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The Interplay of Patient Demographics, Pain and Quality of Life in Chronic Low Back Pain Management Through Physiotherapy

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Original Article

Abstract

Background: Chronic Lower Back Pain (CLBP) represents a pandemic diagnosis of contemporary society. Pain is a multidimensional personal experience influenced by various interrelated subjective and objective factors. In this study, we examined the impact of physiotherapeutic treatment on the quality of life (QoL) of patients with CLBP.

Methods: Multiple linear regression analysis, Paired Student's t-test, and Pearson Correlation were used to statistically analyse data collected through various measurement instruments: a demographic questionnaire, 36-Item Short Form Survey Instrument (SF-36v2) and the Numerical Pain Rating Scale (NPRS). A total of 123 participants (29 males, 94 females) with CLBP were included in the study, undergoing physiotherapeutic rehabilitation lasting eight working days.

Results: The findings indicate positive associations between Age, Education level, Female gender with QoL, while negative associations were observed between BMI, work experience, and Difference in pain with QoL. In the study, only SF36 dimensions showed statistically significant improvements following physiotherapy in individuals with chronic low back pain namely Pain Reduction, Social functioning and Physical Functioning.

Conclusion: The results provide a solid foundation for further professional and scientific research in this field, as well as for the complex multidisciplinary collaboration between physiotherapy and medical sciences.

Keywords: Chronic lower back pain, Quality of Life, Physiotherapy

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1. Introduction

Chronic lower back pain (CLBP) is a subjective symptom and can result from various known or unknown deformities or diseases (Hartvigsen et al., 2018). Demographic factors of the active working population play a significant role in the physiotherapeutic rehabilitation of CLBP (Hansen et al., 2023). These factors define the demographic characteristics of a given population, with the most common being age, sex, race, ethnicity, and geographic area of residence. Other factors include education level, employment status, income, and disability status (Licciardone, 2021). Research indicates that several demographic factors are consistently associated with the prevalence and severity of CLBP and subsequent physical activity limitations. The prevalence of CLBP exhibits an age-dependent pattern, typically increasing with age and peaking in middle to older adulthood (Aroke, Srinivasasainagendra, et al., 2024).

A notable sex disparity exists, with women generally experiencing higher rates of CLBP, reporting greater pain intensity and functional disability compared to men. This difference may be attributed to a combination of physiological and social factors, including hormonal fluctuations, reproductive health, and occupational roles (Bizzoca et al., 2023). Additionally, a robust inverse relationship has been established between socioeconomic status and the risk and severity of CLBP. Individuals with lower income, less formal education, and those in physically demanding occupations have a higher predisposition to developing CLBP and experiencing greater symptom severity (Aroke, Nagidi, et al., 2024). This association is likely multifactorial, stemming from occupational stressors and disparities in access to quality healthcare and preventative resources (Costa et al., 2023). The association between physical activity and lifestyle and CLBP is complex and can be characterised as a non-linear, "U-shaped" curve. Both a sedentary lifestyle and engagement in highly strenuous physical labour are independently associated with an elevated risk of CLBP and related disability.

Physiotherapy has a significant influence on the quality of life of back pain patients. The evidence-based practices and interventions used in physiotherapy can help alleviate pain and other symptoms, improve functional ability, enhance social interactions, increase physical activity, and, as a result, improve physical and overall well-being and quality of life. A review of the scientific literature in this field indicates that physiotherapy and CLBP represent a broad research area and that the production of research literature has grown significantly in recent decades (Šajnović et al., 2024). Despite the increasing emphasis on integrating physiotherapy with related disciplines (primarily kinesiology) and other healthcare fields (psychology and psychotherapy), the literature highlights that the physiotherapeutic process remains the cornerstone of successful CLBP rehabilitation (Baroncini et al., 2024).

Various literature reviews suggest that multiple outcome measures are recommended for assessing physiotherapy effectiveness: functional outcomes (Oswestry Disability Index, Roland-Morris Disability Index) (Chiarotto et al., 2016), pain-related outcomes (NPRS, Pain Disability Index) (Chou, 2010), psychosocial outcomes (Avoidance Beliefs Questionnaire) and other outcomes (return to work, complications, or adverse effects of the disease). Additionally, QoL assessment (SF-36v2) is highlighted as one of the fundamental factors in CLBP research (Chapman et al., 2011).

QoL manifests across multiple dimensions and has a significant impact on the success of CLBP therapy. It is defined as a combination of objective and subjective dimensions and is generally lower in CLBP patients due to increased pain perception and consequent impairment in normal functioning (Agnus Tom et al., 2022).

