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a cross-sectional exploratory study

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Observational Studies

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Associations of health-related quality of life with sociodemographic characteristics, health, pain, and lifestyle factors, and motivation for changing lifestyle in adults living with chronic pain: a cross-sectional exploratory study

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Abstract

Objectives: We investigated the associations between health-related quality of life (HRQoL) and health, pain and lifestyle factors, as well as motivation for lifestyle changes, in adults living with chronic pain referred to a Danish pain centre.

Methods: A total of 144 outpatients completed a questionnaire on HRQoL (EQ-5D-5L), health, pain, lifestyle factors (Body Mass Index [BMI], physical activity, smoking, alcohol, physical fitness, eating, sleep and stress) and motivation for lifestyle changes. We used multiple linear regression analyses to assess associations between HRQoL and the independent variables.

Results: The participants (age mean 50 years, 81% females) had ≥2 body pain sites (93%), BMI≥25 (64%), sedentary lifestyle (43%) and multiple (n≥2) elevated metabolic risk factors (58%). Most considered lifestyle important for HRQoL (72%) and expressed moderate to very high motivation for changing lifestyle (92%). Poorer HRQoL in the study population was significantly associated with higher pain intensity in the most painful body site (β=−0.316, p=0.001) and very poor sleep quality (β=−0.410, p=0.024). Serious-to-extreme problems in usual activities were associated with significantly poorer health (β=−0.328, p=0.030).

Conclusions: Adults living with chronic pain participating in this survey had significantly lower self-evaluated HRQoL than the general population. Lower HRQoL was significantly associated with greater pain intensity and poor sleep quality. Serious-to-extreme problems in usual activities, such as work, study, housework, family and leisure, were associated with poorer self-evaluated health. We observed high frequencies of overweight, obesity, sedentary lifestyle, pain in multiple body sites and multiple lifestyle-related risk factors in the study population. Most participants felt motivated for changing lifestyle. Further interventions addressing pain alleviation, sleep quality, prevention of problems in usual activities and promotion of healthy lifestyle, e.g. physical activity and healthy eating, are needed to estimate the effect of a lifestyle-oriented

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approach on health and quality of life in people living with chronic pain. The results of this study will inform the research project reg. SJ-703, the Danish the Research Ethics Committee for Region Zealand, Denmark.

Keywords: activities of daily living; health behaviour; health-related quality of life; healthy lifestyle; pain management.

Introduction

Chronic pain is a severe health challenge with multiple negative consequences for the individual, the health care system and society [1]. Over the past decades, it has become evident that non-pharmacological treatment options are effective and beneficial when treating chronic pain because of their mild or none side effects, compared to pain medication use [2, 3]. Recent evidence highlights the need for comprehensive non-pharmacological interventions aimed at multiple lifestyle factors to prevent chronicity in people living with chronic pain [4]. The lifestyle factors, such as physical activity, Body Mass Index (BMI), tobacco and alcohol consumption, physical fitness, healthy eating, sleep quality and stress, are considered modifiable and relevant for lifestyle management of chronic pain [5]. Interventions that target lifestyle through physical activity and exercise can lower the meta-inflammatory effects of chronic pain, reduce pain and improve function and quality of life [6–9]. However, healthcare interventions can also approach lifestyle through targeting everyday human activities and interpret lifestyle as the way of living based on habitual occupational choices and routines, e.g. regarding eating, sleeping, or being physically active [10]. Evidence suggests that occupational therapy interventions targeting participation in daily activities related to self-care, work and leisure while taking healthy lifestyle considerations into account can improve overall health and well-being among people living with chronic pain [11–13]. Considering lifestyle from an occupational therapy perspective may broaden the focus in lifestyle interventions from improving metabolic health to overall well-being and quality of life. Health-related quality of life (HRQoL) has been considered a relevant effect measure in chronic pain interventions because of its ability to capture the overall improvement in health and well-being [14], despite possible fluctuations in the self-perceived HRQoL in specific life areas. We hypothesised that occupational therapy lifestyle intervention as a treatment modality focussing on everyday occupations and lifestyle to improve HRQoL might be useful in multidisciplinary chronic pain treatment. However, it would be relevant to clarify the interrelations between HRQoL in various everyday life areas and health, pain and lifestyle factors and motivation for changing lifestyle to adapt such an intervention to a particular chronic pain cohort. Since gender differences also seem to influence participation and response to pharmacological and non-pharmacological chronic pain interventions such as lifestyle interventions [15, 16], identifying possible gender effects on motivation for participation in a lifestyle intervention could improve treatment adherence, responsiveness and tailoring. To inform the development of a lifestyle occupational therapy intervention for adults living with chronic pain referred to a Danish pain centre, we wanted to investigate how HRQoL in the population is associated with sociodemographic characteristics, health, pain and lifestyle factors, as well as how motivated the population is for changing lifestyle.

Methods

Study design

We conducted a cross-sectional exploratory study among adults with chronic pain reported according to the STROBE extension for cross-sectional studies [17, 18].

