Article

The Complex Interplay of Demographic Factors, Physiotherapy, Quality of Life and Stress in Chronic Lower Back Pain Patients

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The Complex Interplay Between Demographic Factors and Quality of Life in Chronic Lower Back Pain Patients During Physiotherapy Intervention

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Abstract: 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. Using statistical methods, including regression analysis and Student's t-test, we statistically analyzed data collected through various measurement instruments: a demographic questionnaire, 36-Item Short Form Survey Instrument (SF-36v2), the Perceived Stress Scale (PSS) and the Numerical Pain Rating Scale (NPRS). A total of 123 participants with CLBP were included in the study, undergoing physiotherapeutic rehabilitation lasting eight working days. The findings indicate positive correlations between education level, female sex, and age with QoL, while negative correlations were observed between BMI, work experience, and QoL. 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; stress; physiotherapy

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 demographic factors include education level, employment status, income, and disability status (Licciardone, 2021).

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). A physiotherapist's verbal and nonverbal approach to the patient, along with their knowledge and skills, forms the foundation of trust, which directly and indirectly influences the therapeutic outcomes (Good et al., 2024; Synnott et al., 2016; Vukičević et al., 2021).

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; Verville et al., 2023; Zaina et al., 2023). A physiotherapist's skills,

acquired knowledge, and verbal and nonverbal communication with the patient influence the therapy's effectiveness (Borsook et al., 2016; Hall & McIntosh, 2008; Vukičević et al., 2021) and consequently impact the patient's QoL.

The literature review suggests that multiple outcome measures are recommended for assessing physiotherapy effectiveness: functional outcomes (Oswestry Disability Index, Roland-Morris Disability Index, etc.) (Chiarotto et al., 2016), pain-related outcomes (NPRS, Pain Disability Index, etc.) (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, etc.) 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 (Berković-Šubić, 2021). 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 behaviors, and catastrophizing. These factors affect both CLBP severity and the success of physiotherapy (Herrero et al., 2024; Hong et al., 2014). Fear and its associated reactions, such as kinesiophobia, contribute to negative outcomes, leading to heightened pain perception, increased emotional distress, and greater disability, ultimately resulting in poorer QoL (Luque-Suarez et al., 2019; Varallo et al., 2021).

A literature review indicates that studies on QoL in CLBP patients were primarily conducted between 2015 and 2016 (Caby et al., 2016; Goossens et al., 2015; Ickmans et al., 2016; Kamper et al., 2015).

While many studies focus on the physical aspects of QoL in relation to CLBP, they neglect psychological, social, and emotional dimensions. Additionally, there is a significant gap in research assessing the impact of various interventions on both CLBP and QoL and a lack of studies utilizing patient-reported outcomes measures. To reduce this gap we performed a study on a randomly selected cohort of CLBP patients undergoing physiotherapeutic rehabilitation lasting eight working days. Using statistical methods, including regression analysis and Student's t-test, we statistically analyzed data collected through various measurement instruments and a demographic questionnaire.

2. Methodology

Data Collection and Measurement Instruments

The study population was sampled purposively and randomly. A total of 123 patients suffering of CLBP were included. 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 and exclusion criteria. The inclusion criteria were as follows: age between 18 and 60 years (inclusive), the presence of chronic low back pain persisting for more than six months, and completion of physiotherapy treatment for chronic low back pain. The exclusion criteria included: age below 18 or above 60 years, absence of physiotherapy treatment for low back pain, and subacute low back pain (lasting three months or more).

All participants underwent physiotherapy treatment, having been referred by a specialist in physical medicine and rehabilitation or a primary care physician, either via a work order or as part of a rehabilitation program.

The physiotherapy treatment lasted for eight working days. The rehabilitation techniques applied in the treatment included magnetotherapy, individualized exercises, transcutaneous electrical nerve stimulation (TENS), manual therapy, and interferential therapy. However, the specific application of these modalities varied among participants.

