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ORIGINAL RESEARCH

The Economic Analysis of the Overlooked Recurrent Low Back Pain: Three Years Retrospective Observational Study

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Purpose: Recent redefinitions of pain emphasize the importance of the previously overlooked recurrent low back pain (LBP). Understanding the direct medical cost for recurrent LBP cases based on the cost per visit is crucial economically. We aimed to compare the cost per visit for LBP and recurrent LBP, including the impact of gender and type of medical service, estimating the approximate annual cost of recurrent LBP.

Patients and Methods: Data on LBP categorized according to ICD-10 codes (G54, G55, M45, M46, M47, M48, M49, M51, M53, and M54) from the Polish National Health Fund (NHF) and Opolskie Rehabilitation Center (OCR) were analyzed based on the recurrent state as outlined in the new chronic pain definition.

Results: In OCR, a recurrent LBP was confirmed for 22.78% of patients, of which 59.72% were female ($p<0.001$). The mean value of a single procedure for recurrent LBP was 110.56 EUR, it was significantly higher for males (135.35 EUR) than for females (92.94 EUR) ($p=0.008$). Recurrent LBP generated a higher cost per visit for medical services than LBP ($p<0.001$), except for physiotherapy. Notably, males had a higher cost per visit in inpatient admissions, while females had a significantly higher cost per visit in physiotherapy services for both LBP and recurrent LBP. Moreover, recurrent LBP generated a statistically higher cost per visit for medical services than non-recurrent cases, except for physiotherapy. The average annual cost of LBP-related medical services in Poland was €243,861,639.

Conclusion: Recurrent LBP accounts for 5% of total direct LBP costs and has a higher cost per visit than LBP, excluding physiotherapy services. Gender significantly affected per-visit costs, with males having more inpatient admissions and females utilizing more physiotherapy services for both LBP and recurrent LBP.

Keywords: cost analysis, recurrent low back pain, medical services, multidisciplinary care, biopsychical model of pain, ICD-11

Introduction

Low back pain (LBP) was recognized as a global health problem in the 1990s when the number of patients doubled to over 619 million, and it has become the leading cause of disability worldwide.[1,2] Studies show increasing costs associated with back pain, but the economic burden due to LBP varies between countries.[3] For example, the estimated annual total cost of LBP in Switzerland was €6.6 billion,[4] and in the United Kingdom £12.3 billion.[5] In Western countries, the societal cost of the LBP has been estimated at 1–2% of gross national product,[6] with over 80% of these costs attributed to loss of productivity and disability.[2]

Substantial costs are incurred for physician visits related to diagnosing and treating LBP.[7] Understanding why LBP becomes persistent or recurrent is a crucial aspect from both medical and financial viewpoints.[8,9] Globally recognized limited effectiveness of the chronic LBP treatment resulted in a high economic burden.[1,3] It's proposed to be improved by

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systemic solution in ICD-11 introduced for MG.30 with three pathways demanding different medical services eg physiotherapy.[10,11] Therefore, the optimal management of medical services and the cost-effectiveness of treatment requires economic evaluation.[12] Most studies reported annual cost or cost per capita.[13,14] However, more reliable data can be obtained by individual cost per visit, which is considered a critical metric allowing for better distribution of resources between different types of medical services. Different costs are associated with varying approaches to LBP treatment, making the cost per visit crucial for developing cost-effective management strategies to mitigate the economic burden of LBP. Factors influencing the cost per visit in healthcare systems include service utilization, primary care access, healthcare information systems, cost-sharing mechanisms, and care quality.[15,16] Effective management and policy interventions should address these factors to optimize healthcare costs while maintaining or improving care quality.[17]

Several systemic solutions have been implemented. First, chronic low back pain (cLBP) has been classified as a disease in the International Classification of Diseases, 11th Revision. Second, the newly proposed biopsychosocial model of chronic pain management is commonly recommended[18,19] and the World Health Organization has released new guidelines for primary cLBP[10,11] emphasizing the role of holistic management by different healthcare professionals within a wider multidisciplinary team.

The newest pain redefinition indicated the importance of the recurrent state for chronic pain.[20,21] Almost all available LBP cost analyses considered cLBP as a pain lasting three or more months, and little is known about the economic cost of recurrent LBP.[13] However, more than half of the LBP cases reported pain lasting over 12 months, occurring in multiple episodes.[7,22] Thus, the direct cost of medical services for recurrent LBP cases is important from an economic perspective.

Poland, one of the largest central European countries, has a similar LBP prevalence to Germany.[23] In 2019 LBP was the second most common chronic disease in Poland with an incidence of around 26% among the adult population.[24] The biopsychosocial model of chronic pain management recommends changes in the management of healthcare services.[11] Hence, our objective was to examine the cost per visit, considering factors such as gender, and types of medical services. Furthermore, we estimate the approximate annual cost of recurrent LBP.

Materials and Methods

The retrospective observational study was conducted from December 2023 to February 2024. In accordance with Polish legislation and the General Data Protection Regulation, obtaining ethics committee approval was deemed unnecessary as the dataset used was fully anonymized and contained no identifiable personal data. Additionally, we obtained a formal statement confirming that the study does not constitute an experiment and is therefore not subject to review by the Bioethics Committee at the Poznan University of Medical Sciences (KB-496/23). Based on the Bioethics Committee's decision, obtaining patient consent was also not required, as the study did not involve any experimental interventions or the processing of personal data.

Data Sources

We extracted data on the number of medical services and the overall treatment cost of LBP patients in Poland and its regions from the Polish National Health Fund (NHF) records spanning from 2019 to 2021, categorized according to ICD-10 codes: G54, G55, M45, M46, M47, M48, M49, M51, M53, and M54. It included the gender, age, and valuation of services related to the above-mentioned ICD-10 codes. The data incorporated with division by voivodeships, counties, and costs in primary healthcare, outpatient services, and inpatient treatment.