Setting

The Multidisciplinary Pain Center (MPC) at Naestved Hospital (Region Zealand, Denmark) is a specialised regional pain centre that consults around 1,000 outpatients with complex chronic pain conditions annually and provides multidisciplinary pain treatment delivered by physicians, nurses, psychologists, physiotherapists and a social worker.

Participants

A convenience sample of 144 outpatients referred to the MPC, who were either in-treatment or recently completed the treatment at the time of the investigation, was contacted by e-mail between December 2018 and March 2019. All participants were aged ≥18 years, had ≥3 months of pain experience before the investigation and had complex health challenges that no longer could be covered by general practice, demanding a specialised multidisciplinary intervention.

Data collection

An online questionnaire of 101 questions was developed for the study, using SurveyXact by Ramboell (Aarhus, Denmark) software. The questionnaire was pilot tested for possible inconsistencies and misinterpretations among a group of 11 outpatients and health professionals and adjusted in terms of the ease of completing the questionnaire. The questionnaire was primarily available for completion

online. Two rounds of online distributions were planned and conducted. The procedure was extended with the third round of reminders to increase the response rate. Three reminders were sent by e-mail at 10 days intervals to increase the response rate. Additionally, the outpatients having an appointment at the MPC were asked if they wished to participate. The participants could complete the questionnaire either on paper or iPad, depending on their preferences. Practical support was available from trained instructors (graduated occupational therapists), both in-person in the waiting room at the MPC, by phone or by e-mail.

Variables

Sociodemographics: We assessed the highest educational level reached (according to the Danish Educational Nomenclature [19]) and the employment status (classified according to the Danish Health Authority's National Health Survey 2017 [20]) of the participants. We calculated gender and age from the civil registration number containing the participants' birth date and gender identification.

HRQoL: The primary outcome of interest for this study was HRQoL in mobility, self-care, usual activities (in work, study, housework, family and leisure), pain/discomfort and anxiety/depression assessed by the EQ-5D-5L, EuroQol (hereafter, EQ-5D). HRQoL was measured on a five-point categorical scale: 1='no problems', 2='slight problems', 3='moderate problems', 4='severe problems' and 5='extreme problems' (EQ-5D values) [21, 22]. EQ-5D is a standardised instrument for the assessment of current self-rated HRQoL [23]. We obtained the EQ-5D survey form in Danish (EuroQol; Registration ID: 28126). For regression analyses, we calculated a cumulative utility score (EQ-5D Index) with the help of the Danish EQ-5D valuation set (Crosswalk DK Value set) applied to the EQ-5D values [24]. The EQ-5D Index ranges from – 0.594 to 1 and considers all states below zero being 'worse than death', while 'one' expresses 'perfect health' [25].

Health status: HRQoL-related health perceived on the assessment day and measured on a visual analogue scale (EQ-5D, EQ-VAS) from 0='the worst health you can imagine' to 100='the best health you can imagine' was the secondary outcome of interest for this study [21, 22].

Pain: Pain sensation was registered on a body chart (see Appendix A), representing 45 anatomic regions in anterior and posterior body positions to quantify pain spreading as an indicator for pain sensitivity [26]. The participants marked all painful body sites during the last week and then the most painful body site during the same period. If the participants marked more than one body site as the most painful, these results were not included in the analysis. We used the valid and reliable 11-point NRS-scale ranging from 0='no pain' to 10='worst pain imaginable' to evaluate pain intensity for the most painful body site [27]. Current medication use for pain relief (categorised as yes/no), including medication type specification for the consumption of both non-prescription analgesics (e.g. paracetamol) and opioids (e.g. morphine), were registered. Pain relief medication regimen was registered as yes/no.

Lifestyle factors: Variables physical activity, BMI, smoking, alcohol consumption, physical fitness, healthy eating, sleep quality and stress were included to capture the self-reported lifestyle status of the participants and identify the lifestyle factors that needed attention.

Physical activity: Average weekly amount of time in hours and minutes used at moderate and vigorous physical activity was reported according to the 2019 physical activity advice for adults to determine the risk of a sedentary lifestyle [20]. The participants were asked to report all physical activity related to leisure time and transport varying more than 10 min at a time. Increased heart rate and intensive breathing defined moderate physical activity, while vigorous physical activity demanded also sweating and meantime difficulty in leading a conversation.

BMI: BMI for each participant was calculated by dividing weight in kilograms by the square of the height in metres, with the threshold of BMI≥25 for overweight and BMI≥30 for obesity, to evaluate the overweight and obesity bound health risks [28]. To calculate BMI, we used self-reported body weight and height, considered valid measures in males and females across various social groups [29].

Smoking and alcohol: The participants reported smoking cigarettes and alcohol drinking status as yes/no, supported by reports on an average weekly number of cigarettes and alcohol consumption in standard units, e.g. 330 mL (beer), 120 mL (wine) and 40 mL (liquor) [30]. Other types of smoking other than cigarettes were not included.