In addition to pathophysiological factors, other elements can influence pain intensity, disability, and QoL in CLBP patients (Gerhardt, Andreas Hartmann et al., 2012), including depression, anxiety, pain coping behaviours, and catastrophising. Fear and its associated reactions, such as Kinesio phobia, contribute to negative outcomes, leading to heightened pain perception, increased emotional distress, and greater disability, ultimately resulting in poorer QoL (Varallo et al., 2021).

Furthermore, there is a significant gap in research addressing the impact of interventions on both CLBP and QoL simultaneously, lack of studies utilising patient-reported outcomes measures and lack of integrated and holistic research approaches relating various aspects of CLBP and its treatment (Baker et al., 2025).

To reduce this gap, we performed a study on a randomly selected cohort of CLBP patients undergoing physiotherapeutic rehabilitation lasting eight working days.

The aim of the study was to investigate the influence of demographic factors on the effectiveness of physiotherapy in CLBP patients, with QoL and difference in pain serving as the primary measure of treatment success.

2. Methodology

2.1 Study Sample

We used the G*Power (version 3.1.9.7), an open-source software that employs statistical power analysis to calculate the minimum required sample size for statistical tests (G*Power, n.d.).

The calculated minimum sample size for multiple linear regression (10 predictors, effect size = 0.1, error probability = 0.05, Power = 0.95) was 110 participants. The study population was sampled

purposively and randomly. The research sample was selected based on referrals for physiotherapy treatment, either through a medical work order or as part of a rehabilitation program. Signed informed consent was received from all participants. Patient selection was determined according to specific inclusion criteria. Inclusion criteria included: age between 18 and 60 years (inclusive), the presence of chronic low back pain persisting for more than six months (Farley et al., 2024; Manchikanti et al., 2009), and completion of physiotherapy treatment for chronic low back pain. There were no specific exclusion criteria. To ensure random selection, a randomised sampling method was employed. Each patient willing to participate in the study was asked to roll a standard six-sided die. Patients who rolled a six were selected for inclusion. This procedure was repeated until the desired sample size of 150 was achieved. However, 27 individuals withdrew during the research process, resulting in a final sample of 123 participants, which was still above the cutoff value for reliable statistical analysis. The reasons for their withdrawal were not known to the researcher, as these patients stopped attending the scheduled sessions.

The physiotherapy treatment lasted for eight working days and spanning trough the period of two months, according to referrals in Slovenia which states that in one order the patient is eligible for eight physiotherapy sessions. Before treatment, each patient was examined first by a physician and then by a physiotherapist who determined the physiotherapy procedures.

The selected procedures formed a holistic and personalised treatment for each individual patient. The rehabilitation techniques applied in the treatment included a combination magnetotherapy, individualised exercises, ultrasound therapy, laser therapy, magnetotherapy kinesiotherapy, transcutaneous electrical nerve stimulation (TENS), manual therapy, consultations about sport activities and interferential therapy.

2.2 Measurement instruments

Participants completed a demographic questionnaire with the assistance of the principal investigator. The Quality of life (QoL) was measured with the 36-Item Short Form Survey Instrument (SF-36v2). Pain intensity was measured using the Numerical Pain Rating Scale. Demographic Questionnaire: The demographic questionnaire was developed specifically for the purpose of this article and included essential demographic variables such as sex, age, height, weight, educational attainment, total years of employment, and satisfaction with monthly income. Quality of Life Assessment: The 36-Item Short Form Survey Instrument (SF-36v2) is a widely used generic, multidimensional tool designed to evaluate health-related quality of life and treatment outcomes (McHorney et al., 1994; Sullivan et al., 1995). It is psychometrically robust, comprehensive, and assesses eight dimensions of quality of life: physical functioning, role limitations due to physical health, bodily pain, general health perception, mental health, emotional well-being, social functioning, and vitality. The overall quality of life (QoL) was calculated as the average of the eight-dimension scores, it is one of the most frequently used validated quality-of-life instruments (Bregant & Neubauer, 2011). Participants responded to a total of 36 questions, with results coded according to a standardised scoring system ranging from 0 to 100. Higher scores indicate fewer limitations, better physical, emotional, and mental health, greater vitality, and improved social functioning (RAND, 1992). In addition to eight standard SF36 dimensions we also used Health Change, an item which is treated separately because it measures something fundamentally different from the eight SF-36 dimensions and is a transition measure, not a status measure. It doesn't reflect the respondent's present level of functioning or well-being but rather their subjective sense of improvement or decline, Nevertheless, it is frequently used together with SF36 (Dimitrijević et al., 2024). For this study, the SF-36v2 was translated from English to Slovenian by a medical specialist and subsequently back-translated into English by a public health professional fluent in English to ensure linguistic and conceptual equivalence. Before translation both experts also compared the translated version to already existing Slovenian version of the SF-36 questionary (Logar Zakrajšek et al., 2018) and performed necessary adaptions. Finally, the questionnaire was pilot tested on a sample of 10 patients. Pain Intensity Assessment: Pain intensity was measured using the Numerical Pain Rating Scale (NPRS), where participants rated their CLBP on a scale from 0 to 10 (0 = no pain, 10 = worst possible pain) before and after physiotherapy treatment. The difference between the pain score before and after the intervention was used as an outcome measure for physiotherapy rehabilitation and as a variable in regression analysis. The NPRS is a reliable pain assessment tool with high test-retest reliability (Hawker et al., 2011; Hrvatin & Puh, 2021). Finally, all questionnaires were pilot tested on a sample of 10 patients to assure the feasibility, practicality, and effectiveness of the questionaries.

