MEDICAL UNIVERSITY – VARNA
"PROF. DR. PARASKEV STOYANOV"
FACULTY OF MEDICINE

DEPARTMENT OF NEUROLOGY AND NEUROSCIENCES

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"Health Related Quality of Life in Patients with Disc Disease"

THESIS SUMMARY
of a PhD thesis
For awarding the educational and scientific degree "Philosophy Doctor"
Scientific speciality: Neurology

Scientific supervisor:
prof. Ara Garabed Kaprelyan, MD, PhD, DSc

Varna
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The dissertation is presented on 178 pages and contains 94 figures and 31 tables. The bibliography covers a total of 257 literary sources, of which 12 are in Cyrillic and 245 are in Latin.

The dissertation has been discussed and sent for defense by the Department Council and the Department of Neurology and Neurosciences at the Faculty of Medicine at the Medical University in Varna, Bulgaria. The public defense will be held on 27 March 2025 on grounds of Article 4(2) of the Academic Staff Development in the Republic of Bulgaria Act, Article 2(2) of the Implementing regulations on the Academic Staff Development in the Republic Bulgaria Act, Article 5(2) in conjunction with Article 73 of the Regulations on the Terms and Conditions for Award of Scientific Degrees and Occupation of Academic Position at Varna Medical University, before scientific jury consisting:

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The defense materials are published on the website of the Medical University "Prof. Dr. Paraskev Stoyanov"-Varna at: www.mu-varna.bg
All researches included in the dissertation were carried out at UMBAL MEDIKA, Ruse, Department of Neurology and Diagnostic Consultative Center-2, Ruse.

Note: The numbers of the tables and figures in the thesis summary do not correspond to those in the dissertation.

TABLE OF CONTENTS

ABBREVIATIONS USED

QoL	-	Quality of Life
HRQoL	-	Health Related Quality of Life
LBP	-	Low Back Pain
DH	-	Disc Herniation
MRT	-	Magnetic Resonance Tomography
CT	-	Computer Tomography
CNS	-	Central Nervous System
VAS	-	Visual Analogue Scale
NPRS	-	Numeric Pain Rating Scale
RMDQ	-	Roland-Morris Disability Questionnaire
ODI	-	Oswestry Disability Index
NDI	-	Neck Disability Index
CNFDS	-	Copenhagen Neck Functional Disability Scale
PHQ-9	-	Patient Health Questionnairy-9
IASP	-	International Association for the Study of Pain
CS	-	Central Sensitization

1. INTRODUCTION

Spine diseases are becoming an increasingly important medical, economic and social problem in the modern world. Pain in the three sections of the spine can occur on the basis of different pathologies, but in some patients it is due to damage to the intervertebral discs due to disc degeneration, protrusion or disc herniation.

One of the most common reasons for a visit to a neurologist is pain in the back, neck and lower back, often accompanied by the involvement of the limbs. Very often, the cause of these complaints are disc herniation, first in the lumbar region, followed by the lumbar region and finally in the thoracic region. Despite the high prevalence of asymptomatic disc herniation in the population, symptomatic cases are the cause of frequent hospitalizations, unsatisfactory treatment results, and impaired quality of life for these patients. Injuries to the intervertebral discs in the cervical or lumbar region are one of the most common causes of hospitalization in neurology departments and clinics, and it is noticeable that some patients are hospitalized more than once a year and often have hospitalizations every year. In some cases, patients underwent surgical treatment, but recurrence of the disc herniation and pain syndrome was often registered.

Patients with disc disease are treated by various specialists - general practitioners, neurologists, physiotherapists, neurosurgeons and orthopedists, and it seems that there is no single diagnostic and therapeutic algorithm. Due to the frequent lack of an objective assessment of the condition of these patients, in most cases only a temporary and short-term effect of the treatment is achieved, recurrence of symptoms, deterioration of their quality of life, duplication of health services and, ultimately, poor social - economic effect.

The impact on the patients' quality of life could be due to the pain syndrome, the decreased neurological symptoms, the often accompanying depressive symptoms and the adverse socio-economic effect on the patients and their families due to frequent absences from work, increased health costs and refusal of entertainment in free time.

A characteristic feature of herniated disc pain is the combination of neuropathic and nociceptive pain, and this could account for certain differences in health-related quality of life. Given the complex pathogenic mechanisms for the occurrence of neuropathic pain and its misrecognition and underestimation in mass practice, a trend is emerging for unsatisfactory control of pain and disability, and hence worsened quality of life in these patients, as well as poor health-economic results. Central sensitization has been shown to mediate the relationship between psychological factors and pain levels, and therefore interventions focused on this mechanism may be important, and understanding the pathophysiology of neuropathic pain requires the development of new diagnostic algorithms and a personalized approach to patients.

Regardless of whether the pain is acute or chronic, it reduces activity, disrupts quality of life and identity. The measurement of various indicators of pain, disability, co-occurring depression and quality of life assessment can provide control over the course of the disease and making the best decisions for diagnosis and treatment and in this sense provide a better quality of life related to with the disease, as well as to reduce the cost of health services.

Patients with disc disease suffering from chronic low back pain or neck pain require continuous follow-up of the condition in terms of disability, pain intensity and mental status in order to achieve a satisfactory level of quality of life related to health. The introduction and use in daily practice of validated tools to assess their condition would be beneficial to achieve this goal and would also lead to the avoidance of unnecessary health interventions and reduction of

treatment costs. Therefore, conducting an in-depth clinical-epidemiological study of health-related quality of life in patients with disc disease is of increasing health, social and economic importance.

2. PURPOSE, TASKS AND HYPOTHESES

2.1. Purpose:

To investigate health-related quality of life in patients with disc disease and its relationship to disability, pain and depression

2.2. Tasks:

2.2.1. To investigate health-related quality of life, pain intensity, degree of disability and level of depression in patients with disc disease using self-report scales.

2.2.2. To investigate the influence of some demographic factors – gender, age and place of residence

2.2.3. To investigate the impact of location of disc pathology on health-related quality of life, degree of disability, pain and depression.

2.2.4. To determine the relationship between depression, pain, disability and health-related quality of life

2.3. Hypotheses:

2.3.1. The location of the disc herniation, age, gender and place of residence affect the quality of life differently

2.3.2. Disability in patients with a herniated disc depends on the localization of the hernia, gender, age and place of residence

2.3.3. Depression affects all factors that determine the quality of life

2.3.4. There is a relationship between pain, depression and disability

3. MATERIAL AND METHODS

3.1. Study contingent

To fulfill the set tasks, a total of 120 patients with disc herniation, proven on CT or MRI, were studied. All patients were outpatients or inpatients. They were divided into two groups - 44 with disc herniation in the cervical region and 76 with disc herniation in the lumbar region.

3.2. Study design

The study was conducted on the territory of UMBAL MEDIKA OOD and Diagnostic consultative center 2, Ruse in the period October 2023 - May 2024

3.2.1. Inclusion criteria:

• Patients with symptomatic disc herniation or disc protrusion in the cervical or lumbar region proven on CT or MRI (presence of pain, vertebral and radicular syndrome – individually or a combination of them)

• Outpatients and hospitalized patients.

• Signed informed consent to participate in the study

3.2.2. Exclusion criteria:

• Patients under 18 years of age

• Patients over 65 years of age

• Patients with severe debilitating chronic somatic diseases and mental illness.

• Patients operated for disc herniation, regardless of the time of the operative intervention.

• Patients who have not signed an informed consent

(The age group over 65 years is excluded because in the elderly group the frequency of other chronic diseases that may affect the study increases. Patients with disc herniation are not included in the study because of the high frequency of atypical symptoms in this location).

3.3. Methods

3.3.1. Survey method

Subjects completed self-report questionnaires assessing disability, pain intensity, quality of life, and depression.

3.3.1.1. Back and Low Back Disability Assessment Questionnaires

- Roland-Morris Disability Questionnaire (RMDQ)
- Oswestry Disability Index Questionnaire (ODI)

3.3.1.2. Disability Assessment Questionnaires in the Cervical Department

- Copenhagen Neck Functional Disability Scale
- Neck Disability Index (NDI) questionnaire

3.3.1.3. Pain Assessment Questionnaire - Visual Analog Pain Rating Scale in its digital version - Numeric Pain Rating Scale (NPRS)

3.3.1.4. Quality of Life Questionnaire - SF-36

3.3.1.5. Patient Health Questionnaire (PHQ-9)

3.3.2. Statistical methods

3.3.2.1. Descriptive methods

- Alternative analysis – presents the structural distribution of qualitative variables
- Analysis of variance – quantitative variables are represented by arithmetic mean when assessing central tendency and by standard deviation and standard error of the mean when assessing dispersion

3.3.2.2. Graphical methods for comparing and visualizing statistical data.

3.3.2.3. Methods of statistical evaluation • 95% confidence intervals for mean values and relative shares.

3.3.2.4. Hypothesis testing methods. The level of significance of the null hypothesis was taken as $p \geq 0.05$

- One-way analysis of variance (ANOVA) for comparison of three or more independent samples
- Mann-Whitney U test for comparison of independent samples under non-normal distribution
- Spearman's test to look for a statistically significant relationship between two categorical variables
- Correlation analysis (Pearson's coefficient) to look for a relationship between different variables

3.4. Conducting and organizing the study

Study participants were stratified by sex, age group, location of disc herniation, and place of residence, with an approximate 1:1 gender split. A detailed history and neurological status were taken, all examined with CT or MRI of the spine and proven pathology (disc herniation, disc protrusions). The necessary information for the study was obtained by the third day of hospitalization, respectively on the first day for outpatients. All subjects completed self-report questionnaires and their data were recorded in an individual patient protocol.

4. OWN RESULTS

4.1. Description of the study population

A total of 120 patients were studied, of which 76 had lumbar disc herniation and 44 had cervical disc herniation.

4.1.1. Demographic data

Of all examined patients, 64 (53.3 %) were men, 56 (46.7 %) were women. Urban residents are 70 (58.3 %) and rural residents are 50 (41.7 %).

Among patients with lumbar disc herniation, there were 51 (67.1 %) men, 25 (32.9 %) women, with cervical disc herniation 13 (29.5 %) men and 31 (70.5 %) women. There are 37 (48.7 %) rural residents with lumbar disc herniation, 39 (51.5 %) living in the city, 31 (70.5 %) of the patients with cervical disc herniation live in the city, 13 (29.5 %) in the village.

Patients were divided into five age groups – from 18 to 24 years, from 25 to 34 years, from 35 to 44 years, from 45 to 54 years and from 55 to 65 years of age.

The mean age for all 120 subjects was 47.5 years, with a standard deviation of ± 11.34 (CI 95% from 45.4 to 49.5). For all patients, the distribution by age groups in percentages is presented in the Table 1.

Table 1. *Distribution by age groups of all participants*

Age Groups y/o	**Count**	**Percent %**	**Cumulative Percent %**
18-24	6	5,0	5,0
25-34	15	12,5	17,5
35-44	20	16,7	34,2
45-54	40	33,3	67,5
55-65 y	39	32,5	100
N	120	100	

The mean age for women was 49.0 years ± 10.4 (CI 95 % 46.2 - 51.7), for men 46.2 years ± 12.1 (CI 95 % 45.4 - 49.5), the mean age of urban residents was 46.9 years ±11.1 (CI 95 % 44.3 - 49.6), and of rural residents - 48.2 years ± 11.7 years (CI 95 % 44 .9 - 51.6).

The mean age of patients with cervical disc herniation was 49.5 ± 11.1 (CI 95 % 46.2 - 52.9) and of those with lumbar disc herniation was 46.3 ± 11.40 (CI 95 % 43.7 - 48.9).

In terms of age, all the examined, as well as in the separate groups according to the location of the disc herniation, place of residence and gender, do not have a normal age distribution curve (Fig. 1), and all groups have a similar distribution (Fig. 2, Fig. 3, Fig.4, Fig. 5, Fig. 6, Fig. 7).