Demographic balance was taken into account. The G*Power program (version 3.1.9.7) calculated the minimum required sample size, which was 147 participants. A total of 150 participants were initially enrolled in the study. However, 27 individuals withdrew during the research process, resulting in a final sample of 123 participants included in the statistical analysis. The Quality of life (QoL) was measured with the 36-Item Short Form Survey Instrument (SF-36v2) (1), the perceived stress with the Perceived Stress Scale (PSS) (2) and the intensity of CLBP with the Numerical Pain Rating Scale (NPRS) (3). Participants completed a demographic questionnaire with the assistance of the principal investigator.

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. For research validation, 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 post-treatment pain score was used as an outcome measure for physiotherapy rehabilitation. The NPRS is a reliable pain assessment tool with high test-retest reliability (Hawker et al., 2011; Hrvatin & Puh, 2021).

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. It is one of the most frequently used validated quality-of-life instruments (Bregant & Neubauer, 2011).

Each dimension comprises a varying number of questions: bodily pain and social functioning (2 questions), emotional well-being (3 questions), role limitations due to physical health and vitality (4 questions), mental health and general health perception (5 questions), and physical functioning (10 questions). Participants responded to a total of 36 questions, with results coded according to a standardized 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). 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 to ensure linguistic and conceptual equivalence.

Perceived Stress Assessment

The Perceived Stress Scale (PSS) is a widely used tool for quantitatively assessing stress levels, demonstrating high reliability and consistency (Cohen et al., 1983; NovoPsych, 2023). Participants responded to 10 items, rating each on a scale from 0 to 4 (0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, 4 = very often). Items 4, 5, 7, and 8 were reverse-scored. Total scores range from 0 to 40, categorized as follows: 0–13 = Low stress level, 14–26 = Moderate stress level and 27–40 = High stress level.

For this study, the PSS was translated from English to Slovenian by a medical specialist and subsequently back-translated into English language by a public health professional to ensure consistency and accuracy.

Statistics

The data was analyzed using SPSS software V28 (IBM, Rochester). Paired Student's t-test, Spearman 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.

3. Results

Table 1 demonstrates an increase in perceived overall quality of life (QoL) following physiotherapy, along with improvements in its components: role limitations due to physical health, energy/fatigue, emotional well-being, social functioning, pain management, general health, and perceived health change. While physical functioning showed a decrease, only the improvements in social functioning, physical functioning, health change and pain management were statistically significant. Furthermore, significant correlations were observed between pre- and post-physiotherapy QoL scores and all its components. The strongest correlations were found for physical and social functioning, while the weakest were for health change and energy/fatigue. All correlations were positive, indicating that patients with higher QoL scores before the intervention also tended to have higher scores afterward, and conversely, patients with lower initial scores also had lower post-intervention scores. This suggests that patients with initially higher QoL may experience greater benefits from physiotherapy.

Table 1. Quality of life before and after the physiotherapy intervention.

	Before		After		Correlation p <0.001	Paired Student t-Test p-Value
	Mean	**Std. Deviation**	**Mean**	**Std. Deviation**		
Physical Functioning	51,2	23,9	49.6	44,8	0,803	<0.006
Role limitations due to physical health	23,4	35,8	26.6	15,6	0,570	0,457
Role limitations due to emotional problems	53,7	46,4	52.4	13,6	0,586	0,713
Energy/Fatigue	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
Pain	35,4	18,5	40.1	23,8	0,633	<0,001
General health	53,1	18,1	54.1	14,8	0,723	0,0515
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

Table 2 indicates that none of the demographic variables were significantly associated with quality of life (QoL) after the intervention. However, the table suggests potential positive influences on QoL from age, education, needs satisfaction, and female gender. Conversely, body mass index (BMI), work experience, and the change in pain levels (presumably a decrease) appear to have negative associations with QoL. The strongest observed associations were with change in pain levels (15.2%), age (11.5%), and work experience (11.9%).

Table 2. Regression analysis coefficients between demographic variables and Quality of life after the physiotherapy intervention.

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

4. Discussion

Most of the existing literature on the effectiveness of physiotherapeutic treatment (PT) 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 involvement of additional influencing factors, such as motivation, trust (Drossman et al., 2021; Good et al., 2024; Vukičević et al., 2021), psychological (Marshall et al., 2022; Van Ryckeghem et al., 2018) and neurobiological pain-coping mechanisms (Knezevic et al., 2023), patients' past experiences, and the type of physiotherapeutic intervention (Kwan-Yee Ho et al., 2022).