Additionally, data for analysis was obtained from the Opolskie Centre of Rehabilitation in Korfantow (OCR). The study included medical records of LBP patients aged 21 years or above, with diagnoses falling under the following ICD-10 codes: G54, G55, M45, M46, M47, M48, M49, M51, M53, and M54. Individuals with tumors, trauma, and chronic inflammatory conditions were excluded from the analysis.

Study Sample and Data Analysis

We examined the overall cost of the LBP medical services according to ICD-10 within the 3-year follow-up period in years 2019–2021 at OCR depending on the recurrent state as outlined in the new chronic pain definition.[20,25] In relation to the definition of recurrent low back pain, Stanton highlights the difficulty of adopting a single, uniform definition for

this phenomenon.[25] However, based on the work of de Vet, recurrent LBP can be defined as episodes of low back pain that occur after periods without symptoms or after periods when the patient has not sought medical care for low back pain.[26] De Vet suggests that the gap between the resolution of pain and the recurrence of symptoms should be at least 30 days. Assuming that chronic pain lasts for more than 12 weeks, and that patients do not necessarily seek consultation immediately after the pain resolves, we have adopted a 30-day pain-free gap. Furthermore, since patients often do not consult immediately after symptom recurrence, in our analysis, based on medical service data, we have defined recurrent LBP as subsequent medical services related to the same ICD-10 code within six months from the initial diagnosis. This definition aims to reflect the real-world recurrence of low back pain in clinical practice. Consequently, patients were categorized based on the number of revisits after 6 months for the same diagnosis of LBP. The LBP patients were assigned into groups "0" – lack of revisits, "≤2" – up to two revisits, and '≥3' – three or more revisits. Recurrent LBP was considered for the patients who re-attended '≥3'. The patients from the group '≤2' were not considered as recurrent LBP due to the fact that they represented mixed states, non-recurrent LBP, post-surgery control visits, medical consultations, etc. Additionally, we provided a breakdown based on the gender and the type of medical service received, including inpatient admission (orthopedics and rehabilitation departments), outpatient consultation, and physiotherapy services. Excluding patients with mixed or non-recurrent cases may overlook individuals who experience intermittent or less frequent episodes of low back pain, potentially leading to an underestimation of the true burden of low back pain across different patient groups. This could limit the generalizability of the study's findings to a broader population. Furthermore, it is important to note that the adoption of a six-month gap between medical services may result in the exclusion of patients who seek care within a shorter time frame. Additionally, the use of different ICD-10 codes interchangeably for the same condition may lead to some data being missed. Thus, the exclusion was made to create a more homogeneous group for analyzing recurrent low back pain, and we believe the biases introduced are minimal given the study's parameters. The whole process of data extraction, categorization and analysis is presented in Figure 1.

We found a similar gender ratio (55:45; F:M) in the value of services between Poland, the Opole region, and OCR. Using a prevalence-based bottom-up approach,[13,27,28] we evaluated the burden of recurrent LBP in Poland based on the results from OCR, taking gender into account. This involved multiplying the number of recurrent LBP medical services provided by OCR within a defined period by the corresponding cost according to the NHF valuation. To estimate the value of procedures performed in Poland, we computed the average service value in OCR, along with a 95% confidence interval (95% CI). These intervals were derived using 5000 bootstrap replicates, where each individual procedure's value had a 50% chance of being included in the average.

Based on the incidence of recurrent LBP in OCR, we determined the number of medical services for recurrent LBP performed in Poland in 2019–2021 depending on gender. By multiplying this number by the average service value in OCR, the total cost of the recurrent LBP could be projected. To obtain the annual cost, we divided the resulting value by three. Inflation during the reported period was low, the exchange rate remained stable, and the terms of contract settlements in this area essentially did not change. Thus, the values in Euro were calculated based on the original prices in PLN and the exchange rate of 1 Euro = 4.35PLN (The National Bank of Poland, November 27, 2023).

Statistical Analysis

The data analysis involved several key methodologies. Firstly, the cost per visit was analyzed. The Shapiro–Wilk test assessed the data distribution, ensuring adherence to normality assumptions. Subsequently, due to the nonparametric nature of the data, descriptive statistics such as the median and interquartile range were used for summarization. To evaluate differences in costs between genders, the Mann–Whitney *U*-test was chosen given the non-normal distribution of the data, providing robust comparisons of central tendencies. Additionally, the Kruskal–Wallis ANOVA was applied to assess cost disparities across specified groups of patients, as it is a nonparametric alternative suitable for simultaneously comparing multiple groups. Subsequent post-hoc analysis was conducted using the Dunn-Benjamini-Hochberg method to adjust for multiple comparisons, as it effectively controls the false discovery rate. Unlike more conservative methods like Bonferroni correction, this approach reduces the risk of Type I errors without excessively increasing the risk of Type II errors, thus providing a balance between sensitivity and specificity in detecting true differences.