2.3 Statistics

The data was analysed using SPSS software V28 (IBM, Rochester). Paired Student's t-test, Pearson correlations, and linear regression analysis were used to determine associations between demographic variables and QoL and the influence of physiotherapy intervention to the change in QoL. A statistical correlation coefficient $p < 0.05$ was considered statistically significant. The normality was evaluated using the Kolmogorov-Smirnov test.

3. Results

A total of 123 participants (29 males, 94 females) with CLBP were included in the study. The descriptive statistics of demographic variables shown in Table 1.

Table 1: Demographic variables

Demographic variable	Average	Standard deviation
Age in years	51.6	11.4
BMI in kg/m²	27.5	5.5
Education level	Middle school	
Work experience in years	26,8	11.7

Table 2. compares mean values and standard deviations of QoL and its dimensions before and after an intervention, along with Pearson correlation and paired t-test p-values. Following findings were observed:

- Physical Functioning: Mean decreased slightly (51.2 → 49.6), but variability increased (23.9 → 44.8). Correlation is strong (0.803), and p-value = 0.010 → significant change.
- Role Limitations (Physical Health): Mean increased (23.4 → 26.6), variability de-creased, correlation moderate (0.570), p-value = 0.457 → not significant.
- Mental Health: Slight decrease (53.7 → 52.4), variability dropped sharply (46.4 → 13.6), correlation moderate (0.586), p-value = 0.713 → not significant.
- Vitality: Slight increase (48.3 → 50.1), variability increased, correlation moderate (0.493), p-value = 0.311 → not significant.
- Emotional Well-being: Slight increase (60.1 → 61.0), variability increased, correlation moderate (0.510), p-value = 0.615 → not significant.
- Social Functioning: Increase (65.2 → 70.0), variability decreased, correlation strong (0.734), p-value = 0.012 → significant improvement.
- Bodily Pain: Increase (35.4 → 40.1), variability increased, correlation strong (0.633), p-value < 0.001 → highly significant improvement.
- General Health Perception: Slight increase (53.1 → 54.0), correlation strong (0.723), p-value = 0.051 → borderline significance.
- Health Change: Increase (42.4 → 47.7), variability doubled, correlation moderate (0.460), p-value = 0.023 → significant improvement.
- Quality of Life (QoL): Increase (48.1 → 50.0), variability slightly increased, correlation strong (0.699), p-value = 0.110 → not significant.

Additionally, we compared pain levels before and after the interventions using paired Student's which showed significant reduction of the pain (t-test p < 0,001)

Significant improvements were observed in Bodily Pain (p < 0.001), Physical Functioning (p = 0.010), Social Functioning (p = 0.012), Health Change (p = 0.023) and a borderline improvement in General Health Perception (p ≈ 0.051).

Other domains showed no statistically significant change, despite some mean differences.

The intervention seems most effective for pain reduction, physical functioning, and social functioning.

Mental health and emotional well-being did not change significantly.

High Pear-son correlations suggest scores before and after are related, meaning individuals' relative positions remained similar.