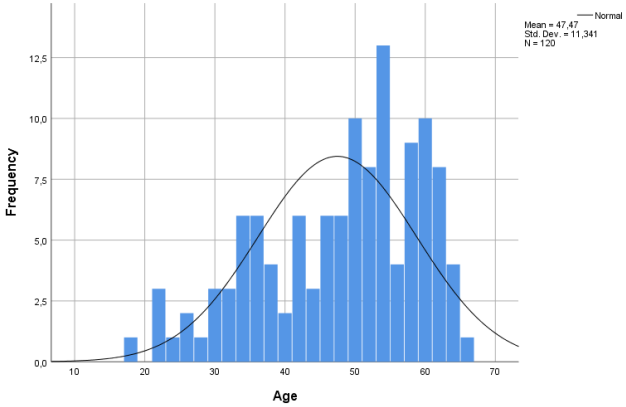

Figure 1. *Age distribution in all participants*

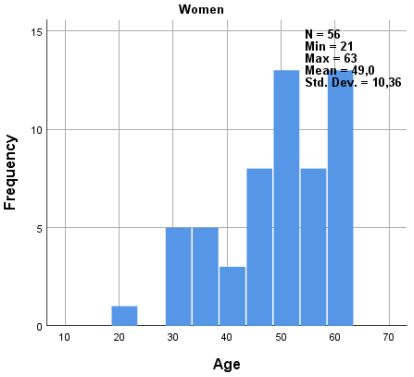

Figure 2. *Age distribution in women*

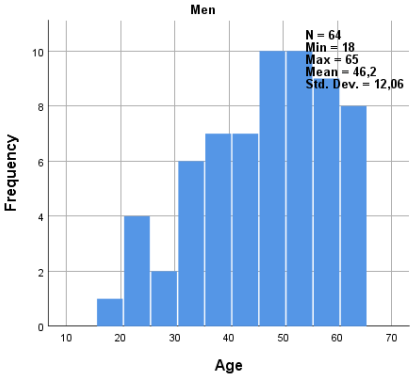

Figure 3. *Age distribution in men*

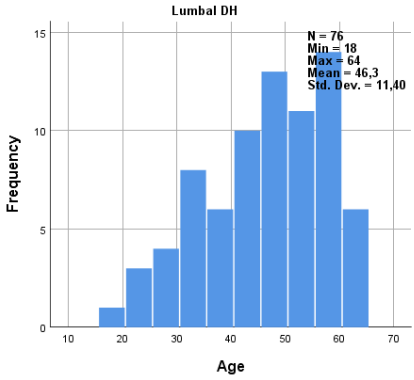

Figure 4. *Age distribution in participants with lumbal DH*

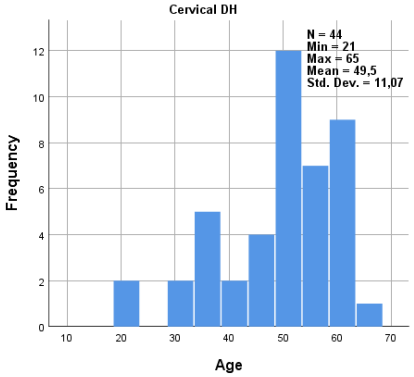

Figure 5. *Age distribution in participants with cervical DH*

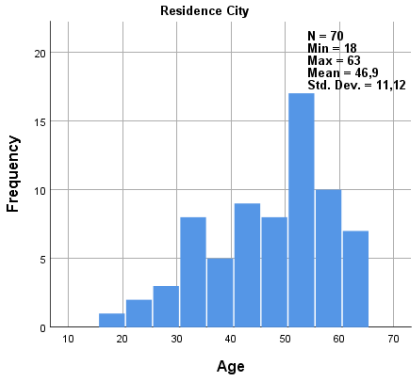

Figure 6. *Age distribution in participants with urban residence*

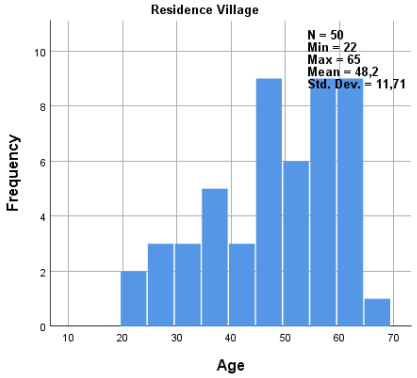

Figure 7. *Age distribution in participants with rural residence*

Table 2. *Distribution of participants by age group depending on place of residence*

Residence	Age Group (y/o)	Count	Frequency (%)	Cumulative %
City	18-24	4	5,7	5,7
	25-34	9	12,9	18,6
	35-44	12	17,1	35,7
	45-54	25	35,7	71,4
	55-65	20	28,6	100
	Общо	70	100	
Village	18-24	2	4	4
	25-34	6	12	16
	35-44	8	16	32
	45-54	15	30	62
	55-65	19	38	100
	Total	50	100	

Table 3. *Distribution of participants by age group depending on gender*

Gender	Age Group (y/o)	N	Frequency (%)	Cumulative %
Men	18-24	5	7,8	7,8
	25-34	8	12,5	20,3
	35-44	12	18,8	39,1
	45-54	21	32,8	71,9
	55-65	18	28,1	100
	Total	64	100	

Women	18-24	1	1,8	1,8
	25-34	7	12,5	14,3
	35-44	8	14,3	28,6
	45-54	19	33,9	62,5
	55-65	21	37,5	100
	Total	56	100	

Overall for the studied contingent, as well as separately by sex, place of residence and location of the disc herniation, more than half of the examined fall into the two age groups from 45 to 65 years of age and there is an insignificant percentage of participants in the youngest age group, as the absolute number and the percentage distribution in age groups according to the above indicators are presented in the following Figures 8, 9, 10, 11, 12 and 13.

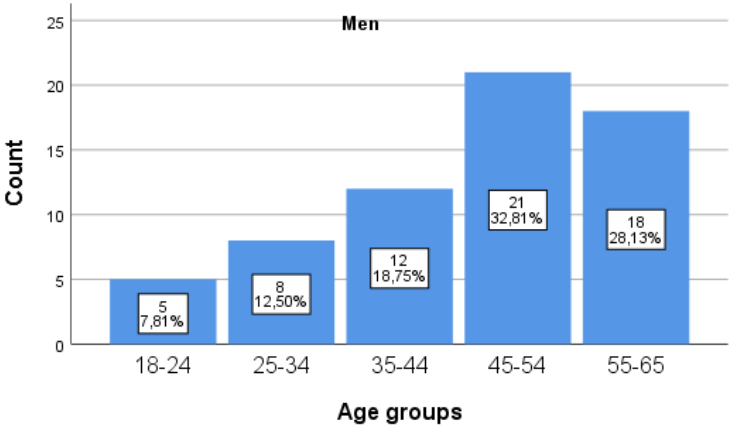

***Figure 8**. Distribution by age group for male participants*

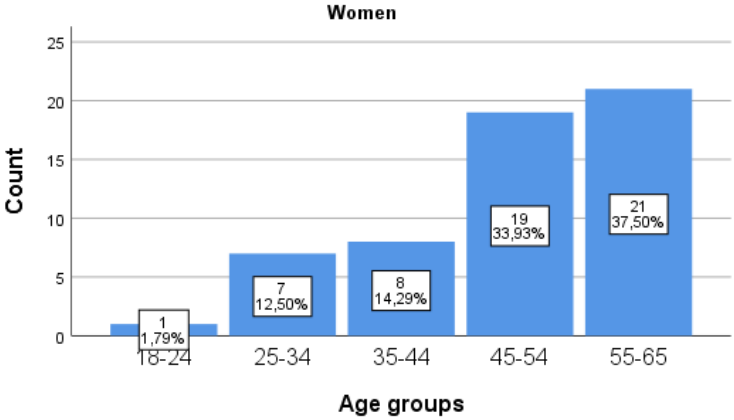

Figure 9. *Distribution by age group for female participants*

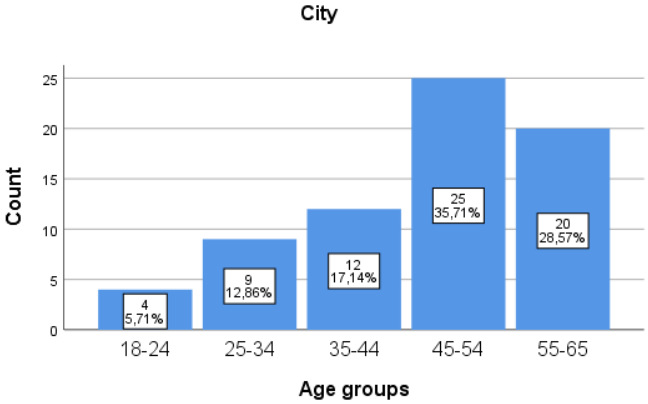

Figure 10. *Distribution by age group in urban residents*

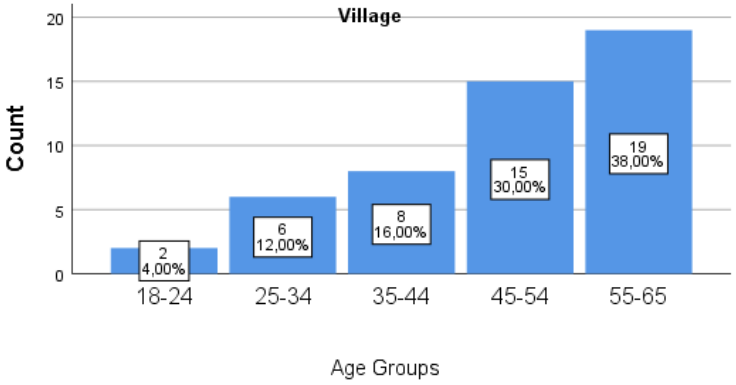

Figure 11. *Distribution by age group in rural residents*

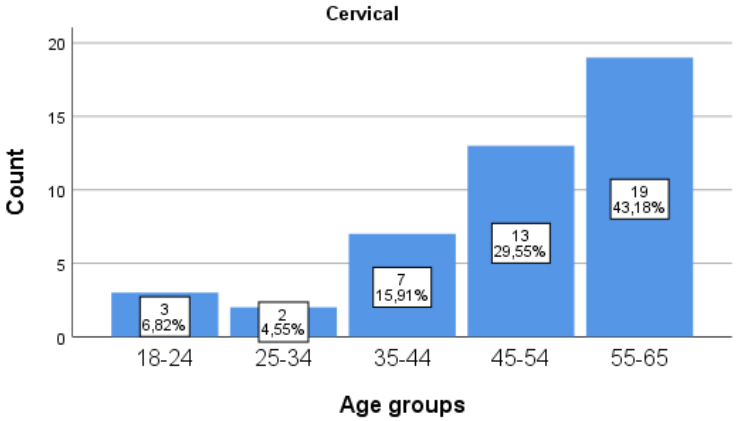

Figure 12. *Distribution by age group in participants with cervical DH*

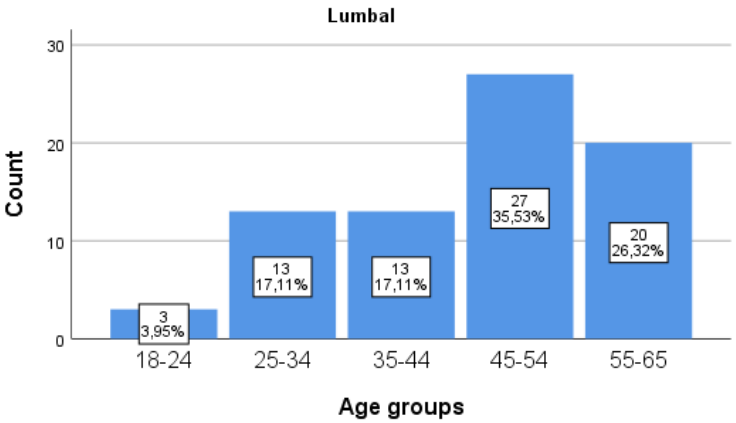

Figure 13. *Distribution by age group in participants with lumbar DH*

4.2. Analysis and assessment of pain intensity

To assess the intensity of pain when using the Visual Analogue Scale in its digital version - Numeric Pain Rating Scale (NPRS). Depending on the reported results from 1 to 10, the subjects were divided into three groups - with a low degree of pain at values of 1 to 3 points inclusive, with moderate pain from 4 to 6 points and severe pain from 7 to 10 points on the scale.

For all the examined, the obtained results are as follows: 1 patient (0.83 %) of the studied contingent assessed their pain with 1 point, two or 1.67 % assessed it with 2 points, with 3 points - 14 examined (11.67 %), with 4 points - 17 subjects (14.17 %), with 5 points - 22 or 18.33 % of the subjects, with 6 points - 21 or 17.50 %, with 7 points - 23 subjects (19.17 %), 14 subjects (11.67 %) assessed the pain with 8 points, 5 (4.17 %) and one (0.83%) with 9 and 10 points respectively (Fig. 14).

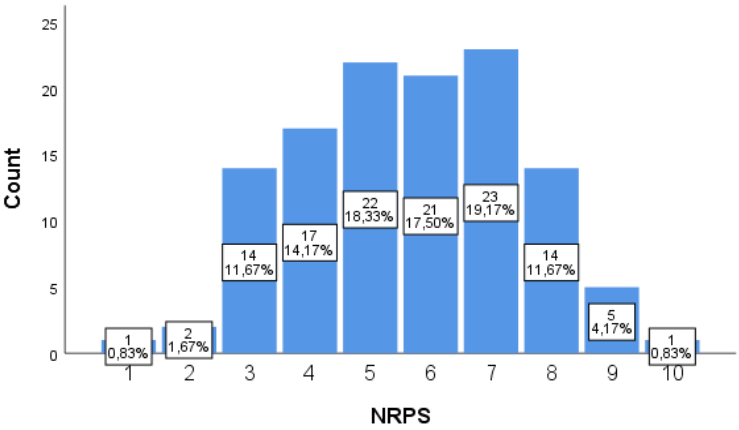

***Figure 14**. Self-reported pain scores in all subjects*

In all 120 examined, the arithmetic mean value of the obtained results was 5.66 ± 1.83, (CI 95 % 5.33 - 5.99) with a minimum value of 1 and a maximum value of 10, and the positional mean value was 6, corresponding to moderate pain (Fig. 15).

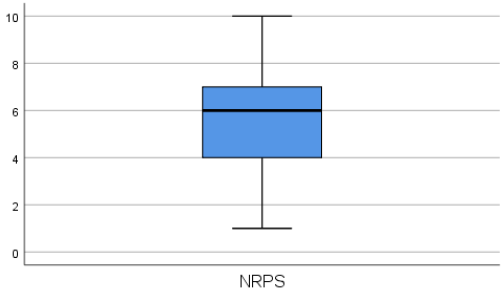

***Figure 15**. Median, minimal and maximal pain intensity for all participants*

Half of all 120 surveyed patients with disc herniation fall into the group of those experiencing moderate pain, about a third are

those with severe pain and the least are those with a low degree of pain (Fig. 16).