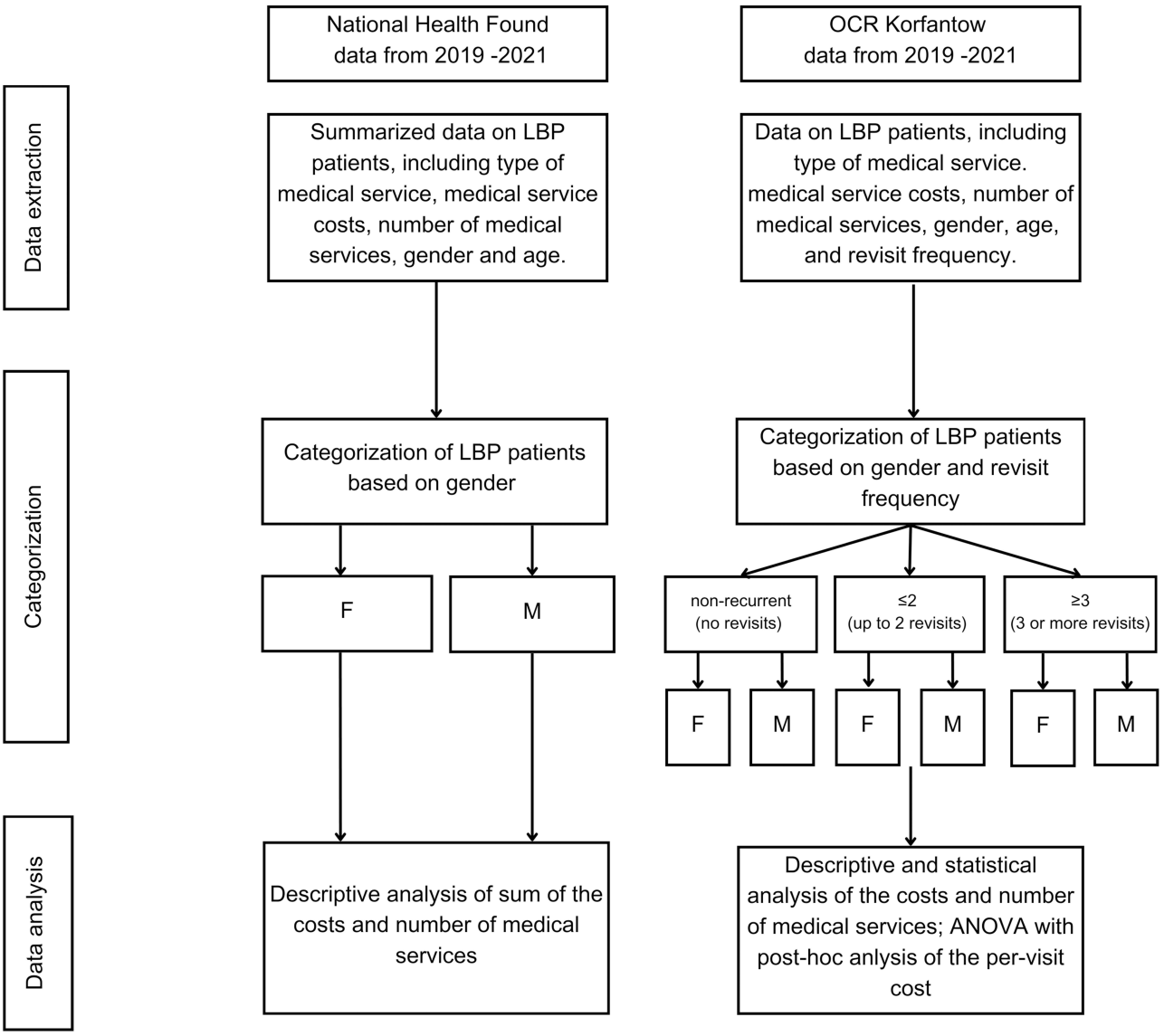

Figure 1 Flow diagram of the study design.

Secondly, average cost values divided into groups according to gender or type of medical service were compared. The homogeneity of variance of the tested data was assessed using Levene's test and for the average cost values Welch's *t*-test was used.

Results

According to NHF data from 2019 to 2021, the average annual cost of LBP-related medical services in Poland was 243,861,639 euros, with a total of 315,450 services provided per year (147,119 used by males, 168,331 by females). From OCR we included a cohort of 3226 patients with LBP in the study, with a statistically significant higher number of females (60.29%) compared to males (39.71%, $p<0.001$). The breakdown of individual medical services for the analyzed patients was as follows: inpatient admission (n=642) - female 57.48% vs male 42.52% ($p<0.001$), physiotherapy services (n=1323) - female 63.04% vs male 36.96% ($p<0.001$), and outpatient consultation (n=2021) - female 59.08% vs male 40.92% ($p<0.001$).

In OCR, a recurrent LBP was confirmed for 22.78% of patients (n=735), of which 59.72% were female ($p<0.001$). For that subpopulation medical services provided were as follows: inpatient admission (n=112, 17.45% of LBP);

physiotherapy services (n=452, 34.16% of LBP); and outpatient consultation (n=690, 34.14% of LBP). Physiotherapy services and outpatient consultations were used significantly more often by females (p<0.001), however there was no statistical difference between genders for inpatient admissions.

The cohort of the recurrent LBP covered 34.25% of the total cost of the LBP medical services in OCR. The distribution of recurrent LBP costs was as follows: inpatient medical care - 60.75%, physiotherapy service - 31.80%, and outpatient consultations - 7.45%. The breakdown by number of medical services demonstrated a significantly higher number of services for females (58,48%) compared to males (41,52%, p<0.001). The mean value of a single procedure in OCR for recurrent LBP was 110.56 EUR [CI: 97.21; 124.15]; it was significantly higher for males (135.35 EUR [109.24; 164.64]) than for females (92.94 EUR [CI: 78.94; 108.04]) (p=0.008).

Analysis of the Median Individual Cost per Visit of LBP Patients at OCR in the Years 2019-2021 Based on the Number of Revisits and Gender

The ANOVA confirmed that the group "≥3" defined as recurrent LBP significantly differentiated the median individual cost per visit of LBP patients for both females and males (p<0.0001). Detailed data on the cost of LBP medical services, with a cost analysis based on the number of revisits and gender, can be found in Table 1. Post-hoc analysis indicated that the median individual cost of LBP per visit for groups "≤2" and "≥3", and for both genders, was significantly higher than for all patients (p<0.003). Furthermore, the cost of the group "≥3" was significantly higher than the group "≤2"; but the analysis, depending on gender, revealed significant differences for females only (p<0.01). For a comprehensive breakdown of post-hoc analysis outcomes, please refer to the Supplementary Appendix (Table S1). The intragroup cost analysis of individual LBP patients for all LBP services and groups "≤2" and "≥3" revealed no significant differences depending on gender.