Physical fitness, healthy eating, sleep quality and stress: The participants were asked to use a five-items categorical scale inspired by the Danish Health Authority's National Health Survey 2017 [5, 20] to evaluate each lifestyle factor last month. The categorical scale included items 'very good', 'good', 'neither good nor poor', 'poor' and 'very poor' for physical fitness and sleep quality. The same scaling principle guided the participants in evaluating their eating from 'very healthy' to 'very unhealthy' and stress from 'very low' to 'very high'. All the scales were provided with an additional category ('do not know') for indecisive responses. To keep the assessment load as low as possible, we decided not to ask for a further in-detail evaluation.

Motivation: The participants were asked how motivated they were for working with lifestyle changes during their chronic pain treatment using a five-items categorical scale developed for the study, choosing correct response among the following, either 'very high', 'high', 'moderate', 'low', 'very low' or 'do not know' (for indecisive responses).

Analysis

We conducted the descriptive statistical analysis, estimating means and standard deviations (SD) for continuous variables and frequency distributions for categorical variables. We described and compared the mean of the EQ-5D Index and the proportions of specific HRQoL-related problems in the participants with the Danish normative population means [31] using a two-sample t-test.

We applied the following rules to the tests of the association between HRQoL and health, pain and lifestyle factors, as well as motivation for changing lifestyle: a) For all categorical variables, categories with observations n<5 were collapsed with the next category, e.g. extreme and severe levels; b) 'Do not know'-answers were

recoded as indecisive answers to the middle position on the five-item scales ('neither good/nor poor') and included in the analysis.

We included all the independent variables in a multiple linear regression model because of their sufficient clinical relevance for HRQoL in people living with chronic pain and practical relevance for the research objectives of this study [32]. In the analysis, dichotomised EQ-VAS score (VAS 0–50/51–100) was used for 'poor' or 'good' health status (independent variable, binary). All the regression models contained covariates gender (male-female) and age (continuous). Finally, we explored possible significant associations between the specific EQ-5D domain scores, i.e. HRQoL-related problems in the particular life areas (categorical) and health (EQ-VAS as the dependent variable, continuous) using multiple linear regression analysis. We tested the assumptions underpinning multiple linear regression analysis visually by scatterplots that showed a linear relationship between HRQoL and the independent variables, and Q–Q plots, and numerically by Shapiro–Wilk W test that showed normal distribution of the residuals. Inspection of Variance Inflation Factor (VIF) values for the independent variables was conducted to check their multicollinearity. The residuals' variance homogeneity (homoscedasticity) was inspected by plotting the residuals vs. fitted (predicted) values. We reported the multiple linear regression analysis results as poorer or better health, based on the beta (β) coefficients.

We analysed the association of motivation (a binary variable 'very highly to highly motivated' or 'other', e.g. 'moderately motivated' to 'very low motivated' or 'no opinion') with gender and age (grouped) using a logistic regression model. We inspected the logistic regression model using post-estimation tools, such as calculating predicted residuals, estimating predicted margins and the Pearson $\chi 2$ test for goodness of fit. The logistic regression analysis results were reported in odds ratios as predicted difference in motivation level, accounted for gender and age.

We evaluated statistical significance at the 95%-confidence level (95% CI), $p<0.05$, for all the tests. We used Stata/IC 16.0 (StataCorp, College Station, TX, USA) for the data analysis.

Results

Descriptive analysis

Sociodemographic characteristics and pain experience

Of the 289 outpatients approached, 144 reports were obtained (response rate 50%). Some survey responses were incomplete (n=32, 22%), but we used the available data from those in the analyses. We experienced partial missingness as missing completely at random (MCAR), with no linkage to sociodemographics or other characteristics. The responder-nonresponder analysis revealed no differences in age (mean 50; SD 13) and a lower frequency of women (70%) among the nonresponders compared to the responders (81%), see Table 1. About 30% of the participants had primary or secondary school as their highest level of education. Although 86% were of the working-age (18–64 years), only 24% of the population

Table 1: Sociodemographic and pain-related characteristics of the participants.

Variable (sample size, n)[a]	Value (mean [SD]; frequency [range])
Females	
In responders (n=144)	117 (81%)
In nonresponders (n=145)	101 (70%)
Age, years	
In responders (n=144)	50 (13; 19–81)
In nonresponders (n=145)	50 (13; 26–94)
Age groups, years old (n=144)	
18–24	3 (2%)
25–34	20 (14%)
35–44	22 (15%)
45–54	50 (35%)
55–64	29 (20%)
65–74	17 (12%)
≥75	3 (2%)
Highest achieved education level (n=139)[b]	
Primary and lower secondary school	32 (23%)
Secondary school	10 (7%)
Vocational education	34 (24%)
Short-cycle higher education	28 (20%)
Medium-cycle higher education	30 (22%)
Long cycle higher education	5 (4%)
Employment status (n=139)	
Employed[c]	33 (24%)
Unemployed[d]	59 (43%)
On disability pension	20 (14%)
Retired	21 (15%)
Students/trainees	6 (4%)
Body pain sites (n=126)	
0	3 (2%)
1	6 (5%)
2	21 (17%)
3	3 (2%)
4	9 (7%)
5	7 (6%)
≥6	77 (61%)
Body pain spreading, % of the body (n=126)	
Up to 25	77 (61%)
25–50	28 (22%)
50–75	12 (10%)
Over 75	9 (7%)
Body pain location[e] (n=126)	
Low back	65 (52%)
Lower spine	44 (35%)
Thoracic spine	32 (25%)
Shoulders/upper arms (front/back)	28 (22%)
Head (front/back)	27 (21%)
Knees (front/back)	27 (21%)
Feet (dorsal/plantar)	27 (21%)
Abdomen	26 (21%)
Back	26 (21%)
Hands (dorsal/palmar)	25 (20%)
Neck	19 (15%)
Chest	13 (10%)
Elbows/forearms (front/back)	10 (8%)
Thighs/lower legs (front/back)	8 (6%)