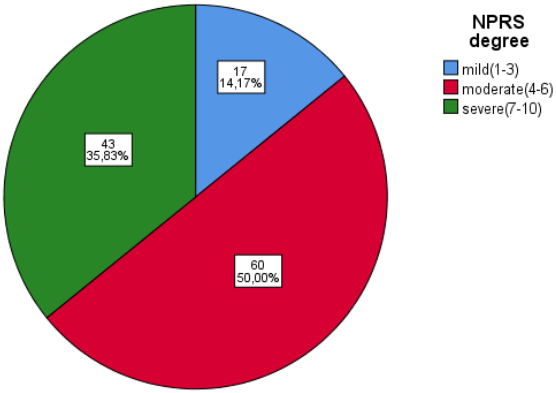

Figure 16. *Distribution of all participants by degree of pain*

In the individual groups examined, the share of those with moderate pain remains around 50 % (Fig. 17, 18, 19, 20 and 21), with a higher than average percentage of severe pain being reported only in women compared to men (Fig. 22).

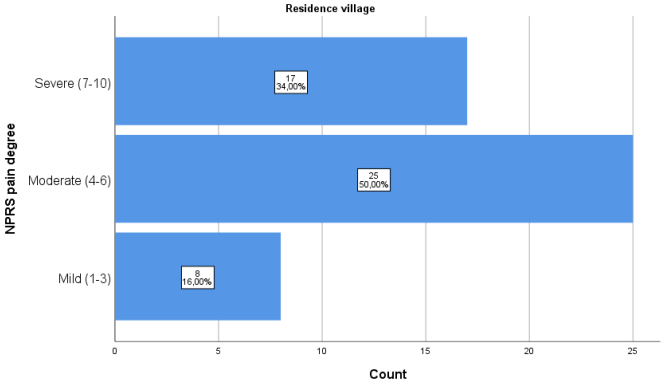

Figure 17. *Distribution by degree of pain in rural residents*

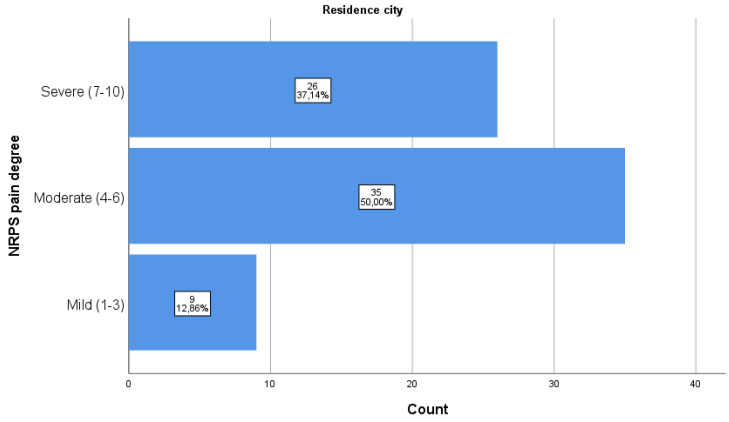

Figure 18. *Distribution by degree of pain in urban residents*

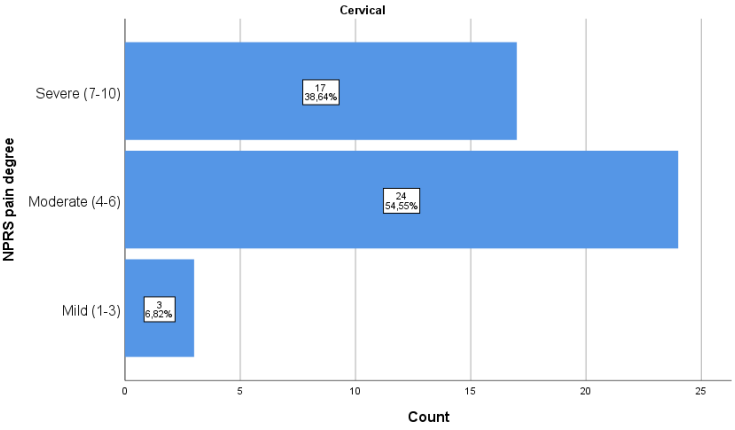

Figure 19. *Distribution by degree of pain in patients with cervical DH*

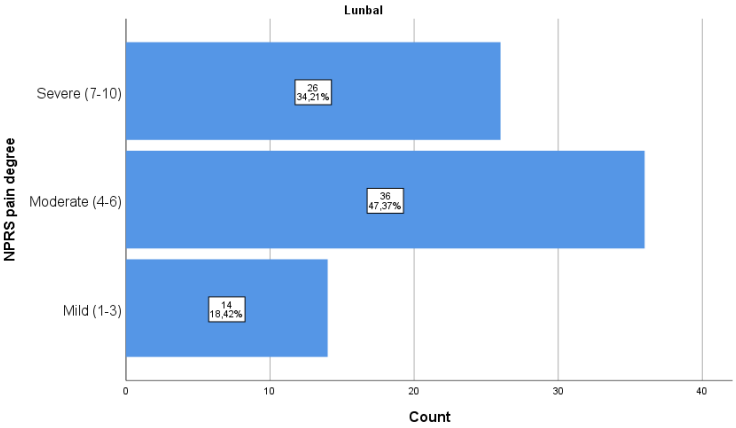

Figure 20. *Distribution by degree of pain in patients with lumbar DH*

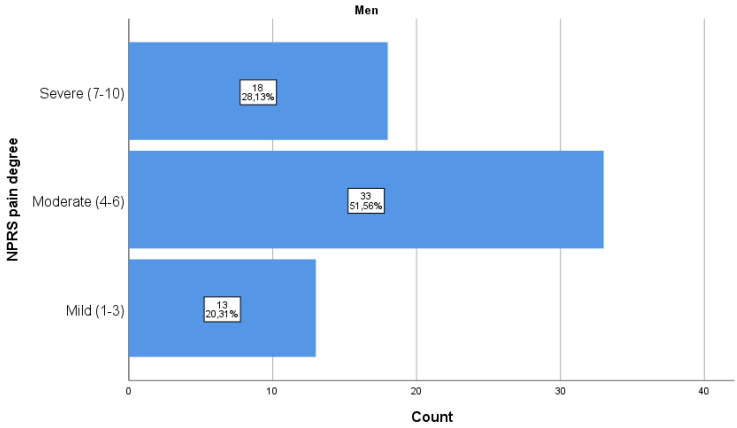

Figure 21. *Distribution by degree of pain in men*

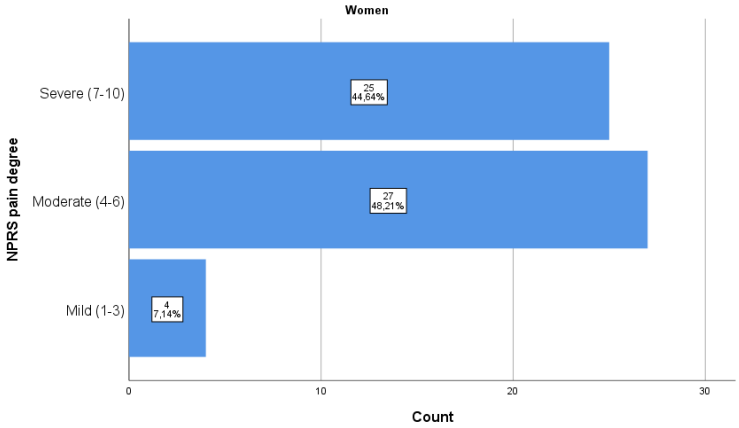

Figure 22. *Distribution by degree of pain in women*

When comparing mean pain scores for women, the NPRS was 6.14 ± 1.76 (CI 95 % 5.67 - 6.61), while for men it was 5.23 ± 1.80 (CI 95 % 4.79 - 5.88), with a difference between the most common score of 1 point, respectively 5 for men and 6 for women (Fig. 23).

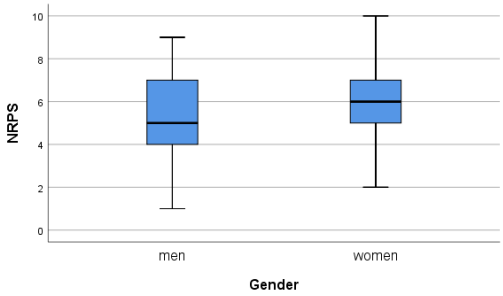

Figure 23. *Median, maximum and minimum pain intensity in male and female participants*

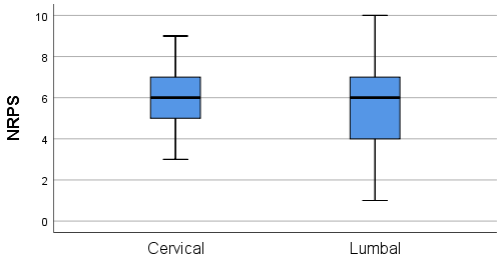

Figure 24. *Median, maximum and minimum pain intensity in participants with cervical and lumbar disc herniation*

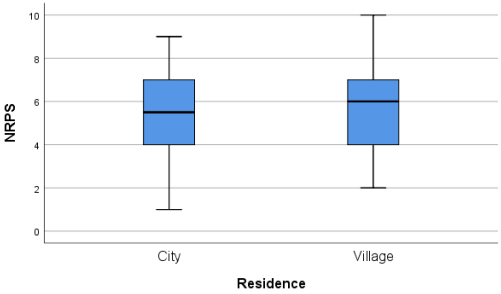

Figure 25. *Median, maximum and minimum pain intensity in participants urban and rural residents*

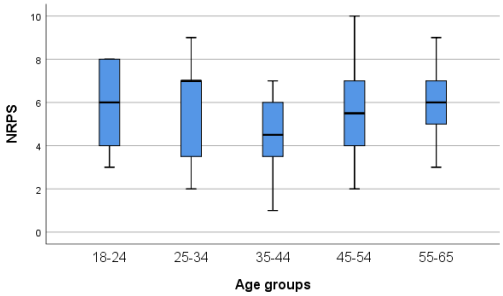

Figure 26. *Median, maximum and minimum pain intensity in participants from different age groups*

A strong correlation was found between NPRS-rated pain and participants' gender, and no such relationship with DH localization, age and place of residence.

Table 4. *Dependence of pain sensation with sex, age, place of residence and localization of DH*

	Gender	Age	Residence	Localization of DH
Pearson's coeff.	0,249	0,157	0,019	0,114
p- value	0,006	0,086	0,834	0,215
Spearman's rho.	0,238	0,061	0,010	0,103
p-value	0,009	0,221	0,910	0,265
N	120	120	120	120

4.3. Assessment and analysis of depression level

According to the results of the PHQ-9 health assessment questionnaire, the respondents are divided into 5 groups: from 0 to 4 points - no depression, from 5 to 9 points - mild depression, from 10 to 14 points - moderate depression, from 15 to 19 points - moderately severe and over 20 points - severe depression.

In our study, the mean value of the PHQ-9 depression survey was 6.24 ± 4.92 for all 120 subjects (CI 95 % 5.36 - 7.13), 6.48 ± 4.78 (CI 95 % 5.03 - 7.93) in cases with cervical disc herniation and 6.11 ± 5.0 (CI 95 % 4.96 - 7.25) at the lumbar, corresponding to a mild form.

In women, the mean value of the PHQ-9 test was 7.09 ± 4.98 (CI 95 % 5.76 - 8.42) and in men - 5.50 ± 4.75 (CI 95 % 4.31 - 6,69). For urban residents, the mean value of the PHQ-9 total was 5.30 ± 4.26 (CI 95 % 4.20 - 6.40) and for rural residents it was 7.56 ± 5.02 (CI 95 % 6, 13 - 8.99).

With regard to the distribution in the different degrees of depression, more than half of all 120 examined show some depressive symptoms, almost a third show mild symptoms, with moderate are about 1/5 of the total number, and those with moderately severe and severe depression are total 6.67 % (Fig. 27).

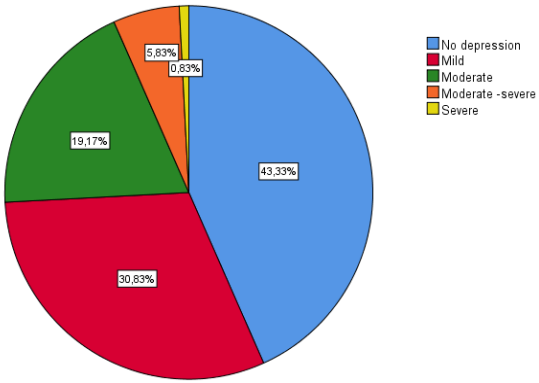

Figure 27*. Distribution by degree of depression in all participants*

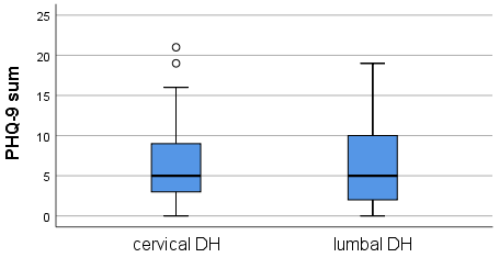

Figure 28. *Median, maximum and minimum value of depression depending on the localization of DH*

When comparing PHQ-9 scores across all respondents, we found that in the non-depressed group, those with lumbar disc herniation outnumbered participants with cervical DH, while in the mildly depressed group, respondents with cervical DH predominated. The group with a severe form of depression lacks participants with lumbar DH.