Analysis of the Median Individual Cost per Visit of LBP Patients at OCR in the Years 2019-2021 Based on the Number of Revisits, Gender, and Type of Medical Services

Inpatient Treatment

ANOVA confirmed that the recurrent state differentiated the median individual cost of LBP per visit for both females and males (p<0.012). Detailed data regarding the cost of LBP per visit, with a cost analysis based on the number of revisits, can be found in Table 2. Post-hoc analysis revealed that the recurrent state (≥3 revisits) resulted in significantly higher median individual costs compared to all LBP services (p<0.001), for both females and males (p<0.01). For a comprehensive breakdown of post-hoc analysis outcomes, please refer to the Supplementary Appendix (Table S2). The intragroup analysis

Table 1 The Median Individual Cost per Visit in Euros of the LBP Patients at OCR in the Years 2019–2021 Based on the Number of Revisits and Gender

		All LBP Services	Post 6 Months Revisit			p-value
			"0"	"≤2"	"≥3" Recurrent cLBP	
Total	Median IQR	144.88 19.66–451.37	53.45 16.37–311.86	191.31 40.52–557.68	198.65 72.76–534.62	<0.001
Female	Median IQR	151.48 23.59–419.31	67.61 17.3–302.69	172.97 42.45–557.29	215.42 76.73–528.55	<0.001
Male	Median IQR	134.96 19.6–484.4	44.55 16.12–363.23	228.79 40.36–558.21	188.82 65.97–565.28	<0.001
^p F vs M		0.603255	0.703951	0.966479	0.655112	

Notes: Exchange rate 1 euro = 4.35 PLN (The National Bank of Poland, November 27, 2023); p-value – ANOVA Kruskal Wallis; ^p F vs M – U-Mann Whitney test; "0" – lack of the revisit; "≤2" – series up to two revisits; "≥ 3"- series of three or more revisits.

Abbreviations: F, female; M, male; IQR, interquartile range.

Table 2 The Median Individual Cost per Visit in Euros of the LBP Patients at OCR in the Years 2019–2021 Based on the Number of Revisits, Gender, and Type of Medical Service

Type of medical services	All LBP Services		Post 6 Months Revisit			p-value
			„0"	"≤2"	"≥3" Recurrent cLBP	
Inpatient admission						
Total	Median IQR	550.34 550.34–1210.76	550.34 550.34–968.61	550.34 550.34–1153.1	1727.56 550.34–3980.93	<0.001
Female	Median IQR	550.34 550.34–1060.86	550.34 550.34–733.79	550.34 550.34–1113.79	1117.46 550.34–2653.78	0.012
Male	Median IQR	576.55 50.34–2653.78	550.34 550.34–1210.76	968.61 550.34–1326.07	2653.78 820.01–4049.91	<0.001
p^ F vs M		<0.001	0.046	0.168	0.007	
Physiotherapy services						
Total	Median IQR	275.17 130.51–302.69	275.17 221.06–302.69	302.03 122.51–557.68	263.38 117.93–388.19	0.003
Female	Median IQR	282.51 132.87–302.69	275.17 221.97–322.69	282.51 116.49–540.71	282.51 124.48–421.41	0.025
Male	Median IQR	275.17 123.17–302.90	275.17 206.38–302.69	302.69 133–565.02	241.1 106.4–342.13	0.010
p^ F vs M		0.417	0.921	0.229	0.032	
Outpatient consultation						
Total	Median IQR	18.36 9.17–34.4	16.25 8.91–19.66	15.72 7.86–23.32	35.99 24.49–59.97	<0.001
Female	Median IQR	18.36 9.18–33.69	15.72 8.91–20.83	15.72 7.86–23.71	35.34 20.44–59.7	<0.001
Male	Median IQR	18.36 9.18–34.86	16.72 8.91–19.66	15.72 7.86–22.01	37.15 23.19–60.73	<0.001
p^ F vs M		0.507	0.825	0.924	0.360	

Notes: Exchange rate 1 euro = 4.35 PLN (The National Bank of Poland, November 27, 2023); p-value – ANOVA Kruskal Wallis; ^p F vs M – U-Mann Whitney test; "0" – lack of the revisit; "≤2" – series up to two revisits; "≥ 3"- series of three or more revisits.
Abbreviations: F, female; M, male; IQR, interquartile range.

confirmed that in the "all LBP services" group, medical services for males were significantly more expensive than for females. This finding remained consistent across those with equal to or more than 3 revisits (Table 2).

Physiotherapy Services

ANOVA confirmed that the recurrent LBP differentiated the median individual cost of LBP per visit for both females and males ($p<0.025$). Detailed data regarding the cost of individual LBP medical services, with a cost analysis based on the number of revisits, can be found in Table 2. Post-hoc analysis revealed that the median individual costs for those with up to 2 revisits were significantly higher than that of all LBP medical services ($p=0.047$). This trend persisted when analyzing males individually ($p=0.015$), but not for the female group ($p=0.448$). Moreover, the median individual cost per visit of the medical services for patients with up to 2 revisits was found to be significantly more expensive than for those with 3 or more revisits in total ($p<0.015$) and for the male cohort ($p<0.011$), but not for the female cohort ($p=0.701$). For a comprehensive breakdown of post-hoc analysis outcomes, please refer to the Supplementary Appendix (Table S2). The intragroup analysis confirmed no

significant differences between the median individual cost of LBP patients based on gender. However, the median cost per visit for females was found to be more expensive than for males in the recurrent state group (≥3 revisits) (Table 2).

