	< 0.001	0.69	0.77
Catastrophizing thoughts[d]						
Rumination	> 8.5	0.710 (0.02)	68.5/62.4	< 0.001	0.68	0.74
Magnification	> 5.5	0.696 (0.02)	66.0/62.4	< 0.001	0.66	0.73
Helplessness	> 11.5	0.741 (0.02)	67.9/66.7	< 0.001	0.71	0.77
Total	> 25.5	0.729 (0.02)	66.7/66.4	< 0.001	0.69	0.76
Pain beliefs[e]						
Organic	< 23.5	0.681 (0.02)	60.3/61.9	< 0.001	0.65	0.71
Psychogenic	-	0.527 (0.02)	-	0.160	0.49	0.56
Total	< 36.5	0.649 (0.02)	65.5/69.0	< 0.001	0.61	0.69
Anxiety[f]						
Total	> 7.5	0.617 (0.02)	60.6/57.0	< 0.001	0.58	0.66
Depression[g]						
Total	> 7.5	0.614 (0.02)	52.8/63.8	< 0.001	0.57	0.65
Sleep quality[h]						
Total	> 51.5	0.641 (0.02)	612/604	< 0.001	0.60	0.68
Physical health[i]						
Physical functioning	> 57.5	0.718 (0.02)	66.7/66.0	< 0.001	0.69	0.75
Physical role	> 37.5	0.719 (0.02)	65.7/70.0	< 0.001	0.69	0.75
General health	> 47.5	0.685 (0.02)	62.1/68.1	< 0.001	0.65	0.72
Mental health[j]						
Emotional role	> 50.0	0.661 (0.02)	57.2/67.9	< 0.001	0.63	0.70
Vitality	> 21.9	0.630 (0.02)	58.0/62.5	< 0.001	0.59	0.66
Mental health	> 18.3	0.590 (0.02)	62.1/59.1	< 0.001	0.55	0.63
Social functioning	> 57.7	0.676 (0.02)	66.4/60.3	< 0.001	0.65	0.72

AUC: area under the curve, SE: standard error, CI: confidence interval.
[a]Pain intensity was calculated by the numeric rating scale (NRS).
[b]Pain disability was calculated by the pain disability questionnaire (PDQ).
[c]Pain related anxiety was evaluated with the pain anxiety symptom scale (PASS-20).
[d]Catastrophizing thoughts were evaluated with the pain catastrophizing scale (PCS).
[e]Pain beliefs were assessed by the pain beliefs questionnaire (PBQ).
[f]Anxiety was assessed by the hospital anxiety and depression scale-anxiety (HAD-A).
[g]Depression was assessed by the hospital anxiety and depression scale-depression (HAD-D).
[h]Sleep quality was assessed by the Pittsburgh Sleep Quality Index (PSQI).
[i]Physical health was evaluated with the Short-Form-36 (SF-36).
[j]Mental health was evaluated with the SF-36.

significant difference between the groups in terms of sex distribution. Previous prevalence data have also found no difference between the two groups in terms of the female sex [10].

The relationship between chronic pain and employment status may be bidirectional. Chronic pain is more common in people who do not work or are unable to work. Moreover, patients with chronic pain reported

that activity restrictions affect their work life [29]. Some previous studies [10,27,30] have shown significant associations between HCIP and no work experience or long-term unemployment. Similarly, quitting work due to pain and no work experience were risk factors for HCIP in the current study. In addition, the ratio of obesity and comorbid diseases in patients with HICP patients was higher and the mean family income was lower compared to the patients with non-HCIP. These findings broadly support other studies in this area [4,10,31]. Several studies have reported that higher levels of education are associated with lower pain prevalence [32]. The reason for the lack of significance for this condition in this study might be due to the high ratio of females in both groups, and low level of education for both females and the elderly population in Turkey. Although there has been a decrease in tobacco use in recent years, there is still a high ratio of tobacco use in Turkey, and this ratio was found to be high in both groups. The prevalence of HICP were reported in some previous studies [4,10,27].

In the current study, HCIP was at a higher ratio (58.7%) than in previous studies. The methodology of this study was based on data collection from tertiary pain clinics, not a survey study, and it can be assumed that patients with lower pain severity are less likely to be in tertiary care. Patients have been referred to specialized pain centers following insufficient treatments in primary care, and this process may take a long time in Turkey. Relationships have been reported between prolonged duration of pain, the chronic nature of the underlying condition, delay in admission to pain clinics, and inadequate pain management [33].