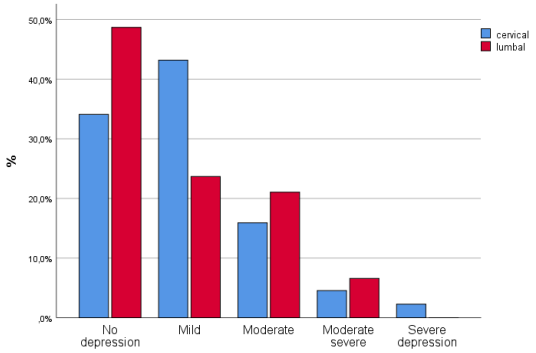

Figure 29. *Distribution by groups according to the severity of depression in cervical and lumbar DH*

In the comparative study of the level of depressive symptoms in men and women, again there were no significant differences in the range and the most common values.

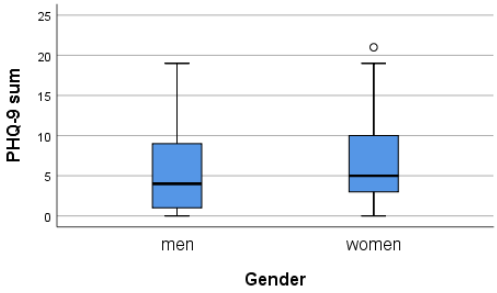

Figure 30. *Median, maximum and minimum value of depression depending on gender*

In the distribution by groups with absence of depression and different degrees of depression, we found that in the group with no depression there are about 20 % more men than women, while in mild depression there are more women and no men with a severe form of depression.

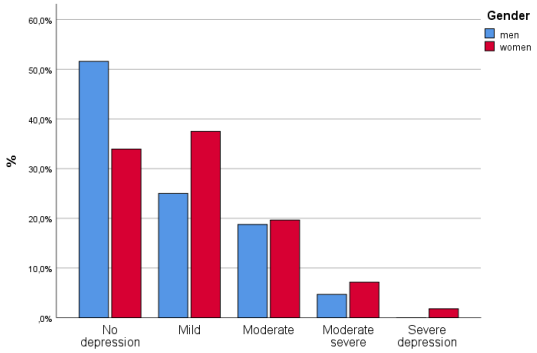

Figure 31. *Distribution by groups depending on the severity of depression in men and women*

When comparing depression questionnaire scores in urban and rural residents, we found differences in scores with higher levels in rural residents.

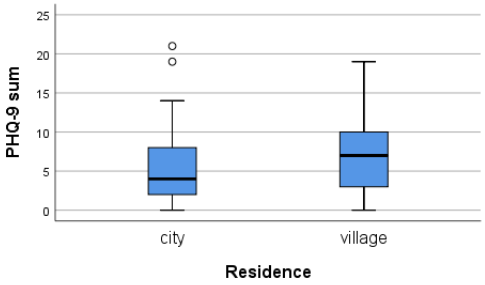

Figure 32. *Median, maximum and minimum value of depression in urban and rural residents*

When divided into groups according to the results of the PHQ-9 questionnaire, differences were again found, with urban residents having a higher relative proportion showing no symptoms of depression, a minimal percentage having moderately severe and severe depression, and although rural residents had no falling into the severe depression group, they were generally more in the mild, moderate, and moderately severe depression groups.

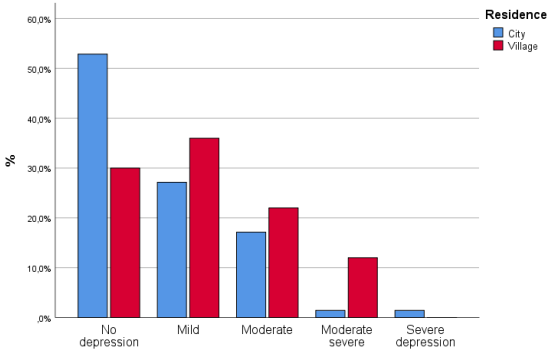

***Figure 33**. Distribution by groups according to the severity of depression in urban and rural residents*

In the different age groups, the mean values of the PHQ-9 questionnaire result are presented in Table 5.

***Table 5**. Results of the PHQ-9 depression questionnaire across age groups*

Age Groups (y/o)	N	Min.	Max.	Mean Value	Standard Deviation
18 -24	6	1	8	4,50	± 2,95
25-34	15	1	19	6,93	± 5,42
35-44	20	0	18	5,55	± 5,11
45-54	40	0	21	5,73	± 5,07
55-65	39	0	19	7,13	± 4,67

Among the age groups from 25 to 34 years, from 35 to 44 years and from 45 to 54 years, we did not find significant fluctuations in the range of results, with the lowest values reported by the youngest respondents from 18 to 24 years of age, and with the highest values and correspondingly the most prominent symptoms of depression are the oldest participants from 55 to 65 years of age.

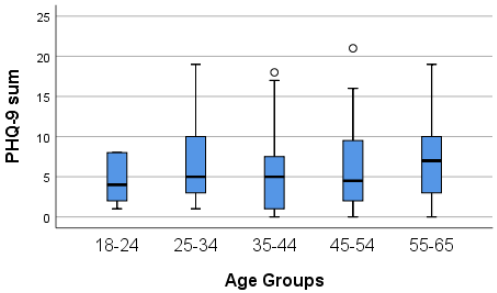

Figure 34. *Median, minimum and maximum value of depression in different age groups*

The distribution by groups is presented in Fig. 35, where it can also be seen that about 70 % of the participants in the group from 18 to 24 y/o do not show symptoms of depression, and about 30 % have a mild form.

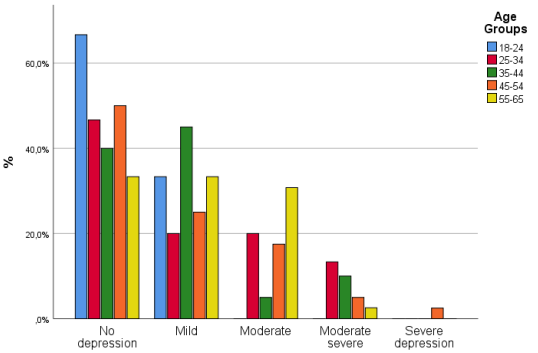

***Figure 35**. Distribution by groups depending on the severity of depression in different age groups*

The distribution of the examined depending on the results of the PHQ-9 questionnaire by groups - absence or different degrees of depression in relation to the localization of the disc herniation (in the cervical and lumbar region), by gender and place of residence - city or village is presented respectively in the Figures 36, 37, 38, 39, 40 and 41.

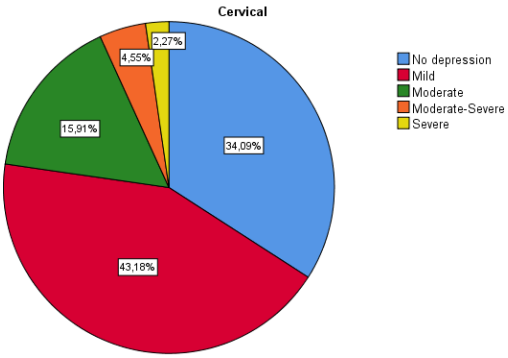

***Figure 36.** Distribution by degree of depression among participants with cervical DH*

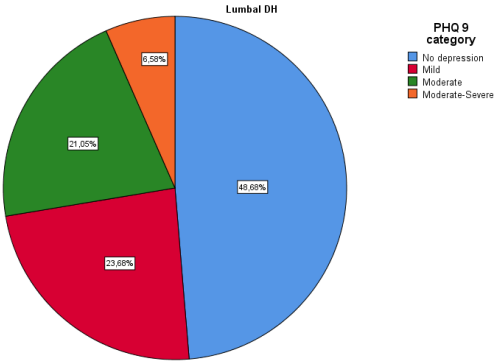

Figure 37. *Distribution by degree of depression among participants with lumbar DH*

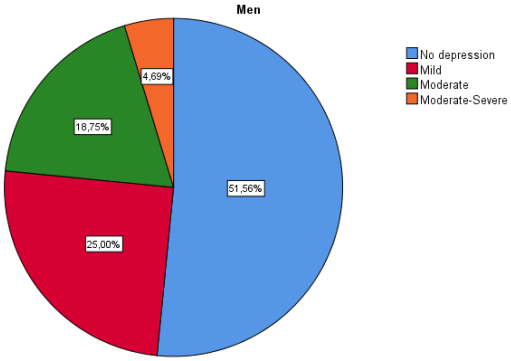

Figure 38. *Distribution by degree of depression among men*

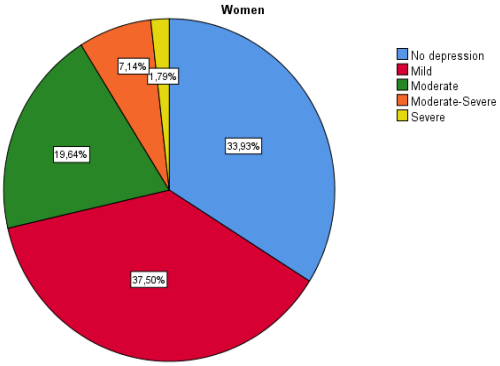

Figure 39. *Distribution by degree of depression among women*

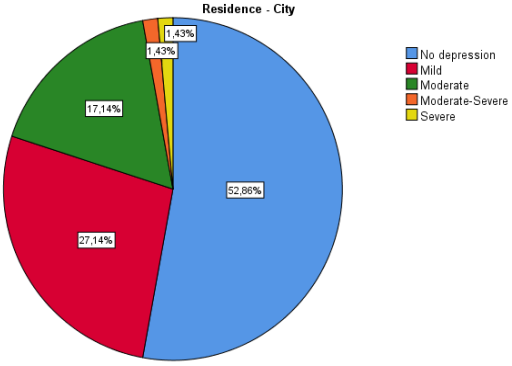

Figure 40. *Distribution by degree of depression among urban residents*

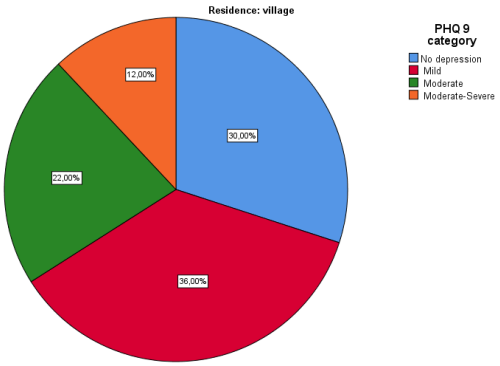

Figure 41. *Distribution by degree of depression among rural residents*

From the presented distribution by degree of depression, it can be seen that nearly half of men, urban residents, and participants with lumbar disc herniation fall into the no-depression group, while for women, rural residents, and those with cervical disc herniation, this group is about one third. There was a small percentage of participants with a severe form of depression among those of the female sex, with cervical disc herniation and among urban residents.

There is a difference in the distribution of results in men and women depending on the degree of depression and pain perception, as in the groups with no depression, moderate and moderately severe depression, women have higher values for the level of pain.

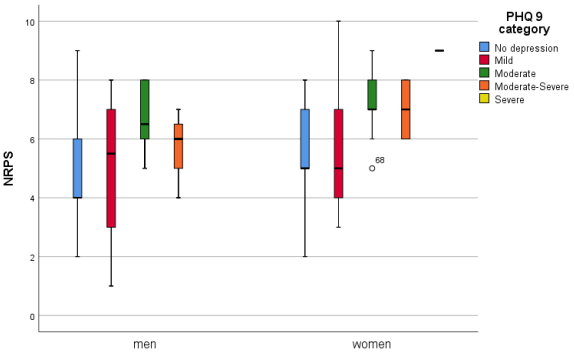

Figure 42. *Median, minimum and maximum level of pain depending on the degree of depression in men and women*

Despite the differences in the levels of depression reported in the individual groups of respondents, we found a statistically significant relationship ($p < 0.05$) of depression only with the place of residence (Table 6).

Table 6. *Relationship of depression with gender, place of residence, localization of DH and age*

	Gender	**Residence**	**Localization of DH**	**Age**
Pearson' coeff.	0,16	0,23	0,04	0,11
p-value	0,08	0,01	0,69	0,24
Spearman' rho.	0,18	0,24	0,61	0,14
p-value	0,05	0,01	0,51	0,13
N	120	120	120	120

4.4. Evaluation and analysis of the degree of disability

4.4.1. Results for degree of disability with the NDI and ODI Questionnaires

To assess disability in the group examined with cervical disc herniation, we used the Neck Disability Index (NDI) questionnaire, in the group with lumbar DH - the Oswestry Disability Index (ODI) questionnaire.

According to the results obtained in both NDI and ODI tests, the respondents are divided into five groups - without disability (from 0 to 4 points), with mild disability (from 5 to 14 points), with moderate disability (15-24 points), with severe disability (from 25 to 34 points) and with total disability (35 to 50 points).

Overall, for all surveyed participants, the average value of the obtained results was 17.1 ± 9.90 (CI 95 % 15.31 - 18.89), corresponding to moderate disability.