Outpatient Consultations

ANOVA confirmed that the recurrent state differentiated the median individual cost of LBP for both females and males ($p<0.001$). Detailed data regarding the cost of individual LBP medical services, with a cost analysis based on a number of revisits, can be found in Table 2. Post-hoc analysis revealed that the median individual costs of medical services for those with 3 or more revisits were significantly higher than the "all LBP medical services" ($p<0.001$). This trend persisted when analyzing both genders individually ($p<0.001$). Moreover, patients with up to 2 revisits were found to be significantly less costly than those with 3 or more revisits in total ($p<0.001$), for both females ($p<0.001$) and males ($p<0.001$). For a comprehensive breakdown of post-hoc analysis outcomes, please refer to the Supplementary Appendix (Table S2). The intragroup analysis confirmed no significant differences between the median individual cost of medical services for LBP based on gender. This finding remained consistent across the "≤2" and '≥3' LBP patient groups (Table 2).

The Simulation of Gender-Specific Costs of Recurrent cLBP in Poland for the Years 2019-2021

To calculate the costs of recurrent LBP, we utilized the average procedure value provided in OCR from 2019 to 2021, disaggregated by gender, because the values for both genders differed significantly. Considering the number of procedures performed in Poland - 172,961 in females and 151,164 in males - we estimated an average annual direct cost of the recurrent LBP medical services in Poland amounted to EUR 12,178,366 with a 95% CI of [10,055,580; 14,524,806] - EUR 6,820,033 with a 95% CI of [5,504,400; 8,295,903] for males and EUR 5,358,333 with a 95% CI of [4,551,180; 6,228,903] for females.

Discussion

To the best of our knowledge, this study represents the first attempt to calculate the direct cost of recurrent LBP. Importantly, we considered gender and type of medical service as parameters for cost analysis. According to the recently released chronic pain guidelines, we defined the recurrent state as three or more revisits due to the same presentation six months after the original diagnosis and within the 3-year follow-up period.[21] The estimated annual direct cost of the recurrent LBP was 12,178,366 EUR, accounting for approximately 5% of the total direct cost of LBP. The recurrent LBP generated a higher cost per visit compared to LBP, except for physiotherapy service. Furthermore, gender emerged as a significant factor in per-visit cost analysis across various medical services, with males bearing a greater burden of inpatient admissions, while females tended to utilize more physiotherapy services.

No previous study has considered the economic consequences of recurrent LBP. Nowadays, the recurrent state is indicated as one of the most important subjects for future pain studies.[29,30] Similar to Machado et al,[31] we established the incidence of recurrent LBP as one in five patients. However, other authors reported that the incidence of recurrent LBP ranges from 24 to 80% in the first year.[32,33] The new definition of chronic pain precisely distinguishes recurrent state criteria but, in the past, the term recurrent LBP was used in a variety of meanings eg causing care-seeking or causing activity limitation,[8,32] episodic LBP, or rarely a certain number of symptoms recurrences within a defined period.[9] Therefore, it seems that the overestimation of recurrent state incidence is probably due to the lack of a uniform definition. Additionally, different types of methodology used for cost analyses complicated data comparison. While one in five patients in OCR was diagnosed with the recurrent state, they were responsible for one-third of the total direct cost. Similarly, other authors noted that a relatively small number of chronic LBP cases with symptoms persisting for more than three months generated the largest percentage of cost.[34,35] As previously documented, the majority of LBP costs are generated by the public rather than private hospitals.[36] Thus, we analyzed the direct cost of the public healthcare system as most of the authors.[13,37–40] However, other studies confirmed that the direct cost of the LBP covered only a fraction of the total sum, eg approximately 10% of both direct and indirect LBP costs.[4] Therefore, the actual cost of the recurrent LBP in Poland is likely larger than estimated in our study.

Additionally, only two studies on LBP and cLBP have considered cost analysis from a gender perspective, both showing a higher cost burden for females.[14,41] We confirmed that the recurrent state provoked the increase in the median cost per visit with no statistically significant difference between the genders. Interestingly, gender disparities in cost intensity emerged depending on the type of medical services. We focused on the cost per visit depending on the type of medical service, not the total amount spent on invasive and non-invasive treatments delivered by different specialists. We confirmed that for recurrent LBP, gender differences significantly affect the cost of inpatient treatment, which was twice as high for men as for women ($p<0.007$). Moreover, the funds for physiotherapy services and inpatient admissions were predominantly spent on females and males, respectively. Future studies should consider a more detailed cost analysis of the various types of medical services. This is particularly important because Phillips et al[42] suggested the importance of comparing healthcare costs between non-surgical cLBP patients and those who received more invasive therapies, including surgery. Our study supports this concept, and we further emphasize the significance of gender analysis. Specifically, we found that the female gender significantly increased the cost per visit of physiotherapy services for recurrent LBP ($p=0.032$). In the most recent meta-analysis regarding the economic burden of cLBP, authors reported that one-third of the direct cost of medical services was covered by physical therapy and inpatient service in equal proportion.[3] In our study, inpatient treatment covered almost two-thirds of the total direct cost. The differences in our cost distribution may be explained by the fact that we considered inpatient admissions to both orthopedic and rehabilitation units. Thus, some of the physiotherapy services were included in the cost of inpatient care. The allocation of costs between health services varies from country to country and most of the studies report annual cost or cost per capita.[13,14,43] In Sweden, it has been shown that physician visits account for about 10% of the total direct and indirect costs of cLBP, with minimal burden from other outpatient visits, ie visits other than to physician and physiotherapist, which accounted for 1% of the total costs.[44] In the United States, the cost of physician consultation for LBP patients covered 2.5–3% of all health appointments.[45] However, according to data from primary care in France, 40% of the direct cost of the cLBP was generated by physiotherapy and hospitalization, and over 20% by diagnostics and physician fees.[41] In our study, the lowest cost per visit was confirmed for outpatient consultations, covering 7.45% of the overall LBP cost. We separately estimated the cost of inpatient admissions, physiotherapy services, and outpatient consultation provided by a physician, which could prove important for future economic policies on recurrent LBP management.