Table 1: (continued)

Variable (sample size, n)[a]	Value (mean [SD]; frequency [range])
Major body pain sites (n=125)	
Low back	34 (27%)
Knees (front/back)	12 (10%)
Neck	11 (9%)
Feet (dorsal/plantar)	10 (8%)
Shoulders/upper arms (front/back)	9 (7%)
Thighs/lower legs (front/back)	8 (6%)
Head (front/back)	7 (6%)
Abdomen	7 (6%)
Thoracic spine	7 (6%)
Lower spine	7 (6%)
Hands (dorsal/palmar)	6 (5%)
Back	4 (3%)
Elbows/forearms (front/back)	2 (2%)
Chest	1 (1%)
Pain intensity in the most painful body site[f] (n=122)	8 (2; 3–10)
Taking opioids for pain relief[g] (n=138)	70 (51%)

[a]The total n of the reports in each question category is provided. [b]The categories refer to the Danish Educational Nomenclature [14]. [c]Employee or self-employed (full or part-time). [d]At-home staying and on sick leave. [e]The sum of the frequencies does not give 100%, one participant may have had more than one body pain site. [f]Pain intensity in most painful body site on 0–10 NRS-scale within the last month. [g]As a regimen or pro necessitate. SD, standard deviation.

were associated with the labour market and wholly or partly self-supported economically.

The vast majority (90%) of the participants had multiple body pain sites (≥2). More than half of the participants took opioids for pain relief, such as Morphine, Tramadol or similar, either as regimen or pro necessitate. The most common body pain sites were low back (52%), lower spine (35%) and thoracic spine (25%). The low back acted as the most painful body site in 27% of the participants.

Lifestyle factors and motivation for changing lifestyle

Sixty-four percent of the participants were overweight, obese or severely obese (Table 2). Forty-seven percent were current smokers, while none had a high-risk alcohol consumption and 73% reported no alcohol consumption at all. Forty-three percentof the participants did not reach the World Health Organisation's recommended minimum of 150 min of moderate physical activity per week for

Table 2: HRQoL, health and lifestyle in the participants.

Variable (sample size, n)[a]	Value (mean [SD]; frequency [range])
BMI (n=113)	
Underweight (BMI<18.5)	4 (4%)
Normal weight (BMI≥18.5 <25)	36 (32%)
Overweight (BMI≥25 <30)	25 (22%)
Obese (BMI≥30 <40)	42 (37%)
Severely obese (BMI≥40)	6 (5%)
Physical activity weekly, minutes (n=113)	
0	20 (18%)
<150	28 (25%)
≥150 <300 (min. recommended)[b]	21 (18%)
≥300 <600	26 (23%)
≥600	18 (16%)
Smoking (n=113)	47 (42%)
Alcohol consumption[c] (n=113)	
None	82 (73%)
Low risk[d]	30 (26%)
Moderate risk	1 (1%)
Physical fitness (n=113)	
Very good	1 (1%)
Good	9 (8%)
Neither good/nor poor	36 (32%)
Poor	36 (32%)
Very poor	30 (26%)
Don't know	1 (1%)
Eating habits (n=113)	
Very healthy	3 (3%)
Healthy	31 (27%)
Neither healthy nor unhealthy	63 (56%)
Unhealthy	11 (10%)
Very unhealthy	3 (3%)
Don't know	2 (1%)
Stress (n=113)	
Very low	10 (9%)
Low	20 (18%)
Neither low nor high	46 (40%)
High	20 (18%)
Very high	11 (10%)
Don't know	6 (5%)
Sleep (n=113)	
Very good	2 (2%)
Good	6 (5%)
Neither good/nor poor	37 (33%)
Poor	36 (32%)
Very poor	32 (28%)
Presense of multiple metabolic risks[e] (n=113)	66 (58%)
Importance of lifestyle for quality of life (n=112)	
Very important	37 (33%)
Important	44 (39%)
Neither/nor	22 (20%)
Slightly important	1 (1%)
Very slightly important	1 (1%)
Don't know	7 (6%)

Table 2: (continued)

Variable (sample size, n)[a]	Value (mean [SD]; frequency [range])
Motivation for changing lifestyle[f] (n=112)	
Very highly motivated	29 (26%)
Highly motivated	46 (41%)
Moderately motivated	28 (25%)
Low motivated	3 (3%)
No opinion	6 (5%)
HRQoL	
EQ-5D Index score[g] (n=122)	0.397 (0.254; −0.196–0.824)
EQ-5D Profile[h] (n=122)	
Only level 1 or 2 items	2(2%)
Several level 3 items, no level 4 or 5	25(20%)
Min. one level 4 or 5 item	95(78%)
Health (EQ-VAS score 0–100) (n=121)	45 (24; 1–95)
1–25	32 (26%)
26–50	44 (36%)
51–75	35 (29%)
76–95	10 (8%)