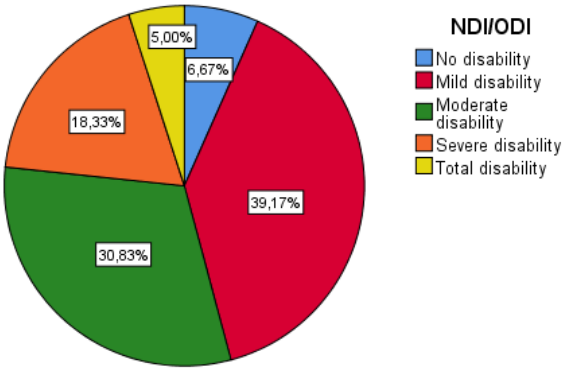

Figure 43. *Distribution by degree of disability among all participants*

The mean values of the examinees with cervical and lumbar DH are also in the range of moderate disability

Table 7. *Comparative results for degree of disability in cervical and lumbar DH*

	N	Min.	Max.	Mean Value	Stand. Deviation	95 % CI
Cervical DH (NDI)	44	1	45	18,55	± 9,10	15,78 - 21,31
Lumbar DH (ODI)	76	3	44	16,26	± 10,30	13,91 - 18,62

The comparison between the different groups - by localization of DH, place of residence, gender and in the different age groups of the degree of disability, assessed by the questionnaires NDI and ODI according to the median of the obtained results are presented in Figures 43, 45, 47 and 49. It can be seen also, that the majority of the examined fall into the second and third groups, respectively with mild or moderate disability, as there are participants with total disability in the group of women and in patients with cervical disc herniation, as well as in the age groups of 25 - 34 yrs., 45 -54 yrs. and 55 - 65 years.

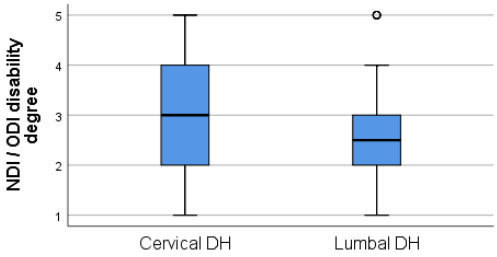

Figure 44. *Median, maximum and minimum value of the degree of disability depending on the localization of DH*

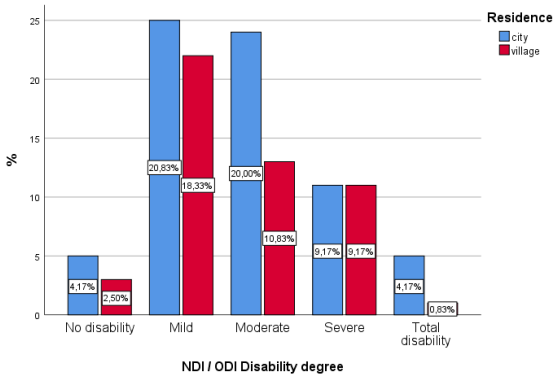

Figure 45. *Distribution by degree of disability in lumbal and cervical DH*

Disability scores obtained from the ODI and NDI questionnaires in urban residents had a mean value of 17.59 ± 10.44 (CI 95 % 15.10 - 20.07). In rural residents, the average value was 16.42 ± 9.17 (CI 95 % 13.82 - 19.02), in both groups of participants - within the limits of moderate disability.

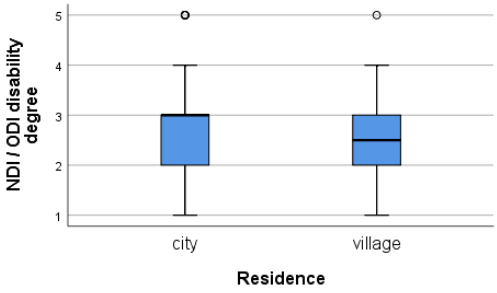

Figure 46. *Median, maximum and minimum value of degree of disability in urban and rural residents*

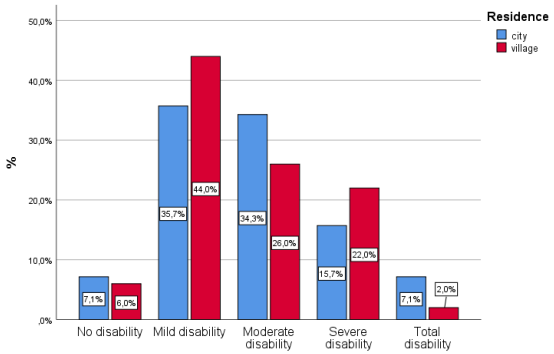

Figure 47. *Distribution by degree of disability in urban and rural residents*

The mean of the ODI and NDI disability scores for men was 15.72 ± 10.44 (CI 95 % 13.26 - 18.18) and for women it was 18.68 ± 9.81 (CI 95 % 16 .05 - 21.31), which is also within the range of moderate disability, but from Fig. 49 it can be seen that most often women fall into the third group of moderate disability, and men into the second (of mild disability).

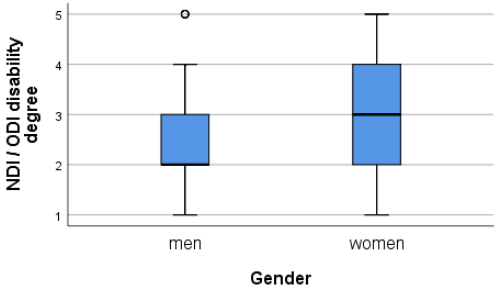

Figure 48. *Median, maximum and minimum value of degree of disability in men and women*

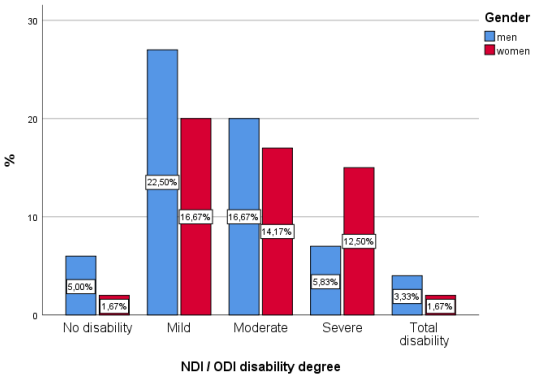

Figure 49. *Distribution by degree of disability in men and women*

For the separate age groups, the mean values of disability assessed with the ODI and NDI questionnaires were as follows: for the youngest participants aged 18 to 24 years it was 16.50 ± 9.50 (CI 95 % 6.53 - 26.47), in the 25 to 34 age group was 20.80 ± 10.56 (CI 95 % 14.95 - 26.65). In the 35 to 44 group the mean was 13.20 ± 6.93 (CI 95 % 9.96 - 16.44), in the 45 to 54 group it was 16.18 ± 10.95 (CI 95 % 15.10 - 20.07). In the oldest participants aged 55 to 65 years, the mean value of disability obtained from the ODI and NDI questionnaires was 18.72 ± 9.50 (CI 95 % 15.64 - 21.80).

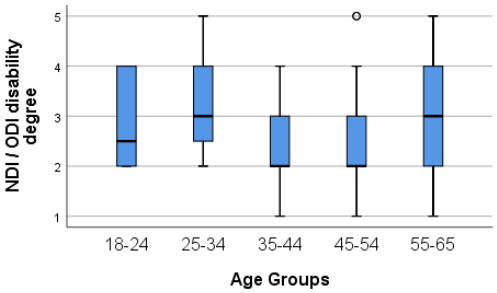

Figure 50. *Median, maximum and minimum value of disability values for different age groups*

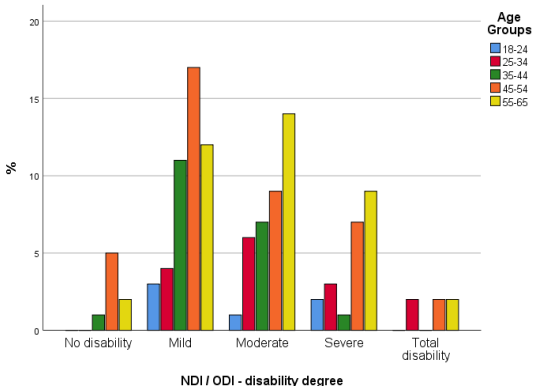

Figure 51. *Distribution by degree of disability in different age groups*

Table 8. *Results for degree of disability from the ODI and NDI questionnaires in the different age groups*

Age Groups (y/o)	Degree of Disability (%)				
	No disability	Mild	Moderate	Severe	Total
18 - 24	0	2,50	0,83	1,67	0
25 - 34	0	3,33	5,00	2,50	1,67
35 - 44	0,83	9,17	5,83	0,83	0
45 - 54	4,17	14,17	7,50	5,83	1,67
55 - 65	1,67	10,00	11,67	7,50	1,67

4.4.2. Results on degree of disability with the CNFDS and RMD Questionnaires

Disability in respondents with cervical disc herniation was also measured by the Copenhagen Neck Disability Functional Scale (CNFDS) and in those with lumbar disc herniation by the Roland-Morris Disability Questionnaire (RMDQ). Both questionnaires are

evaluated based on the number of points obtained, with a higher number indicating a more severe disability, with a maximum number of points, the disability is respectively 100 % or full, with 0 points - no disability.

Disability for the entire study cohort, as measured by the CNFDS and Roland - Morris self-report questionnaires, averaged 35.58 % with a standard deviation of ± 21.76 (CI 95 % 31.65 - 39.52). In the group of subjects with cervical disc herniation, in which the CNFDS questionnaire was used, the mean was 42.88 % ± 24.22 (CI 95 % 35.52 - 50.24), and in those with lumbar disc herniation, when using the RMDQ questionnaire was 31.36 % ± 19.12 (CI 95 % 26.99 - 35.73).

Similar to the results of the disability examination with the NDI and ODI self-report questionnaires, again patients with lumbar disc herniation showed a lower degree of disability compared to those with cervical DH (Fig. 51). There are similar results in the comparison between men and women, with women most often having a higher level of disability than men (Fig. 52), the results are also similar in the comparison of urban and rural residents - at the rural levels are lower (Fig. 53). In the different age groups, again the oldest people from 55 to 65 years of age have the highest levels of disability (Fig. 54).

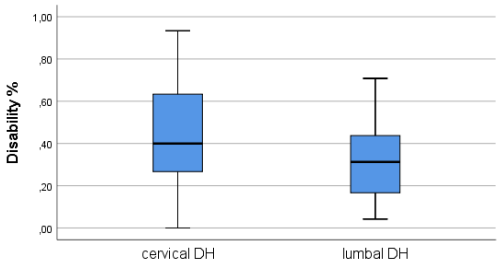

Figure 52. *Degree of disability in cervical and lumbar DH with CNFDS and RMD Questionnaires*

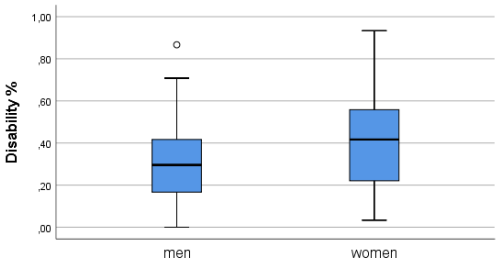

Figure 53. *Degree of disability in men and women with CNFDS and RMD Questionnaires*

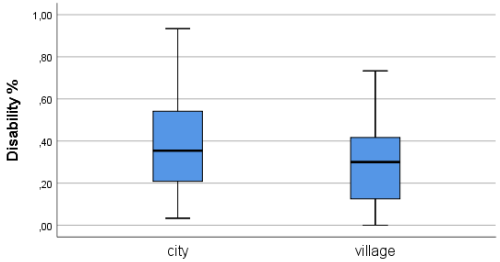

Figure 54. *Degree of disability in urban and rural residents with CNFDS and RMD Questionnaires*

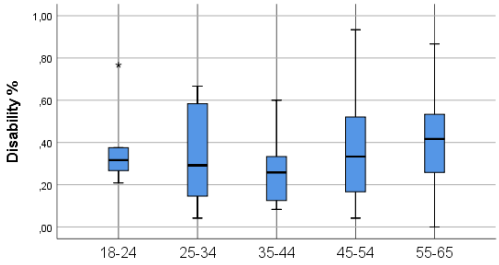

Figure 55. *Degree of disability in different age groups with CNFDS and RMD Questionnaires*

In the statistical processing of the results of the ODI and NDI questionnaires, we found no correlation with the studied factors - gender, age, place of residence and location of the disc herniation, while the results of the RMDQ and CNFDS questionnaires revealed such a correlation with the gender of the participants, as well as with the location of DH ($p < 0.05$ Pearson).

Table 9. *Relationship of disability assessed by the NDI / ODI and CNFDS / RMD Questionnaires with gender, age, place of residence and location of DH*

Disability		Gender	Age	Residence	Localization of DH
NDI and ODI	Pearson' coeff.	0,150	0,030	0,058	0,112
	p- value	0,103	0,748	0,527	0,225
	Spearman' rho	0,161	0,078	0,046	0,146
	p - value	0,080	0,397	0,619	0,111
CNFDS and RMDQ	Pearson' coeff.	0,189	0,133	-0,173	0,240
	p - value	**0,038**	0,148	0,059	**0,049**
	Spearman' rho	0,182	0,169	0,163	0,231
	p - value	**0,046**	0,064	0,074	**0,011**
	N	120	120	120	120

4.5. Quality of life outcomes

The Quality of life of the study participants was assessed using the SF-36 questionnaire. It contains 36 questions and statements grouped into 8 indicators: physical functioning, limitations in role activities due to physical or emotional problems, bodily pain, vitality, social functioning, emotional well-being, and General sense of health. Each indicator is rated on a scale ranging from 0 to 100, where 100 represents full health. The results form two components - physical, Physical health (PH) and mental health - Mental health (MH) (Ware J.E., Kosinski M., Keller S.O., 1994).

The mean HRQoL score for all participants assessed with the SF-36 questionnaire was 52.25 for all domains at a maximum value for the best health-related quality of life of 100, indicating overall moderate disease impact. The most significant influence is in the domain role limit due to physical problems – 34.38 and for physical pain – 42.25 and the least in relation to role limit due to emotional problems - 60 and emotional well-being - 59.97, but General health and the remaining domains are moderately affected (Table 10).