2. Pain variables

Pain is a significant clinical risk factor for chronic pain, and the greater the number of painful regions and level of pain intensity, the greater the likelihood of severe chronic pain [34]. Basic pain intensity provides the opportunity of evaluating pain management interventions because it is a modifiable risk factor [35]. Our results showed that pain intensity is the strongest predictor for HICP and an important predictor of future pain and disability status, similar to previous study results [35–37]. In other words, there is a possibility that higher pain intensity will result in higher pain severity and affect the pain experience. It has been reported that pain frequency is associated with psychiatric condition and pain modulation, and it has been found to have a central role in cognitive processes related to pain, independent of depression and anxiety [38]. Pain frequency and pain intensity were associated with risk factors in patients with HICP in the regression analysis results.

3. HRQoL

Chronic pain affects all aspects of health including physical, psychological, and social well-being defined as HRQoL [39]. Previous studies have reported significantly worse HRQoL and work productivity in patients with HICP than people with low-impact pain [40]. As expected, HICP patients were more affected in terms of both physical health and sleep quality in this study.

4. Neuropsychiatric evaluation

Negative mood predicts increased pain and disability [41]. The relationship between depression, anxiety, and chronic pain is strong, and patients with severe pain are more likely to have depressive symptoms [42]. In this study, depression and anxiety were not risk factors associated with HICP, although they were higher in patients with HICP. Fear is an unpleasant emotion caused by the threat of danger, pain, or harm. Pain-related fear is accepted as a strong psychological predictor of both chronic pain and disability, and it is related to a higher prevalence and a worse prognosis of chronic pain [42–44]. Pain-related fear was found to be a risk factor for HICP in this study. Pain catastrophizing is the exaggerated negative tendency towards a real or anticipated pain experience, and catastrophizing thoughts contribute to the development of pain-related fear. Fear related to pain catastrophizing and existing pain is attributed to the fear-avoidance model of chronic pain [43]. Unlike rumination and magnification, catastrophic thoughts are a reflection of helplessness and an inability to cope with pain. Several studies have shown that helplessness has a key role in levels of pain and disability [43,45]. The current study results showed that helplessness was a risk factor for HICP patients. It is noteworthy that anxiety and depression scores in HICP patients were not as significant as pain-related cognitive processes in this study. These findings suggest that cognitive processes associated with pain may play an important role in pain severity and pain perception rather than anxiety or depression in patients with HICP. However, more research on this topic will lead to revealing an association between chronic pain, mood, and cognitive processes.

ROC analysis is one of the most effective methods of analyzing the efficacy of a diagnostic test and finding

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the optimal cut-off points [46]. This study was the first to employ ROC analysis with measurement tools assessing all the aspects of pain for patients with HICP. Therefore, findings could not be compared with other studies except in pain intensity. Optimal cut-off points for pain intensity were reported in previous studies [47–49]. In the current study, the cut-off point of the pain intensity was > 6.5 in the HICP group and it had a high sensitivity of 83.8% but lower specificity of 68.7%. Although these findings show that pain intensity is a strong predictor of HICP, the authors suggest that it may not be sufficient alone to make a diagnosis in the grading of pain severity. They found that the physical health aspect of HRQoL, pain anxiety, pain-related catastrophizing had acceptable discriminatory power by ROC analysis and presented their new cut-off values. These new results need to be supported by larger samples.

Some limitations should be considered in this study. First is that randomization could not be applied to obtain the data because of the outpatient clinic conditions and, therefore, this may lead to selection bias. Most of the study participants had national health insurance, so there could be no corresponding evaluation with patients with private health insurance, and information could not be obtained from individuals with no health insurance. The number of female patients was extremely high in the study, and as mentioned earlier, the education level of especially elderly female was low in Turkey, and therefore the relationships between education level and chronic pain were not clear. Different occupational groups were not evaluated separately within the employment status. The severity of muscle and joint pain may be different for an individual working in a home office and for a textile worker in a factory required to sit or stand for long periods.

The aim of this study was to differentiate HICP patients from non-HICP patients and to determine the risk factors and associated results for HICP. For the first time in the literature, cut-off points were presented for the scales used to evaluate HICP. These results can be used to target pain management interventions.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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AUTHOR CONTRIBUTIONS

İlteriş Ahmet Şentürk: Study conception; Erman Şentürk: Writing/manuscript preparation; Işıl Üstün: Data curation; Akın Gökçedağ: Data curation; Nilgün Pulur Yıldırım: Methodology; Nilüfer Kale İçen: Project administration.

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