[a]The total n of the reports in each question category is provided. [b]Corresponding to the WHO recommendations on physical activity for adults [27]. [c]No reports in the category 'Don't know'. [d]Corresponding to the limits for low risk (≤7 units/week for women; ≤14 units/week for men) and moderate risk (above the low risk limits), The Danish Health Authority [24]. [e]Risky health behaviour in multiple (n≥2) lifestyle areas, such as BMI≥25; Physical activity weekly, minutes <150; Poor or very poor Fitness; High or very high stress; Smoking 'yes'. [f]No reports in the category 'very low motivated'. [g]Scores >0='worse than death'; '1'='perfect health'. [h]Index 11111=full health; 55555=worst health. SD, standard deviation, BMI, Body Mass Index.

adults. The observed frequencies of sedentary lifestyle (43%) and obesity (42%) were higher compared to the general adult Danish population, comparable with the study cohort at gender and age distribution (17% obese and 29% inactive in 2017) [20, 33, 34]. Many participants evaluated their physical fitness (66%) and sleep quality (68%) 'poor to very poor', while most placed their eating habits at 'neither good/nor poor' (58%) and stress at 'neither low/nor high'-level (41%). However, the majority of the participants (72%) considered lifestyle as an important or very important factor for good quality of life, independently of gender (p=0.12) or age group (F=0.20). Ninety-two percent expressed moderate to very high motivation for changing lifestyle. Multiple (n≥2) metabolic risks in various combinations such as BMI≥30, sedentary lifestyle, unhealthy eating, poor physical fitness, poor sleep quality, high stress level and cigarette smoking were found in 58% of the participants.

Health and HRQoL

Most participants (62%) experienced rather poor health (EQ-VAS score 0–50) and moderate-to-extreme levels of the problems (scores≥3) in pain/discomfort (94%), usual activities (81%) and mobility (61%), see Figure 1.

The two-sample t-test showed that the mean of EQ-5D Index in the study sample differed from the general Danish adult population norms calculated on the sample, comparable with the participants in this survey (n=15.700; age mean 47; SD 16; range 20–79). Thus, the sample had significantly lower HRQoL values than the general population (p=0.000; diff. −0.492 (95% CI −0.520; −0.464)). Maximal cumulative HRQoL-scores observed in the study cohort (EQ-5D Index score max.=0.824) were below the mean value for the general population (EQ-5D Index score mean=0.889; SD 0.154). As in this study sample, the most frequent problem reported by the general Danish population was pain/discomfort experienced at the moderate-to-extreme level by 19–52%, while amongst Danes in general, only 7–35% reported the moderate-to-extreme level of problems in usual activities, and 2–25% – in mobility [31].

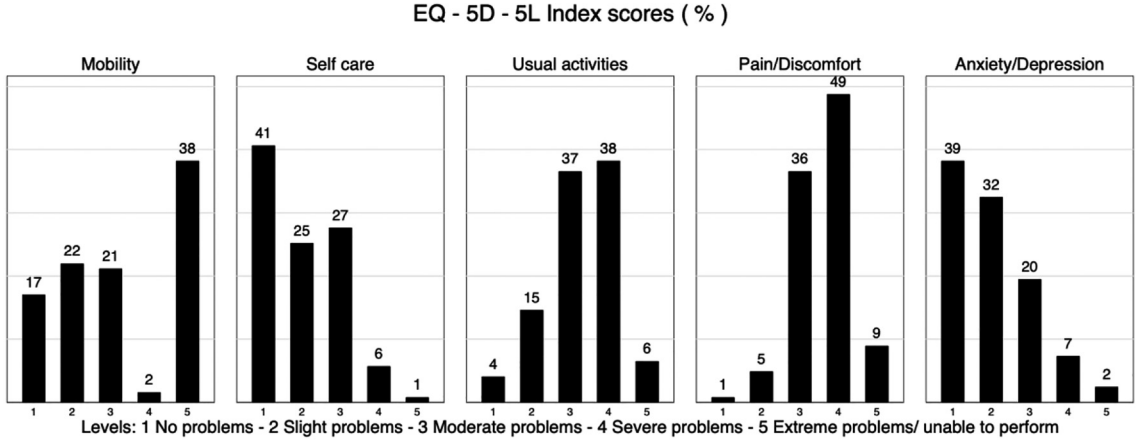

Figure 1: The proportions of HRQoL-related problems in mobility, self-care, usual activities, pain/discomfort and anxiety/depression in the study sample.

The observed associations

Associations of HRQoL with health, pain and lifestyle factors

The multiple linear regression model (p=0.001; 113 observations), including pain intensity in the most painful body site, health, BMI, physical activity level, physical fitness, eating habits, sleep quality and stress level adjusted for gender and age, explained 39% of the variances in HRQoL. HRQoL was significantly poorer in the participants with higher pain intensity in the most painful body site (β=−0.316, p=0.001), as well as at the presence of very poor sleep quality (β=−0.410, p=0.024), holding other variables constant (Table 3).