Table 10. *Quality of life scores for individual SF-36 indicators for all 120 participants*

	Mean Value	Stand. Deviation	CI 95 %
Physical functioning	54.21	± 26,69	49,38 - 59,03
Role limit due physical problems	34.38	± 39,30	27,27 - 41,48
Role limit due emotional problems	60.00	± 41,81	52,44 - 67,56
Energy/Fatigue	53.13	± 17,19	50,02 - 56,23
Emotional well-being	59.97	± 18,79	56,57 - 63,36
Social functioning	57.35	± 23,39	53,13 - 61,58
Bodily Pain	45.25	± 24,03	40,91 - 49,59
General Health	53.71	± 16,15	50,79 - 56,63

The results by domains for the separate groups studied, noting that the greatest impact on HRQoL in terms of role limitation due to physical problems is mainly in women, in patients with cervical DH and in urban residents.

Table 11. *Results for quality of life (SF-36) in the individual groups studied*

	Physical functioning	Role limit due physical problems	Role limit due emotional problems	Energy/Fatigue	Emotional well-beeing	Social functioning	Bodily Pain	General Health
Men	48.28	39.45	67.71	56.60	61.69	58.59	46.91	55.94
Women	60.98	28.57	51.19	48.93	58.00	55.94	43.35	51.16
Lumbar DH	49.21	38.16	67.11	55.20	62.47	59.41	43.91	54.08
Cervical DH	62.84	27.84	47.73	49.55	55.64	53.81	47.56	53.07
City	56.00	33.21	61.91	54.29	61.77	58.36	48.64	55.07
Village	51.70	36.00	57.33	51.50	57.44	55.95	40.50	51.80
Total	54.21	34.38	60.00	53.13	59.97	57.35	45.25	53.71

On the Table 12. and Table 13. respectively are presented the results for the SF-36 profiles of the examinees with cervical and lumbar DH according to their gender. What is striking is the significant difference with lower values of the role limit index due to emotional problems in women with cervical DH and the role limit due to physical problems in women with lumbar DH.

Table 12. *SF-36 Quality of Life Outcomes in men and women with cervical DH*

	Physical functioning	Role limit due physical problems	Role limit due emotional problems	Energy / Fatigue	Emotional well-bing	Social functioning	Bodily Pain	General Health
Men	56.92	26.92	71.80	52.69	55.39	58.85	52.86	51.92
Women	65.32	28.23	37.63	48.23	55.74	51.69	45.39	53.55

Table 13. *SF-36 Quality of Life Outcomes in men and women with lumbar DH*

	Physical functioning	Role limit due physical problems	Role limit due emotional problems	Energy / Fatigue	Emotional well-bing	Social functioning	Bodily Pain	General Health
Men	46.08	42.65	66.68	57.84	63.29	58.53	45.39	56.96
Women	55.60	29.00	68.00	49.80	60.80	61,20	40.90	48.20

4.5.1. Physical functioning outcomes

When examining the limitation of physical functioning and its comparison in the individual groups of respondents, we obtained the following results for the most common distributions from 0 to 100.

In men and women, a difference is reported when comparing the average values of physical functioning in favor of the female gender - the average value for them is 60.98 ± 22.61 (CI 95 % 54.93 - 67.04), and for the male gender is 48.28 ± 28.69 (CI 95 % 41.11 – 55.45), and the analysis of the distribution of this indicator in both genders is with a difference of about 20 for the most common result.

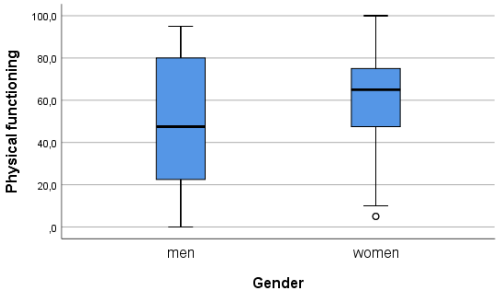

Figure 56. *Median, minimum and maximum degree of physical functioning in men and women*

In the two groups studied, living in the city and in the countryside, we did not find a significant difference in the average values of the results for physical functioning, in the urban residents they were 56.00 ± 26.78 (CI 95 % 49.62 – 62.39), in rural areas – 51.70 ± 26.64 (CI 95 % 44.13 – 59.27), as the difference in the distribution and in the most - the common result is around 10 (Fig. 57).

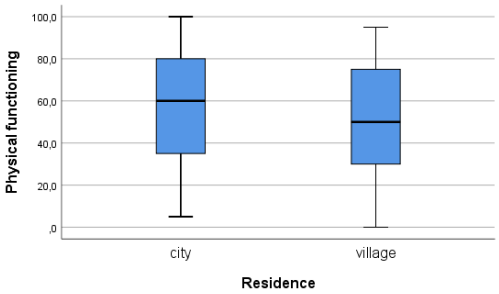

Figure 57. *Median, minimum and maximum degree of physical functioning in urban and rural residents*

When comparing the mean values of the two groups of respondents with cervical and lumbar DH in terms of physical functioning, the results were on average 62.84 ± 23.56 (CI 95 % 55.68 - 70.00) and 49.21, respectively ± 27.36 (CI 95 % 49.20 - 55.44). We also reported a difference in the most common outcome in the two groups with a difference of about 20 in favor of the group with cervical DH (Fig. 58).

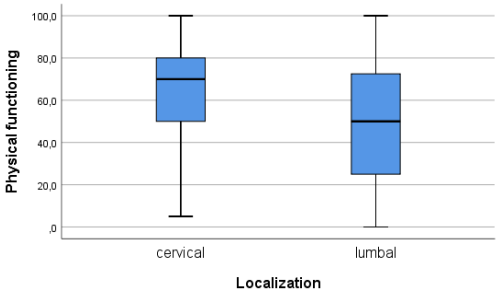

Figure 58. *Median, minimum and maximum degree of physical functioning in participants with cervical and lumbar DH*

In the statistical processing of the results for the physical functioning of the different age groups and a comparison of the average values obtained, the group from 25 to 34 years old with the

lowest result and limitation of functionality is followed by the group of the oldest from 55 to 65 years old, 46.67 ± 29.13 (CI 95 % 30.53 - 62.80) and 49.87 ± 25.43 (CI 95 % 41.62 - 58.12), respectively. In the group of the youngest from 18 to 24 years was 60.00 ± 17.89 (CI 95 % 41.23 - 78.77), in the group from 45 to 54 years is 53.50 ± 28.94 (CI 95 % 44.25 - 62.76), with the least limitation of this indicator being reported for the group from 35 to 44 years old - 68.00 ± 21.11 (CI 95 % 58.12 - 77.88). The distribution of the most frequent results of the limitation of physical functioning, calculated by the SF-36 questionnaire, is presented in Fig. 59.

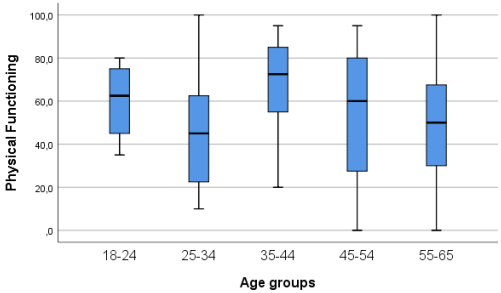

Figure 59. *Median, minimum and maximum degree of physical functioning in different age groups*

We found that there is a statistical relationship between physical functioning and localization of DH ($p < 0.01$), also with gender ($p < 0.05$) and there is no statistically significant relationship between this factor of the quality of life of the respondents and their age and place of residence (Table 14.)

Table 14. *Physical functioning depending on localization of DH, age, place of residence and gender*

	Localization of DH	Age	Residence	Gender
Pearson' corr.	0,25	-0,07	0,08	0,24
p-value	0,007	0,45	0,39	0,009
Spearman' rho	-0,25	-0,08	0,08	0,22
p-value	0,006	0,36	0,38	0,02
N	120	120	120	120

4.5.2. Social functioning outcomes

Regarding the comparison of the social functioning indicator by gender, for men the mean value was 58.59 ± 23.10 (CI 95 % 52.83 - 64.36) and for women the mean value was 55.94 ± 23.85 (CI 95 % 49.55 - 62.33).

There is also a slight difference in terms of the most common result and the distribution of the results in both sexes (Fig. 60).

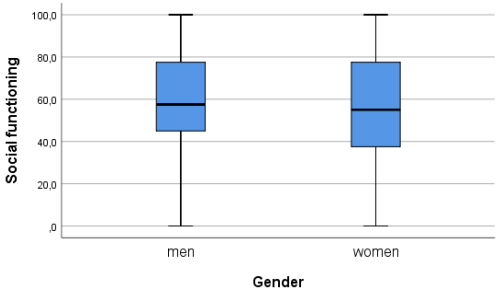

Figure 60. *Median, minimum and maximum value of social functioning according to gender*

When comparing the mean value of social functioning, the cervical herniated disc group had a score of 53.81 ± 20,10 (CI 95 % 47.42 - 60.19) and the lumbar herniated group had a score of 59.41 ±

24.57 (CI 95 % 53.79 - 65.02), with the most common value in respondents with lumbar DH being about 15 points higher (Fig. 61).

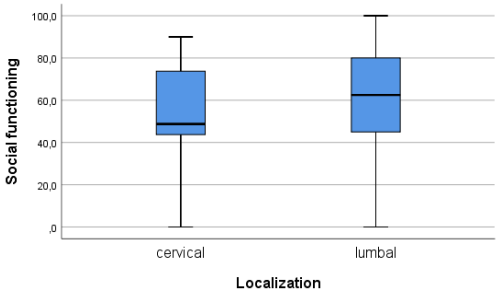

Figure 61. *Median, minimum and maximum value of social functioning according to localization of DH*

The mean values of the impact on social functioning depending on the place of residence differed slightly, respectively 58.36 ± 22.88 (CI 95 % 52.90 - 63.81) for urban residents and 55.95 ± 24.24 (CI 95 % 49.06 - 62.84) for rural, and no difference was taken into account in the most common result and in the two groups studied.

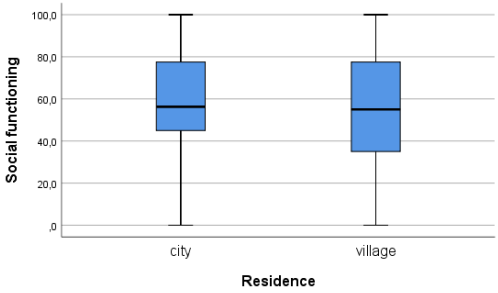

Figure 62. *Median, minimum and maximum value of social functioning according to residence*

The youngest group, from 18 to 24 years old, has the least impact on social functioning. Their arithmetic mean score was 66.67

± 19.15 (CI 95 % 46.57 - 86.76), followed by the 45 to 54 years old group with a result of 61.00 ± 22.37 (CI 95 % 53.85 - 68.16) and the group from 25 to 34 years with a mean score of 57.00 ± 32.56 (CI 95 % 38.97 - 75.03).

The group that showed the best result in terms of the impact on physical functioning had the lowest score - the group from 35 to 44 years old with 52.50 ± 22.12 (CI 95 % 42.15 - 62.85) and those from 55 to 65 years of age with an arithmetic mean score of 54.81 ± 21.65 (CI 95 % 47.79 - 61.83).

The comparison of the most common results and the distribution of the results in the five groups with the corresponding distribution are presented in Fig. 63.

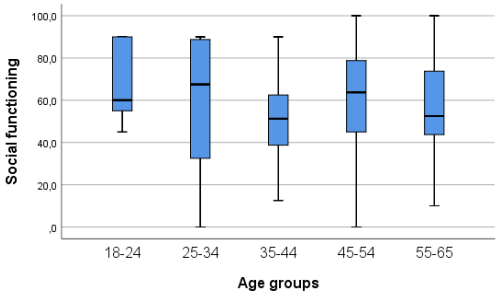

Figure 63. *Median, minimum and maximum value of social functioning according to age*

In the analysis for dependence between the localization of disc herniation, age, place of residence and gender, we did not find a statistically significant relationship with social functioning (Tabl. 15).

Table 15. *Social functioning depending on localization of DH, age, place of residence and gender*

	Localization of DH	Age	Residence	Gender
Pearson' coeff.	0,12	-0,02	-0,05	0,06
p-value	0,21	0,80	0,58	0,54
Spearman' rho	0,13	0,05	0,06	0,07
p-value	0,16	0,62	0,54	0,46
N	120	120	120	120

4.5.3. Role limit due to physical problems

When comparing the role limit indicator due to physical problems (Physical health), in men the mean value was 39.45 ± 41,02 (CI 95 % 29.21 - 49.70), in women it was 28.57 ± 36.75 (CI 95 % 18.73 - 38.41), with a very wide range of distribution of results in both sexes and a greater impact of this indicator due to the disease in women (Fig. 64).

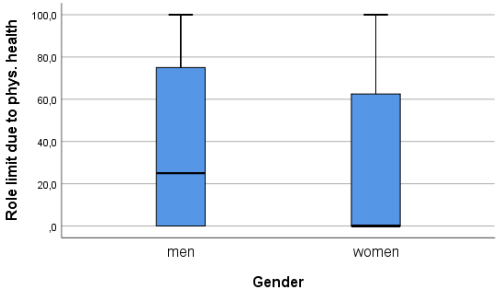

Figure 64. *Median, minimum and maximum value of role limit due to physical problems according to gender*

In the two groups surveyed with cervical and lumbar DH, a difference is again reported regarding the arithmetic mean result, as in the group with cervical DH it is 27.84 ± 37.05 (CI 95 % 16.58 - 39.11), and in the case of lumbar DH it is 38.16 ± 40.31 (CI 95 % 28.95 - 47.37).