There is a growing body of research emphasizing the multidisciplinary approach to treating CLBP, particularly its psychological aspects. Our study contributes to addressing this research question. We highlighted both the physical and psychological dimensions of pain and their significance in rehabilitation. Additionally, we extend this perspective by incorporating the emotional aspect of pain, providing a unique contribution that differentiates our study from others in this research field. Interestingly, our results do not indicate a significant impact of emotions, which is notable given that pain is inherently a multidimensional personal and emotional experience. Emotional well-being in our study showed only minimal change (before: 60,1 points, after: 61,0 points) with statistical with statistically non-significant association (p = 0,615). This opens an avenue for future research on the emotional components of pain. Furthermore, emotions are closely linked to trust, motivation, and past experiences, making them an intriguing subject for further investigation (Kwan-Yee Ho et al., 2022; Lu et al., 2021; Macías-Toronjo et al., 2020; Otero-Ketterer, Peñacoba-Puente, Pinheiro-Araujo, et al., 2022).

The negative beta correlation between BMI (β = - 0,033; Sig. = 0,754), work experience (β = - 0,119; Sig. = 0,469) and QoL is particularly interesting (Table 2). Although the correlations were not statistically significant, the results suggest an important finding of a negative correlation. A possible explanation for the negative correlation between BMI and QoL is 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 (Blüher, 2019; Peck et al., 2021).

However, the negative correlation with 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 (CLBP) 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; Hossain et al., 2018), which is a key component of quality of life (QoL). 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. When all of these factors are combined, it becomes clear that CLBP is indeed a multidimensional experience with multiple risk factors (Kamper et al., 2015; Karasek et al., 1998; Otero-Ketterer, Peñacoba-Puente, Ferreira Pinheiro-Araujo, et al., 2022) and with a significant impact on QoL.

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 a considerable 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; Karran et al., 2020). Higher monthly income provides them with access to additional therapeutic options and greater financial freedom (Atkins & Mukhida, 2022; Karran et al., 2020). Both factors, through psychological mechanisms, influence the emotional and psychological dimensions of QoL and pain levels.

Statistical methods revealed positive association between age and female gender. 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 foreign studies, which reported a negative correlation between age and QoL. The findings of our study point to the *paradox of well-being*, which has been previously described in the literature (Kunzmann et al., 2000; 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 (Rowe & Kahn, 2015; Wettstein et al., 2019).

A very mild positive impact, though statistically insignificant, was also observed with regard to 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; Palacios-Ceña et al., 2021).

Our article reinforces the link between psychological factors, emotions, and pain perception, once again supporting the psychological and emotional dimensions of pain.

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.

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.

Implications on Physiotherapy Practice

Our study show that Physiotherapists can enhance CLBP management by adopting a multidimensional approach by personalizing care to address physical, emotional, and social dimensions. In essence, this study encourages physiotherapists treating CLBP to adopt a more holistic, patient-centred approach that goes beyond solely addressing the physical symptoms. By considering the patient's overall QoL, being mindful of potential demographic influences, and addressing psychological and emotional factors, physiotherapists can strive for more meaningful and comprehensive outcomes for their patients.

6. Conclusion

CLBP represents 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.

CLBP is a complex medical and societal challenge, as it encompasses multiple dimensions, including emotional, psychological, neurobiochemical, and demographic factors. While pain is fundamentally a protective bodily mechanism, prolonged pain can disable individuals physically and psychologically, ultimately deteriorating their QoL over time.

The aim of this study was to investigate the influence of demographic factors on the effectiveness of physiotherapy in CLBP patients, with QoL serving as the primary measure of treatment success. 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 but statistically insignificant correlations were observed between female sex, BMI, education level, age, pain, and physical functioning. The weak correlations 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. Moreover, the findings confirm that physiotherapy significantly reduced pain and improved physical performance.

Use of Artificial Intelligence: AI or AI-assisted tools were not used in drafting any aspect of this manuscript.

Conflicts of Interest: The authors declare no conflicts of interest.

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