The residual plots showed linear relationships between the dependent and independent variables. Q–Q plot and the Shapiro–Wilk W test (p=0.084) delivered no reason to reject the assumption of normally distributed residuals. The residual-vs.-fitted plot illustrated the homogeneity of the variance. The tolerance values for the model variables >0.1 and VIF=2.65 for the independent variables raised no multicollinearity concern.

Table 3: Multiple linear regression results on the association HRQoL with health, pain and lifestyle.

Explanatory variable (ref.)	Coef.	SE	t	p-Value	Beta
Gender (Ref. 'male')	−0.041	0.056	−0.74	0.463	−0.065
Age	0.001	0.002	0.68	0.499	0.070
Health status, 'good health' (Ref. 'poor health', EQ-5D VAS 0–50)	0.027	0.048	0.56	0.577	0.051
Pain intensity[c], NRS (Ref. 0 = 'no pain')	−0.051	0.015	−3.35	0.001[b]	−0.316
BMI (Ref. 'underweight to normal weight')					
Overweight	0.059	0.063	0.94	0.351	0.096
Obese to severely obese	0.040	0.053	0.76	0.448	0.078
PA (Ref. '>150 min weekly')					
<150 min weekly	−0.036	0.055	−0.64	0.521	−0.061
None	0.007	0.069	0.10	0.923	0.010
Smoking tobacco	−0.062	0.048	−1.29	0.200	−0.120
Alcohol consumption	0.065	0.052	1.24	0.219	0.114
Physical fitness (Ref. 'good to very good')					
Neither good nor poor	0.061	0.089	0.68	0.496	0.113
Poor	0.022	0.092	0.24	0.807	0.041
Very poor	−0.032	0.103	−0.31	0.756	−0.056
Eating habits (Ref. 'good to very good')					
Neither good nor poor	0.016	0.060	0.26	0.794	0.031
Poor or very poor	0.031	0.095	0.126	0.744	0.040
Sleep quality (Ref. 'good to very good')					
Neither good nor poor	−0.123	0.097	−1.05	0.297	−0.187
Poor	−0.152	0.100	−1.53	0.130	−0.279
Very poor	−0.101	0.101	−2.29	0.024[a]	−0.410
Stress level (Ref. 'very low')					
Low	0.109	0.096	1.13	0.261	0.163
Neither low nor high	0.123	0.086	1.44	0.154	0.242
High	0.023	0.099	−0.23	0.815	−0.035
Very high	0.072	0.108	0.66	0.511	0.084

F=2.62; df (22; 90); p=0.001; R^2=0.3906; Adj. R^2=−0.2416. PA, physical activity; SE, standard error; Ref., reference category. [a]Significant at 0.05. [b]Significant at 0.01. [c]In the most painful body site.

Associations between specific HRQoL-related problems and health

The multiple linear regression model (p=0.002; 121 observations), including HRQoL-related problems in mobility, self-care, usual activities, pain/discomfort and anxiety/depression adjusted for gender and age, explained 24% of the variances in health. The health score was significantly poorer in those with serious-to-extreme HRQoL-related problems related to usual activities (β=−0.328, p=0.030), holding other variables constant (Table 4).

The residual plots revealed linear relationships between the dependent and independent variables. Q–Q plot and the Shapiro–Wilk W test (p=0.56) delivered no reason to reject the assumption of normally distributed residuals could. The residual-vs.-fitted plot illustrated the homogeneity of the variance. No concern of multicollinearity arose from the tolerance values for the model variables >0.1 and VIF=2.16.

Associations between motivation for changing lifestyle, gender and age

The logistic regression model (p>0.598, 112 participants) showed that high motivation for changing lifestyle was not statistically significantly associated with neither gender nor age of the participants (Table 5). The motivation was highest in the age group of 25–34 years old.

Post-estimation tests revealed 10 covariate patterns in the model. We could not reject the goodness of fit of the model, according to the results of the Pearson χ2 test (p>0.45).

Discussion

This survey investigated the associations between HRQoL in adults living with chronic pain and their sociodemographic characteristics, health, pain, lifestyle factors and motivation for changing lifestyle to inform the development of a lifestyle-oriented occupational therapy program. Reports from 144 adults living with chronic pain showed

Table 4: Multiple linear regression results on the association between HRQoL-related problems in mobility, self-care, usual activities, pain/discomfort and anxiety/depression, and health.