A wide range of results is also observed in both groups with a significantly greater impact on the role limit due to physical problems in the respondents with cervical disc herniation, who are mostly female 70.5 % (Fig. 65).

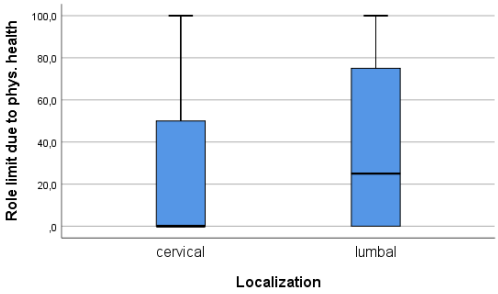

Figure 65. *Median, minimum and maximum value of role limit due to physical problems according to localization of DH*

There is no significant difference regarding role limit due to emotional problems depending on the place of residence. For urban residents the arithmetic mean result is 61.91 ± 43.33 (CI 95 % 51.57 - 72.24) and for rural residents - 57.33 ± 39.86 (CI 95 % 46.00 - 68.66). A wide range of distribution of the obtained results was observed in both groups (Fig. 66).

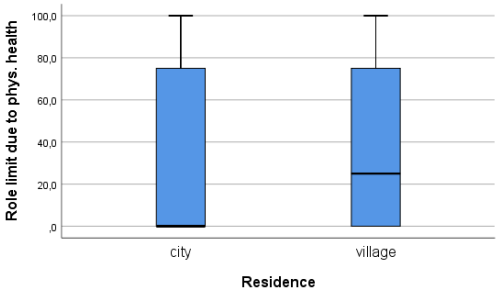

Figure 66. *Median, minimum and maximum value of role limit due to physical problems according to residence*

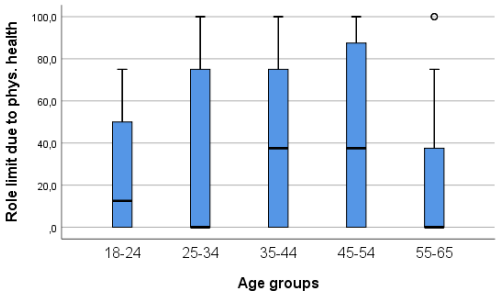

Figure 67. *Median, minimum and maximum value of role limit due to physical problems according to age*

Regarding the role limit due to physical problems, we did not establish a statistically significant relationship between this indicator and the localization of disc herniation, the age of the respondents, their gender and place of residence (Table 16).

Table 16*. Role limit due to physical problems depending on location of DH, age, place of residence and gender*

	Localization of DH	**Age**	**Residence**	**Gender**
Pearson' coeff.	0,13	0,09	0,04	0,14
p-value	0,17	0,34	0,70	0,13
Spearman' rho	0,12	0,12	0,05	0,13
p-value	0,19	0,19	0,62	0,15
N	120	120	120	120

4.5.4. Role limit due to emotional problems

Another factor related to quality of life is role limitation due to emotional problems. According to this indicator, women reported a worse arithmetic mean result - 51.19 ± 41.66 (CI 95 % 40.03 - 62.35), and men it was 67.71± 40.70 (CI 95 % 57.54 - 77.88). In men, a result

of 100 is most often found, i.e. lack of role limit due to emotional problems, while in women the most common result is 50 (Fig. 68).

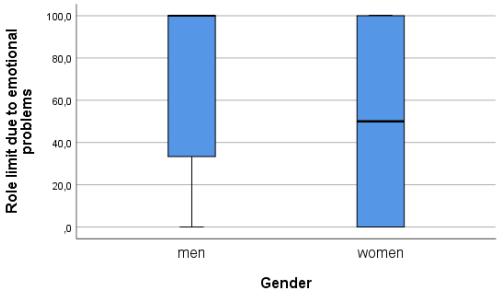

Figure 68. *Median, minimum and maximum value of role limit due to emotional problems by gender*

In respondents with cervical disc herniation, the arithmetic mean score for role limit due to emotional problems was 47.73 ± 42.77 (CI 95 % 34.72 - 60.73), and in those with lumbar DH it was 67.11 ± 39.91 (CI 95 % 58.01 - 76.20). Again, we have a wide range of distribution of the obtained results of this indicator, with a distinctly smaller restriction in the lumbar DH (Fig. 69).

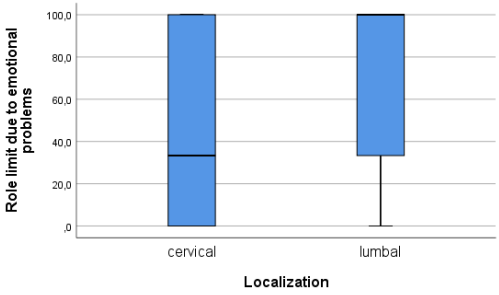

Figure 69. *Median, minimum and maximum value of role limit due to emotional problems by localization of DH*

There is no significant difference regarding role limit due to emotional problems depending on the place of residence, for urban residents the arithmetic mean result is 61.91 ± 43.33 (CI 95 % 51.57 - 72.24) and for rural residents - 57.33 ± 39.86 (CI 95 % 46.00 - 68.66). A wide range of distribution of the obtained results was observed in both groups (Fig. 70).

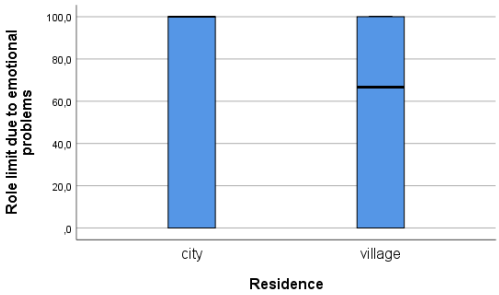

Figure 70. *Median, minimum and maximum value of role limit due to emotional problems by residence*

The role limitation due to emotional problems is most pronounced among the oldest respondents in the group from 55 to 65 years old. Their mean score is 42.74 ± 39.70 (CI 95 % 29.87 - 55.60). The best results were found among the youngest respondents in the group from 18 to 24 years old, with a result of 77.78 ± 40.37 (CI 95% 35.41 - 120.14), and for the group from 25 to 34 years old is 73.33 ± 42.16 (CI 95 % 49.98 - 96.68). In the remaining two groups from 35 to 44 years and from 45 to 54 years old the results were 68.33 ± 38.20 (CI 95 % 50.46 - 86.21) and 65.00 ± 42.00 (CI 95 % 51.57 - 78.43), respectively. The results are presented on Fig. 71.

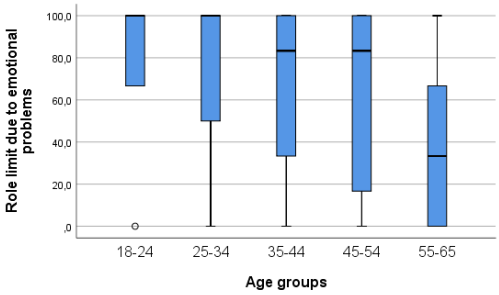

Figure 71. *Median, minimum and maximum value of role limit due to emotional problems by age*

A statistical relationship was found between role limitation due to emotional problems and the location of the disc herniation ($p < 0.05$). Regarding gender, there is also a similar dependence ($p < 0.05$). We found a strong statistical relationship between age and role limitation due to emotional problems ($p = 0.002$ Pearson; $p = 0.001$ Spearman), (Table 17).

Table 17. *Role limit due to emotional problems depending on location of DH, age, place of residence and gender*

	Localization of DH	**Age**	**Residence**	**Gender**
Pearson' coeff.	0,22	0,28	0,051	0,20
p-value	0,01	0,002	0,56	0,03
Spearman' rho	0,22	0,29	0,09	0,20
p-value	0,02	0,001	0,34	0,03
N	120	120	120	120

4.5.5. Results for Energy and Fatigue

When examining energy and fatigue as factors of the quality of life from the SF-36 questionnaire, men showed a higher arithmetic

mean score than women - 56.80 ± 16.39 (CI 95 % 52.70 - 60.89) compared to 48.93 ± 17.26 (CI 95 % 44.31 - 53.55). There is little difference in terms of the distribution of results with a slight preponderance of 10 points for this indicator in men (Fig. 72).

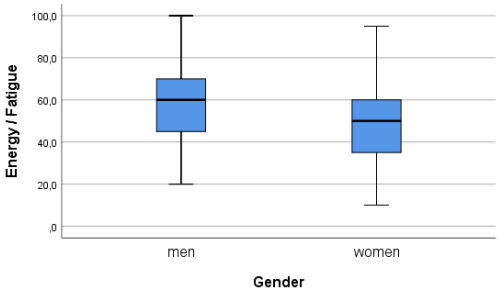

Figure 72. *Median, minimum and maximum value for energy/fatigue by gender*

When comparing this indicator depending on the localization of the disc herniation, in the cervical DH group the mean score was 49.55 ± 15.51 (CI 95% 44.83 - 54.26) and in the lumbar group it was 55, 20 ± 17.86 (CI 95% 51.12 – 59.28). The distribution of results in the two groups is presented in Fig. 73.

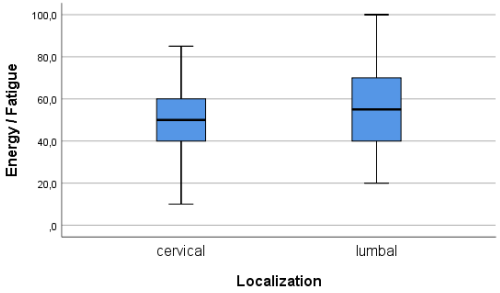

Figure 73. *Median, minimum and maximum value for energy/fatigue by localization of DH*

There is no significant difference in the arithmetic mean scores for energy and fatigue in urban and rural residents. In the former it was 54.29 % ± 18.10 (CI 95 % 49.97 - 58.60), and in the latter it was 51.50 % ± 15.85 (CI 95 % 47.00 - 56.00). There is no significant difference in the distribution of the most common results in the two groups.

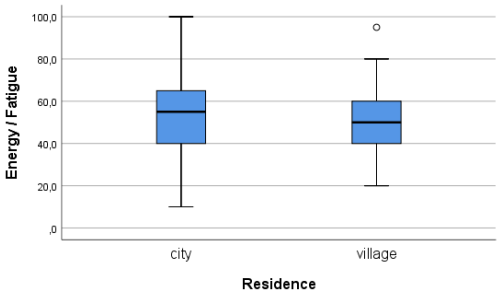

Figure 74. *Median, minimum and maximum value for energy/fatigue by residence*

We also do not report significant differences in the average results for this indicator in the individual age groups. In the group from 18 to 24 years mean value is 58.33 ± 13.29 (CI 95 % 44.39 - 72.28), in the group from 25 to 34 years is 56.67 ± 19.70 (CI 95 % 45.76 - 67.58), from 35 to 44 years is 54.00 ± 18.40 (CI 95 % 45.39 - 62.61), in the group of 45 to 54 years is 54.50 ± 18.84 (CI 95 % 48.78 - 60.53). The lowest score is in the 55 to 65 age group - 49.10 ± 14.04 (CI 95 % 44.55 - 53.66). There is no significant difference in the distribution of the most common results by age group.

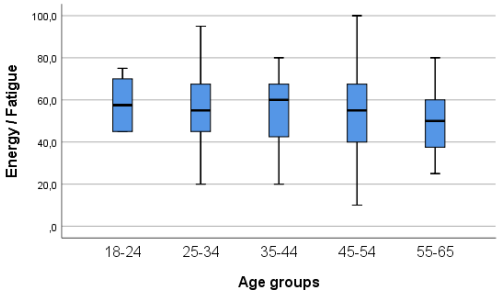

Figure 75. *Median, minimum and maximum value for energy/fatigue by age*

From the obtained results, a statistically significant relationship of energy and fatigue with gender ($p < 0.05$) was found, but there was no such relationship with the localization of disc herniation, age and place of residence (Table 18).

Table 18. *Energy / fatigue depending on location of DH, age, place of residence and gender*

	Localization of DH	**Age**	**Residence**	**Gender**
Pearson' coeff.	0,16	0,14	0,08	0,23
p-value	0,09	0,13	0,38	0,012
Spearman' rho	0,15	0,15	0,09	0,24
p-value	0,09	0,11	0,34	0,010
N	120	120	120	120

4.5.6. Outcomes from research on emotional well-being

Emotional well-being did not show a significant difference between the two sexes. In men, the mean score of the SF-36 questionnaire was 61.69 ± 18.21 (CI 95 % 57.14 - 66.24), and in women it was 58.00 ± 19.42 (CI 95 % 52, 80 - 63.20). There is also no significant difference in the distribution of results for both sexes with a slight preponderance for men of 10 points.

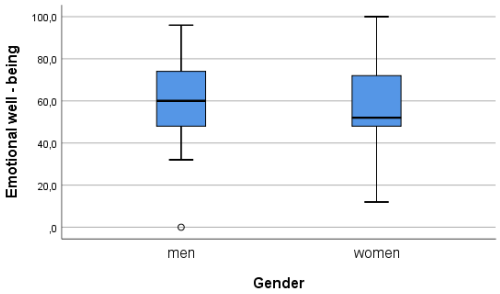

Figure 76. *Median, minimum and maximum value of emotional well-being by gender*

When comparing the emotional well-being in the two groups with cervical and lumbar DH, a slightly higher average score was reported for those with lumbar localization - 62.47 ± 19.39 (CI 95 % 58.04 - 63.01) compared to 55.64 ± 17.08 (CI 95 % 50.45 - 60.83) in lumbar. The distribution of results in the two groups is presented in Fig. 77.