Table 2: QoL and its dimensions, and Health Change, before and after the physiotherapy intervention

	Mean value before	Std. Deviation Before	Mean value after	Std. Deviation after	Pearson correlation*	Paired student t-test p-value
Physical Functioning	51,2	23,9	49,6	44,8	0,803	0,010
Role limitations due to physical health	23,4	35,8	26,6	15,6	0,570	0,457
Mental health	53,7	46,4	52,4	13,6	0,586	0,713
Vitality	48,3	15,3	50,1	25,1	0,493	0,311
Emotional well-being	60,1	12,2	61,0	18,3	0,510	0,615
Social functioning	65,2	25,6	70,0	18,5	0,734	0,012
Bodily pain	35,4	18,5	40,1	23,8	0,633	<0,001
General health perception	53,1	18,1	54,0	14,8	0,723	0,051
Health change	42,4	21,5	47,7	44,8	0,460	0,023
QoL	48,1	13,1	50,0	15,6	0,699	0,110

Note: *p was lower than 0.001 for Pearson correlation for all variables. Bold font denotes the variables where the difference between pre and post physiotherapy scores were significant on 0.05 level.*

Table 3 indicates that none of the variables (Demographic variables + Difference in Pain) taken into the regression analysis were significantly related with QoL after the physiotherapy intervention. However, the results still indicate some weak positive association between Age, Education, Needs satisfaction, Gender and QoL. Conversely, BMI, Work experience, and Difference in pain (The difference in Pain after and before intervention) appear to have negative associations with QoL. The strongest observed associations were observed in Difference in pain (0.159 standard deviations per unit of change), Work experience (- 0.119 standard deviations per unit of change) and Age (0.115 standard deviations per unit of change).

Table 3: Regression analysis coefficients between demographic variables + Difference in pain and Quality of life after the physiotherapy intervention.

	Standardized Beta	t	Sig.
Constant		-0,340	0,734
Age	0,115	0,699	0,486
BMI	-0,033	-0,315	0,754
Education	0,051	0,483	0,630
Work experience	-0,119	-0,727	0,469
Needs satisfaction	0,003	0,032	0,974
Gender	0,010	0,103	0,918
Difference in pain	-0,152	-1,527	0,130

4. Discussion

Most of the existing literature on the effectiveness of physiotherapeutic treatment for CLBP focuses on pain and disability. We partially confirmed this through Student's t-test and correlation analysis, demonstrating improvements in pain levels (paired Student's t-test $p < 0,001$) and mobility (physical functioning; paired Student's t-test $p<0,006$). As shown in Table 1, all other observed QoL variables had p-values greater than 0.01. This suggests a partial association between chronic low back pain (CLBP), physiotherapy, and quality of life (QoL), indicating the possible involvement of additional influencing factors, such as motivation, trust (Good et al., 2024), psychological (Marshall et al., 2022) and neurobiological pain-coping mechanisms (Knezevic et al., 2023), patients' past experiences, and the type of physiotherapeutic intervention (Kwan-Yee Ho et al., 2022) which will be assessed in the future research.

The present study explored the interplay between demographic factors, physiotherapy outcomes, and quality of life (QoL) in individuals with chronic low back pain (CLBP), incorporating both physical and emotional dimensions. While most existing literature on CLBP rehabilitation focuses primarily on pain reduction and physical functioning, our findings underscore the importance of adopting a multidimensional perspective that includes psychological and emotional aspects. Unlike prior studies that examine physical outcomes or psychosocial factors in isolation, this research simultaneously assessed QoL (via SF-36v2), and pain intensity alongside demographic variables. This integrated approach aligns with the biopsychosocial model and responds to calls for more holistic frameworks in CLBP management. Although emotional well-being showed only minimal improvement post-intervention (60.1 to 61.0 points; $p = 0.615$), its inclusion provides valuable insight into the complexity of CLBP rehabilitation. Earlier studies have extensively explored psychological interventions such as cognitive-behavioural therapy or mindfulness for CLBP, but few have examined emotional well-being and pain within the context of physiotherapy outcomes. Our study contributes to filling this gap by analysing these dimensions together with demographic predictors and physiotherapy effectiveness. This combined analysis offers a more comprehensive understanding of patient recovery trajectories and highlights the need for integrated care strategies. The weak and statistically insignificant associations observed between demographic factors and QoL after physiotherapy suggest that physical treatment alone may not fully address the multidimensional nature of CLBP. Psychological distress, catastrophising, and fear-avoidance behaviours (Vergeld et al., 2021) likely play a critical role in shaping outcomes and should be considered in future research and clinical practice. Incorporating emotional and cognitive interventions alongside physiotherapy could enhance treatment efficacy and patient satisfaction.

Regression analysis revealed positive association between age and QoL. The increase in age and QoL is, in fact, an intriguing phenomenon that we observed. Usually, QoL decreases with age or is higher in younger individuals with CLBP. This finding does not align with results from studies, which reported a negative correlation between age and QoL. The findings of our study might point to the paradox of well-being, which has been previously described in the literature (Schilling, 2005). The paradox of well-being suggests that older patients with CLBP may have developed better pain management mechanisms, which in turn leads to better outcomes in QoL dimensions. It thus

describes a contradictory relationship between age and QoL, and well-being, stating that despite cognitive and physical decline, the well-being of the older population is not necessarily worse compared to the younger population, as there are numerous objective and subjective factors that influence QoL (Wettstein et al., 2019).