Explanatory variable	Coef.	SE	t	p-Value	Beta
Mobility					
Serious-to-extreme problems	−6.270	5.225	−1.20	0.233	−0.130
Moderate problems	−7.281	6.437	−1.13	0.261	−0.126
No to slight problems (Ref.)					
Self-care					
Serious-to-extreme problems	0.180	9.197	0.02	0.984	0.002
Moderate problems	3.916	5.130	0.76	0.447	0.074
No to slight problems (Ref.)					
Usual activities					
Serious-to-extreme problems	−15.622	6.934	−2.25	0.026[a]	−0.328
Moderate problems	4.180	6.491	0.64	0.521	0.085
No to slight problems (Ref.)					
Pain/discomfort					
Serious-to-extreme problems	−14.333	9.431	−1.52	0.131	−0.299
Moderate problems	−10.046	9.197	−1.09	0.277	−0.204
No to slight problems (Ref.)					
Anxiety/depression					
Serious-to-extreme problems	9.115	7.146	1.28	0.205	0.115
Moderate problems	−6.874	5.422	−1.27	0.208	−0.116
No to slight problems (Ref.)					
Pain intensity in major body pain site	0.913	1.505	0.61	0.545	0.061
Gender (male)	−4.519	5.225	−0.86	0.389	−0.075
Age	−0.159	0.159	−1.00	0.320	−0.089

F=2.89; df (12; 108); p=0.002; R^2=0.2429; Adj. R^2=0.1588.
[a]Significant at 0.05. SE, standard error; Ref., reference category.

Table 5: Logistic regression results on the association between gender and age, and the motivation for working with lifestyle changes.

Explanatory variable	Odds ratio	SE	z	p-Value	[95% CI]	
Gender						
Male	0.840	0.427	−0.34	0.732	0.310	2.277
Age groups, years old						
35–44	4.270	3.927	−1.58	0.114	0.704	25.895
45–54	1.660	1.007	0.84	0.403	0.506	5.449
55–64	1.157	0.751	0.22	0.823	0.324	4.131
65+	1.825	1.344	0.82	0.414	0.431	7.726

CI, confidence interval; SE, standard error.

that higher pain intensity in the most painful body site (β=−0.316, p=0.001) and a very poor sleep quality (β=−0.410, p=0.024) was associated with poorer HRQoL. The study sample's cumulative HRQoL-score was significantly lower than in the general Danish population (p<0.000; diff. −0.49 (95% CI −0.52; −0.46)). Serious-to-extreme problems in usual activities (β=−0.328, p=0.030) were significantly associated with lower self-evaluated health.

The significant association found between sleep quality and HRQoL in this study has previously also been demonstrated in the general chronic pain population [35]. Poor sleep quality is associated with a two to three times higher risk of greater pain intensity, increased inflammatory markers, and poorer physical health [36]. Previous evidence has linked sleep with HRQoL and found that chronic pain compromises them both [37]. Occupational therapy can promote better sleep quality by helping the participants establish occupational balance based on value-based occupational choices, appropriate occupational planning, knowledge of energy expenditure and use of assistive devices [38].

In occupational science, human health and well-being are considered dependent on a balanced interrelationship between daily occupations related to self-care, productivity and leisure, and the individual's personality and the environment [39]. From this perspective, our findings on the association between severe-to-extreme problems in usual activities and poorer self-evaluated health may underscore the importance of preventing a decline in occupational performance. Likewise, it would be recommendable to assess individual occupational performance deficiencies in work, study, housework, family and leisure at the intervention baseline and elaborate on their improvement.

Besides usual activities, the participants in this study also experienced pain/discomfort and mobility problems that severely affected their HRQoL. Similar HRQoL domains were also the most affected in the general Danish population [31], yet the problem prevalence in this study cohort was about twice as high. Previous research in chronic pain has found that pain, fear of movement, anxiety and depression were interconnected, negatively affecting each other and associated with poor health and HRQOL [40]. The burden of chronic pain observed in the study cohort seemed severe, primarily because of pain spreading, where 93% of the participants had pain in two or more body sites, and 61% had pain in six or more. That supports the evidence highlighting that pain alleviation remains one of the most attractive treatment outcomes for the chronic pain population [33]. However, since taking pain medications has been perceived to enhance the

burden of chronic pain and is associated with adverse events [34, 35], it would be reasonable to approach chronic pain non-pharmacologically, e.g. through a lifestyle-oriented intervention.

Physical activity was not associated with HRQoL in this study cohort. However, previous research has demonstrated that increased physical activity improves health and well-being in various chronic pain conditions [8, 9, 35]. Moreover, the relatively high frequency of sedentary lifestyle detected amongst the participants of this study urges all health professionals to initiate efforts that would reverse this tendency. Therefore, occupational therapists should assist people living with chronic pain to a more physically active life, e.g. while helping them set occupational goals and accomplish the goal work.

Given that 64% of the participants were overweight, obese or severely obese, besides the sedentary lifestyle, we expected the participants also to report unhealthy eating habits, as those are known to impact human metabolic health [41]. Unexpectedly, only 13% of the participants in this study reported unhealthy eating habits, which is 3% less than in the general adult Danish population [20, 34]. This finding could be an instance of misreporting sensitive health behaviour information, as seen previously in health surveys [42]. Even more surprising was that the participants' self-perceived HRQoL seemed to be higher in those with poor eating habits, which could find an explanation in the 'comfort food'-phenomenon where stress and chronic pain predisposes to a calorically dense food intake as a coping strategy [43]. At the same time, this survey revealed a high frequency of two or more lifestyle-related risks (58%), which was more than twice as high as in the general Danish population (24% in men, 19% in women in 2017) [20]. Motivational rates for changing lifestyle were also higher in our sample (92%) than the general Danish population ≥16 years in 2017. In the general population, 71% would like to be more physically active, 56% would like to eat healthier, 33% would like to reduce their alcohol consumption, and approximately 75% of the smokers would like to quit [20]. Thus, despite the low frequency of reported unhealthy eating habits but high anticipated high-risks of poor metabolic health and comorbidity observed in the sample, we argue for targeting eating habits in an occupational therapy lifestyle intervention.