The cost per visit seems to be a critical metric for optimizing resource use across different types of medical services. In our opinion, the median cost per visit provides a more reliable cost-dependency on the examined factors. This is particularly relevant for chronic pain management according to the biopsychosocial model[46] where a combination of multidisciplinary interventions improves overall treatment effectiveness.[47]

Future Perspective

Classifying LBP into recurrent state is relevant from both a medical and budgetary perspective. It has been shown that LBP management can reduce clinical symptoms and economic burden.[48] Gender differences are significant, especially when considering patients' distribution across specific medical services. In the ICD-11 classification, three subclassifications - chronic primary and secondary musculoskeletal pain and also chronic neuropathic pain were introduced. It is clinically important because each of them demands a different treatment strategy. Given the economic burden of recurrent LBP, reallocating resources to targeted therapies could improve patient outcomes and reduce overall healthcare costs. Thus, future research should investigate the impact of different types of medical interventions and their cost-effectiveness. Evaluating specific components of non-invasive treatments, such as manual therapy and exercise programs, could provide valuable insights.[49–52] Furthermore, in some specific cases of chronic pain, neuromodulation may offer a more cost-effective treatment option compared to traditional treatment.[53,54]

Furthermore, the biopsychosocial model for chronic pain management is widely promoted. Identifying one of the three leading chronic pain pathomechanisms influences clinical examination findings and helps select the optimal therapy for patients with the same diagnosis. This new concept is particularly important for cLBP, where the persistence of symptoms is currently explained by the overlap of the three different pain pathomechanisms. Nociplastic pain, for example, requires a different physiotherapy approach, while the presence of neuropathic pain usually excludes the need for physiotherapy services. Therefore, further diagnosis is essential for determining treatment recommendations. Patients with recurrent LBP may experience both of these pathomechanisms. Central sensitization (nociplastic pain) was diagnosed in about 12% of the

cases that qualified for surgery.[42] This may partially explain the high incidence of persistent or recurrent LBP after surgery, also known as failed back surgery syndrome (FBSS).[55]

Limitations

Several factors limit the study results. Firstly, there is a lack of data regarding the cost of primary healthcare or consultations with chronic pain specialists. Additionally, data from departments where surgical treatment is preferred is missing. Furthermore, the analysis of inpatient admissions should differentiate between invasive and non-invasive therapies. Moreover, selecting the study population requires precise diagnostic coding of diagnoses with each treatment or provider visit. Next, due to the retrospective nature of the study, the limitation is the lack of data on comorbidities, income, access to healthcare, working disability and indirect costs. Also, specific factors of chronic pain, such as gender or pathological pain mechanisms leading to chronic LBP stratification in MG.30 (ICD-11), should be taken into account in future studies. Additionally, in Poland medical services are primarily funded by the National Health Fund. However, in future studies, depending on national healthcare policy, income or access to private healthcare should be considered. Next, the time frame of the study fell into the COVID-19 pandemic and could potentially have an impact on the results of the study. However, our study does not consider epidemiological data but whether recurrent LBP influences the economic analysis of LBP. Thus, future studies should take into account a 10-year period, which could allow further observations. Lastly, a further multi-center study could offer a more precise economic analysis and bottom-up cost estimate.

Conclusion

Recurrent LBP accounts for 5% of total direct LBP costs and has a higher cost per visit than LBP, excluding physiotherapy services. Gender significantly affected per-visit costs, with males having more inpatient admissions and females utilizing more physiotherapy services for both LBP and recurrent LBP. Physiotherapy service costs remain stable for recurrent LBP, with females being the primary users. Thus, healthcare policies should examine whether allocated funds are being appropriately distributed and consider implementing preventive strategies for populations at high risk of LBP recurrence, given the high costs associated with treating these patients.

Future multi-centre studies, including both direct and indirect cost analyses, are needed to provide more accurate and comprehensive projections, ensuring better resource allocation and management strategies for LBP treatment.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Ferreira ML, de Luca K, Haile LM, GBD 2021 Low Back Pain Collaborators. Global, regional, and national burden of low back pain, 1990–2020, its attributable risk factors, and projections to 2050: a systematic analysis of the global burden of disease study 2021. *Lancet Rheumatol*. 2023;5(6):e316–e329. doi:10.1016/S2665-9913(23)00098-X
2. Hartvigsen J, Hancock MJ, Kongsted A, et al. What low back pain is and why we need to pay attention. *Lancet*. 2018;391(10137):2356–2367. doi:10.1016/S0140-6736(18)30480-X
3. Fatoye F, Gebrye T, Ryan CG, Useh U, Mbada C. Global and regional estimates of clinical and economic burden of low back pain in high-income countries: a systematic review and meta-analysis. *Front Public Health*. 2023;11:1098100. doi:10.3389/fpubh.2023.1098100
4. Wieser S, Horisberger B, Schmidhauser S, et al. Cost of low back pain in Switzerland in 2005. *Eur J Health Econ*. 2011;12(5):455–467. doi:10.1007/s10198-010-0258-y
5. Maniadakis N, Gray A. The economic burden of back pain in the UK. *Pain*. 2000;84(1):95–103. doi:10.1016/S0304-3959(99)00187-6
6. Dutmer AL, Schiphorst Preuper HR, Soer R, et al. Personal and societal impact of low back pain: the Groningen spine cohort. *Spine*. 2019;44(24):E1443. doi:10.1097/BRS.0000000000003174
7. Kirsch EP, Yang LZ, Lee HJ, Parente B, Lad SP. Healthcare resource utilization for chronic low back pain among high-utilizers. *Spine J*. 2024;24(4):601–616. doi:10.1016/j.spinee.2023.11.017
8. Menezes Costa LDC, Maher CG, Hancock MJ, McAuley JH, Herbert RD, Costa LOP. The prognosis of acute and persistent low-back pain: a meta-analysis. *CMAJ*. 2012;184(11):E613–E624. doi:10.1503/cmaj.111271
9. Stanton TR, Latimer J, Maher CG, Hancock MJ. How do we define the condition 'recurrent low back pain'? A systematic review. *Eur Spine J*. 2010;19(4):533–539. doi:10.1007/s00586-009-1214-3
10. Nicholas M, Vlaeyen JWS, Rief W, et al. The IASP classification of chronic pain for ICD-11: chronic primary pain. *PAIN*. 2019;160(1):28. doi:10.1097/j.pain.0000000000001390