Despite not significant the negative values of beta coefficient regarding BMI (β = - 0,033; Sig. = 0,754), work experience (β = - 0,119; Sig. = 0,469) in regression analysis is particularly interesting (Table 3). Although the associations were not statistically significant, the results suggest an interesting finding of a negative association. A possible explanation might be that individuals with a higher BMI may experience lower QoL due to excess body weight, which hinders their ability to perform daily activities, both social and physical. Additionally, a higher BMI is often associated with greater emotional distress, poorer psychological health, and increased pain intensity (Peck et al., 2021).

On the other hand, a higher level of education was associated with better QoL outcomes after physiotherapy (β = 0,051; Sig. = 0,630). Although this association was also statistically non-significant, it suggests that education level has an impact on QoL. Higher education is typically linked to better employment opportunities and, consequently, greater economic security for patients with CLBP (Hirsh et al., 2019).

The negative value of beta coefficient work experience raises an intriguing question. Our study suggests that QoL decreased with longer work duration. It is evident that with increasing work experience or longer employment duration, both physical and psychological burdens on the individual's body also increase. Since chronic low back pain is associated with physical strains, this finding aligns with previous studies. A longer employment duration (particularly in jobs with ergonomic strain) influences physical changes in the musculoskeletal system, indirectly affecting pain intensity (Cieza et al., 2020), which is a key component of quality of life. Concurrently, increasing work experience in jobs with high psychophysical demands results in higher levels of psychological stress, which impacts the mental component of QoL. Furthermore, jobs that involve customer interaction also carry emotional burdens, which influence the emotional dimension of QoL.

A negligible however positive association between 'needs satisfaction' and QoL (β = 0,0003; Sig. = 0,974) was observed. This might be attributed to a discrepancy between clinical measures of pain and disability and patients' global perception of improvement. This highlights the importance of incorporating patient-reported outcomes in assessing the effectiveness of physiotherapy (Pires et al., 2022).

A very mild positive impact, though statistically insignificant, was also observed regarding gender. It is subtly suggested that women with CLBP have better QoL after physical therapy compared to men. This demographic factor could be related to hormonal status and emotional or cognitive mechanisms of pain perception, which are important dimensions of QoL, which is also in line with the findings of other studies (Hartvigsen et al., 2018).

In the study only, SF36 dimensions showed statistically significant improvements following physiotherapy in individuals with chronic low back pain namely Pain Reduction, Social functioning and Physical Functioning.

4.1 Limitations of the study

Despite incorporating multiple dimensions of QoL and demographic factors and employing precise statistical methods, the study has certain limitations. The study included 123 out of the initially planned 150 participants. While this sample provided insights into the current status of CLBP patients, a larger sample would have increased the statistical power and reliability of the findings. The study did not precisely define the specific CLBP diagnoses of participants. Future research should also consider the duration of CLBP before participants enter the rehabilitation process. The selection of measurement instruments was based on a review of relevant scientific literature on CLBP. However, the choice of assessment tools remains a limitation, as different instruments might yield varying results. The participants were observed for eight working days using a cross-sectional study design. To investigate the long-term effects of physiotherapy on QoL, a prolonged follow-up period and a longitudinal study design would be necessary.

4.2 Ideas for further research

This study provides a broad foundation for further research. Future investigations could focus on the impact of demographic factors on pain, incorporating data on patients' broader socioeconomic status and their psychophysical burdens at home and in the workplace. It also provides a basis for further investigation of subjective factors in CLBP, particularly emotional well-being and pain.

5. Conclusion

CLBP a complex medical and societal challenge representing a burden both for individuals and healthcare systems. It restricts patients on both psychological and physical levels, which consequently affects their daily functioning and overall quality of life (QoL). CLBP is the leading cause of sick leave among the working population worldwide and is one of the primary contributors to the high costs of healthcare systems. The study provides compelling results confirming that demographic factors significantly affect the QoL of CLBP patients. Before entering physiotherapy treatment, the intensity of patients' pain was conditioned by specific QoL components. Weak and statistically insignificant associations were observed between female sex, BMI, education level, age, pain, and physical functioning. The weak associations highlight the need for an in-depth investigation of

QoL and additional influencing factors, such as trust, motivation, past experiences, cognitive mechanisms, the type of physiotherapy intervention, and the duration of CLBP.

Conflict of interests

The authors declare no conflicts of interest.

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