Knowing that non-pharmacological treatment of chronic pain remains a more sustainable and safer alternative or addition to the often insufficient pharmacological treatment [4, 44–47], we believe that occupational therapy has the necessary tools and methods for targeting lifestyle factors from an occupational performance and participation perspective. However, more evidence is needed on the delivery and responsiveness to comprehensive lifestyle interventions in people living with chronic pain, i.e. appropriate subgrouping, treatment doses, gender differences, program adherence to determine the ways of reaching sustainable lifestyle changes and improved HRQoL.

Implications

- Pain intensity and sleep quality are important factors to consider when assessing the quality of life in adults living with chronic pain;
- Addressing problems in usual activities, such as work, study, housework, family and leisure, are essential for the improvement in the health status of the chronic pain population;
- Further research is needed to clarify if a comprehensive multidisciplinary lifestyle-oriented intervention program would improve health and quality of life in adults living with chronic pain.

Limitations

A larger study sample might have demonstrated further associations between HRQoL and other independent variables than pain intensity and sleep quality. Despite the assistance offered by the researchers, only a few participants took contact and received support. More supportive outreach research activities and fewer questions might potentially have helped to avoid missing data. Selection bias towards the participants capable of completing the survey regarding internet access, time and sufficient Danish language, might have been present. Furthermore, a greater number of men might also have affected the results of the analyses of differences between men and women. Therefore, these results need to be cautiously interpreted. The cross-sectional study design and self-reported retrospective data may also contain recall bias, misreporting and social desirability bias, particularly in lifestyle-related data. Anyhow, the support delivered by the research team during the survey distribution and conduct allowed us to reach out to the outpatients who may generally find participating in research activities difficult, which may have strengthened the generalisability of the current investigation.

Conclusion

Adults living with chronic pain participating in this study had significantly lower cumulative HRQoL-score than the

general Danish population. Lower HRQoL in the study cohort was significantly associated with greater pain intensity and poor sleep quality, while the serious-to-extreme degree of problems in usual activities was associated with poorer self-evaluated health. Many participants experienced pain spreading, were overweight and obese, and had a sedentary lifestyle. Most participants were motivated for changing their lifestyle, independent of gender and age. Further health interventions aiming at pain alleviation, better sleep quality, prevention of severe problems in usual activities and promotion of physical activity and healthy eating are needed to estimate the effectiveness of such approaches on health and quality of life in adults living with chronic pain.

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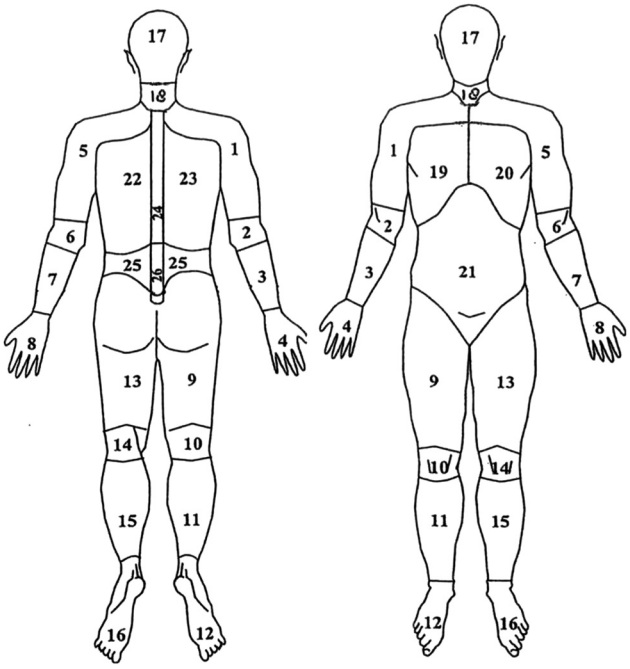
Informed consent: Informed consent has been obtained from all participants in this study.

Ethical approval: The Data Protection Committee in Region Zealand, Denmark (REG-043-2018) approved the protocol. According to the Danish legislation (The Executive Order of the Law on the Ethical Treatment of Health Science Research Projects, § 14, para. 2), questionnaires and surveys that do not include human biological material should not be notified for the Research Ethics Committee approval. The results of this study will inform the research project registered SJ-703 by the Danish the Research Ethics Committee for Region Zealand, Denmark. This study followed the principles of the Helsinki Declaration (the 7th edition).

Data statement: The authors confirm that the data supporting the findings of this study are available within the article and its Appendix A. Additional data associated with this study are available on request from the corresponding author.

Appendix A: Body chart with 45 pain sites on the front and back of the human body



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