11. WHO. WHO guideline for non-surgical management of chronic primary low back pain in adults in primary and community care settings. Available from: https://www.who.int/publications-detail-redirect/9789240081789. Accessed March 17, 2024.
12. Dang A, Likhar N, Alok U. Importance of economic evaluation in health care: an Indian perspective. *Value Health Reg Issues*. 2016;9:78–83. doi:10.1016/j.vhri.2015.11.005
13. Olafsson G, Jonsson E, Fritzell P, Hägg O, Borgström F. Cost of low back pain: results from a national register study in Sweden. *Eur Spine J*. 2018;27(11):2875–2881. doi:10.1007/s00586-018-5742-6
14. Ekman M, Jönhagen S, Hunsche E, Jönsson L. Burden of illness of chronic low back pain in Sweden: a cross-sectional, retrospective study in primary care setting. *Spine*. 2005;30(15):1777. doi:10.1097/01.brs.0000171911.99348.90
15. Bahuguna P, Guinness L, Sharma S, Chauhan AS, Downey L, Prinja S. Estimating the unit costs of healthcare service delivery in India: addressing information gaps for price setting and health technology assessment. *Appl Health Econ Health Policy*. 2020;18(5):699–711. doi:10.1007/s40258-020-00566-9
16. Jamalabadi S, Winter V, Schreyögg J. A systematic review of the association between hospital cost/price and the quality of care. *Appl Health Econ Health Policy*. 2020;18(5):625–639. doi:10.1007/s40258-020-00577-6
17. McIntosh E, Barlow J, Davis H, Stewart-Brown S. Economic evaluation of an intensive home visiting programme for vulnerable families: a cost-effectiveness analysis of a public health intervention. *J Public Health*. 2009;31(3):423–433. doi:10.1093/pubmed/fdp047
18. Qaseem A, Wilt TJ, McLean RM, Forciea MA. for the clinical guidelines committee of the American College of Physicians. noninvasive treatments for acute, subacute, and chronic low back pain: a clinical practice guideline from the American College of Physicians. *Ann Intern Med*. 2017;166 (7):514–530. doi:10.7326/M16-2367
19. Stochkendahl MJ, Kjaer P, Hartvigsen J, et al. National clinical guidelines for non-surgical treatment of patients with recent onset low back pain or lumbar radiculopathy. *Eur Spine J*. 2018;27(1):60–75. doi:10.1007/s00586-017-5099-2
20. da Silva T, Mills K, Brown BT, et al. Recurrence of low back pain is common: a prospective inception cohort study. *J Physiother*. 2019;65 (3):159–165. doi:10.1016/j.jphys.2019.04.010
21. Von Korff M. Studying the natural history of back pain. *Spine*. 1994;19(18 Suppl):2041S–2046S. doi:10.1097/00007632-199409151-00005
22. Verkerk K, Luijsterburg PAJ, Heymans MW, et al. Prognosis and course of disability in patients with chronic nonspecific low back pain: a 5- and 12-month follow-up cohort study. *Phys Ther*. 2013;93(12):1603–1614. doi:10.2522/ptj.20130076
23. Henn L, Schier K, Brian T, Hardt J. Back pain in Poland and Germany: a survey of prevalence and association with demographic characters. *Biomed Res Int*. 2014;2014:901341. doi:10.1155/2014/901341
24. GUS. Zdrowie i ochrona zdrowia w 2020 roku. stat.gov.pl. Available from: https://stat.gov.pl/obszary-tematyczne/zdrowie/zdrowie/zdrowie-i-ochrona-zdrowia-w-2020-roku,1,11.html. Accessed January 28, 2022.
25. Stanton TR, Latimer J, Maher CG, Hancock MJ. A modified delphi approach to standardize low back pain recurrence terminology. *Eur Spine J*. 2011;20(5):744–752. doi:10.1007/s00586-010-1671-8
26. de Vet HCW, Heymans MW, Dunn KM, et al. Episodes of low back pain: a proposal for uniform definitions to be used in research. *Spine*. 2002;27 (21):2409–2416. doi:10.1097/01.BRS.0000030307.34002.BE
27. Radoičić MJ, Božović BV, Ilić KDP, Janković SM, Anđelković JZ, Kostić MJ. Pharmacoeconomic aspects of low back pain treatment: cost of illness study in the Republic of Serbia. *Acta Med Port*. 2019;32(4):272–278. doi:10.20344/amp.10910
28. Gannon B, Finn DP, O'Gorman D, Ruane N, McGuire BE. The cost of chronic pain: an analysis of a regional pain management service in Ireland. *Pain Med*. 2013;14(10):1518–1528. doi:10.1111/pme.12202
29. da CM CL, Maher CG, McAuley JH, Hancock MJ, Smeets RJEM. Self-efficacy is more important than fear of movement in mediating the relationship between pain and disability in chronic low back pain. *Eur J Pain*. 2011;15(2):213–219. doi:10.1016/j.ejpain.2010.06.014
30. Hancock MJ, Maher CM, Petocz P, et al. Risk factors for a recurrence of low back pain. *Spine J*. 2015;15(11):2360–2368. doi:10.1016/j.spinee.2015.07.007
31. Machado GC, Maher CG, Ferreira PH, et al. Can recurrence after an acute episode of low back pain be predicted? *Phys Ther*. 2017;97(9):889–895. doi:10.1093/ptj/pzx067
32. da Silva T, Mills K, Brown BT, Herbert RD, Maher CG, Hancock MJ. Risk of recurrence of low back pain: a systematic review. *J Orthop Sports Phys Ther*. 2017;47(5):305–313. doi:10.2519/jospt.2017.7415
33. Hoy D, Brooks P, Blyth F, Buchbinder R. The epidemiology of low back pain. *Best Pract Res*. 2010;24(6):769–781. doi:10.1016/j.berh.2010.10.002
34. Watson PJ, Main CJ, Waddell G, Gales TF, Purcell-Jones G. Medically certified work loss, recurrence and costs of wage compensation for back pain: a follow-up study of the working population of Jersey. *Rheumatology*. 1998;37(1):82–86. doi:10.1093/rheumatology/37.1.82
35. Guo HR, Tanaka S, Cameron LL, et al. Back pain among workers in the United States: national estimates and workers at high risk. *Am J Ind Med*. 1995;28(5):591–602. doi:10.1002/ajim.4700280504
36. Walker BF, Muller R, Grant WD. Low back pain in Australian adults: the Economic burden. *Asia Pac J Public Health*. 2003;15(2):79–87. doi:10.1177/101053950301500202
37. Alonso-García M, Sarría-Santamera A. The economic and social burden of low back pain in Spain: a national assessment of the economic and social impact of low back pain in Spain. *Spine*. 2020;45(16):E1026. doi:10.1097/BRS.0000000000003476
38. Coates G, Clewes P, Lohan C, et al. Chronic Low back pain with and without concomitant osteoarthritis: a retrospective, longitudinal cohort study of patients in England. *Int J Clin Pract*. 2023;2023:5105810. doi:10.1155/2023/5105810
39. Itoh H, Kitamura F, Yokoyama K. Estimates of annual medical costs of work-related low back pain in Japan. *Ind Health*. 2013;51(5):524–529. doi:10.2486/indhealth.2013-0042
40. Angarita-Fonseca A, Pagé MG, Meloto CB, et al. The Canadian version of the national institutes of health minimum dataset for chronic low back pain research: reference values from the Quebec low back pain study. *PAIN*. 2023;164(2):325. doi:10.1097/j.pain.0000000000002703
41. Depont F, Hunsche E, Abouelfath A, et al. Medical and non-medical direct costs of chronic low back pain in patients consulting primary care physicians in France. *Fundament Clinic Pharmacol*. 2010;24(1):101–108. doi:10.1111/j.1472-8206.2009.00730.x
42. Phillips FM, Slosar PJ, Youssef JA, Andersson G, Papatheofanis F. Lumbar spine fusion for chronic low back pain due to degenerative disc disease: a systematic review. *Spine*. 2013;38(7):E409–422. doi:10.1097/BRS.0b013e3182877f11
43. Maetzel A, Li L. The economic burden of low back pain: a review of studies published between 1996 and 2001. *Best Pract Res*. 2002;16(1):23–30. doi:10.1053/berh.2001.0204

44. Olafsson G. *Health Economic Aspects of Low Back Pain*. Stockholm, Sweden: Department of Learning, Informatics, Management and Ethics, Medical Management Centre, Karolinska Institutet; 2019.
45. Licciardone JC. The epidemiology and medical management of low back pain during ambulatory medical care visits in the United States. *Osteopath Med Prim Care*. 2008;2:11. doi:10.1186/1750-4732-2-11
46. Waddell G. *The Back Pain Revolution*. Elsevier Health Sciences; 2004.
47. da CM CL, Maher CG, McAuley JH, et al. Prognosis for patients with chronic low back pain: inception cohort study. *BMJ*. 2009;339:b3829. doi:10.1136/bmj.b3829
48. Igarashi A, Akazawa M, Murata T, et al. Cost-effectiveness analysis of pregabalin for treatment of chronic low back pain in patients with accompanying lower limb pain (neuropathic component) in Japan. *Clinicoecon Outcomes Res*. 2015;7:505–520. doi:10.2147/CEOR.S89833
49. Cuenca-Zaldívar JN, Fernández-Carnero J, Sánchez-Romero EA, et al. Effects of a therapeutic exercise protocol for patients with chronic non-specific back pain in primary health care: a single-group retrospective cohort study. *J Clin Med*. 2023;12(20):6478. doi:10.3390/jcm12206478
50. Martínez-Pozas O, Sánchez-Romero EA, Beltran-Alacreu H, et al. Effects of orthopedic manual therapy on pain sensitization in patients with chronic musculoskeletal pain: an umbrella review with meta-meta-analysis. *Am J Phys Med Rehabil*. 2023;102(10):879–885. doi:10.1097/PHM.0000000000002239
51. Baraldo L, Battaglino A, Piscitelli D, et al. The correlation between low back pain and strength training in elite athletes: a literature review. *Retos*. 2023;48:727–731. doi:10.47197/RETOS.V48.97449
52. Artiles-Sánchez J, Fernández-Carnero J, Sánchez-Romero EA, et al. Multicomponent exercise program to avoid productivity loss due to COVID-19: a prospective study with a brief report of 2-year follow-up. *Top Geriatric Rehabil*. 2024;40(2):175. doi:10.1097/TGR.0000000000000439
53. Sillevis R, Cuenca-Zaldívar JN, Fernández-Carnero S, García-Haba B, Sánchez Romero EA, Selva-Sarzo F. Neuromodulation of the autonomic nervous system in chronic low back pain: a randomized, controlled, crossover clinical trial. *Biomedicines*. 2023;11(6):1551. doi:10.3390/biomedicines11061551
54. Benítez-Martínez JC, García-Haba B, Fernández-Carnero S, et al. Effectiveness of transcutaneous neuromodulation on abductor muscles electrical activity in subjects with chronic low back pain: a randomized, controlled, crossover clinical trial. *J Pain Res*. 2023;16:2553–2566. doi:10.2147/JPR.S409028
55. Wern CC, Peng P. Failed back surgery syndrome. *Pain Med*. 2011;12(4):577–606. doi:10.1111/j.1526-4637.2011.01089.x