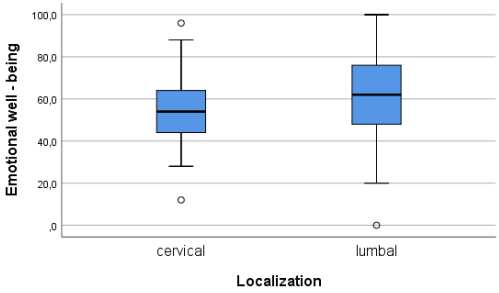

Figure 77. *Median, minimum and maximum value of emotional well-being by localization of DH*

Emotional well-being does not show a significant difference between urban and rural residents. Arithmetic mean values of the results were reported 61.77 ± 19.21 (CI 95 % 57.19 - 66.35) for those living in a city and 57.44 ± 18.08 (CI 95 % 52.30 - 62.58) in

rural residents. There is no significant difference in the distribution of the results for this indicator in the two groups (Fig. 78).

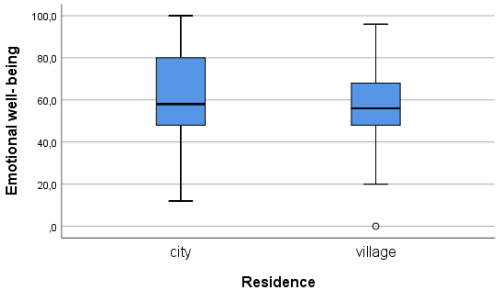

Figure 78. *Median, minimum and maximum value of emotional well-being by residence*

In the separate age groups, no significant difference was reported in the arithmetic mean values of the emotional well-being score. With the highest result of 64.67 ± 18.32 (CI 95 % 45.45 - 83.89) is the group from 18 to 24 years, followed by the group from 25 to 34 years with a result of 62.93 ± 19.91(CI 95 % 51.91 - 73.96), from 45 to 54 years with a score of 62.70 ± 21.73 (CI 95 % 55.75 - 69.65), from 35 to 44 y/o with a result of 58.20 ± 17.63 (CI 95 % 49.95 - 66.45). The lowest score is in the oldest age group from 55 to 65 years with a score of 56.21 ± 15.65 (CI 95 % 51.13 - 61.28). There is no significant difference in the distribution of the most common results in the individual groups (Fig. 79).

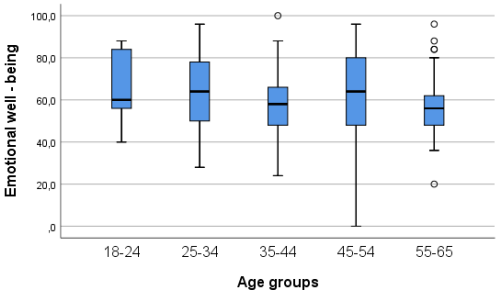

Figure 79. *Median, minimum and maximum value of emotional well-being by age*

In the statistical analysis, no statistically significant relationship of the emotional well-being factor with the age, place of residence and gender of the surveyed participants was found. Only in the Spearman's correlation test did we notice a relationship between the localization of DH and this indicator ($p < 0.05$), which was not confirmed in the Pearson's test ($p > 0.05$), presented on Table 19.

Table 19. Emotional well-being depending on location of DH, age, place of residence and gender

	Localization of DH	**Age**	**Residence**	**Gender**
Pearson' coeff.	0,18	-0,09	-0,11	-0,10
p-value	0,06	0,31	0,22	0,29
Spearman' rho	0,20	0,12	-0,08	-0,12
p-value	0,03	0,18	0,39	0,20
N	120	120	120	120

4.5.7. Results of a study of the bodily pain of the SF -36 questionnaire

In the pain examination, there was no significant difference in mean scores for men and women, 46.91 ± 25.61 (CI 95 % 40.52 -

53.31) for men and 43.35 ± 22.15 (CI 95 % 37.42 - 49.28) for women. Obviously, there is no difference in the distribution of the results and the most common results in both sexes (Fig. 80).

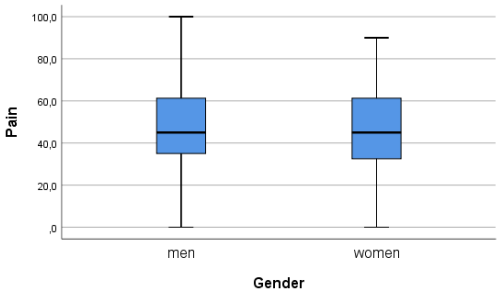

Figure 80. *Median, minimum and maximum pain value depending on gender*

There was also no difference in the results for the pain indicator when comparing the results in the participants with cervical and lumbar DH. In the first group, the mean score was 47.56 ± 19.20 (CI 95 % 41.72 - 53.40), and in the second group it was 43.91 ± 26.45 (CI 95 % 37.87 - 49.96). The distribution of results in the two groups is shown on Fig. 81.

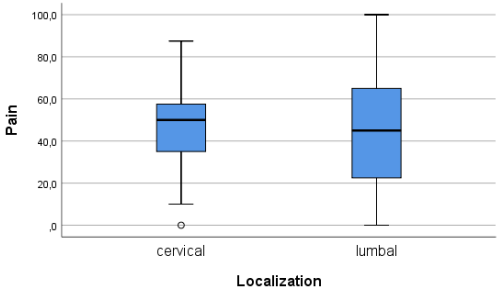

Figure 81. *Median, minimum and maximum pain value depending on localization of DH*

There is a difference of about 8 points in the arithmetic mean values of the result for urban and rural residents in favor of urban residents - for them the result for the pain indicator is 48.64 ± 24.70 (CI 95 % 42.75 - 54.53), and for rural it is 40.50 ± 22.44 (CI 95 % 34.12 - 46.88). The distribution of the results shows the same tendency (Fig. 82).

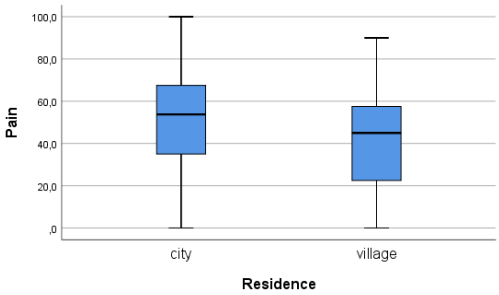

Figure 82. *Median, minimum and maximum pain value depending on residence*

The results for the pain factor in the individual age groups are interesting. It is noteworthy that the group from 25 to 34 years old reported the lowest average values and, accordingly, the greatest pain - 26.83 ± 26.01 (CI 95 % 12.43 - 41.24). The other groups have similar results, with the highest score and correspondingly lowest pain in the group from 35 to 44 years old - 53.25 ± 21.35 (CI 95% 43.26 - 63.24). The remaining results were 47.92 ± 17.99 (CI 95% 29.04 - 66.79) for the 18 to 24 years old group, 47.50 ± 25.98 (CI 95 % 39.19 - 55, 81) and 45.51 ± 20.52 (CI 95 % 38.86 - 52.17) for the oldest from 55 to 65 years. The most common results and their distribution are shown on Fig. 83.

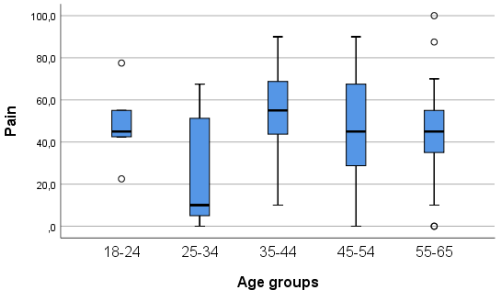

Figure 83. *Median, minimum and maximum pain value depending on residence*

4.5.8. Results of the study of the indicator General health

Regarding the measurement of General health, men had a slightly higher mean score of 55.94 ± 16.52 (CI 95% 51.81 - 60.06) compared to women - 51.16 ± 15.46 (CI 95 % 47.02 - 55.30). The distribution of results by gender is shown on Fig. 84.

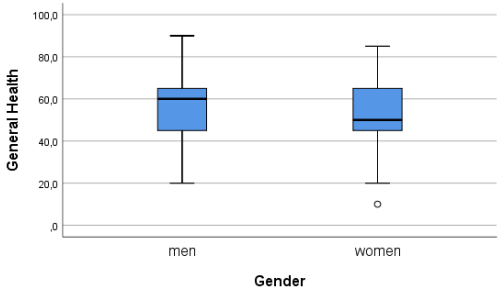

Figure 84. *Median, minimum and maximum value of General health by gender*

With the two different localizations of DH, no difference in the arithmetic mean values of the results for the General health indicator is reported. For cervical DH the result was 53.07 ± 12.90 (CI 95 % 49.15 - 57.00) and for lumbar DH it was 54.08 ± 17.83 (CI 95 %

50.01 - 58.15). The corresponding distribution of results by group is shown on Fig. 85.

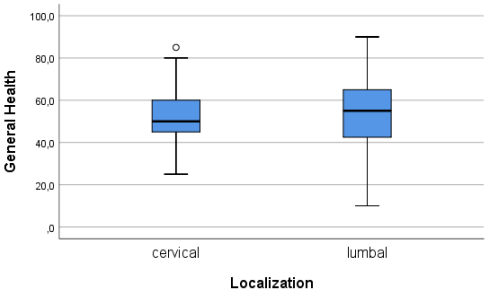

Figure 85. *Median, minimum and maximum value of General health by gender*

The difference in the indicator of General health compared to the place of residence is also insignificant. For urban residents, the reported arithmetic mean result was 55.07 ± 15.46 (CI 95 % 51.38 - 58.76), and for rural residents it was 51.80 ± 17.02 (CI 95 % 46.96 – 56.64). There is also a small difference in the most common outcome in the two groups, shown on Fig. 86.

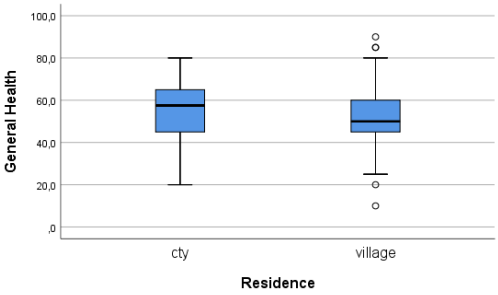

Figure 86. *Median, minimum and maximum value of General health by residence*

Participants from the youngest age group from 18 to 24 years have the highest average arithmetic indicator of General health - 65.83 ± 10.68 (CI 95 % 54.62 - 77.05), with the lowest from 46.41 ± 16.06 (CI 95 % 41.21 - 51.62) are the oldest participants from 55 to 65 years. In the remaining three groups, no significant difference in the average arithmetic results is reported and they are as follows: for the group from 25 to 34 years - 55.00 ± 16.37 (CI 95 % 45.94 - 64.06), for the group from 35 to 44 years it was 58.25 ± 13.70 (CI 95 % 51.84 - 64.66) and for the group from 45 to 54 years was 56.25 ± 15.76 (CI 95 % 51.21 - 61.29).

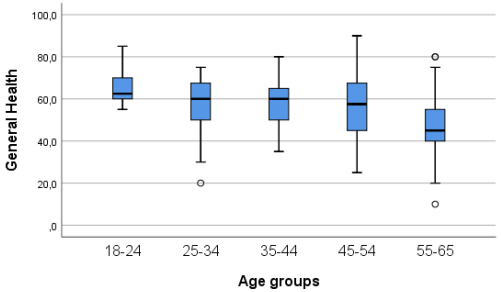

Figure 87. *Median, minimum and maximum value of General health by age*

From the results obtained for all respondents, we found a strong correlation between age and General health, while there was no statistically significant relationship between age and DH localization, depression level, pain intensity and disability, which is presented in the summary analysis.

4.6. SUMMARY CORRELATION ANALYSIS

4.6.1. Analysis of the relationship between DH location and age, gender, place of residence, depression, pain, disability and general health

Pain scores obtained from the NPRS questionnaire were used in this analysis. The visual analog scale is ten-point and is the most commonly used tool to measure pain, while pain scores from the SF-36 questionnaire are obtained in conjunction with the other indicators, are divided into six grades, and are influenced by the impact of pain on daily activities (Questions 20. and 21. of the SF-36 questionnaire).

For all respondents, we found that there is no statistically significant relationship between the location of the disc herniation, respectively in the cervical and lumbar region, and age, level of depression, pain and general health from the SF-36 questionnaire, there is a weak correlation with the place of residence. Regarding disability and the relationship with DH location, we found a relationship ($p < 0.05$) in the study with the CNFDS and RMD Questionnaires, but not in the results of the ODI and NDI disability tests. In our contingent of subjects, a strong statistical correlation was found with gender and localization of DH (Table 20).

Table 20. *Correlation of DH localization factor with age, gender, place of residence, depression, pain, disability and General health*

	Age	**Gender**	**Residence**	**Depression**	**Pain (NRPS)**	**Disability (ODI, NDI)**	**Disability (CNFDS, RMDQ)**	**General Health (SF-36)**
Pearson' coeff.	0,14	0,37	0,19	0,61	0,12	0,11	0,26	0,03
p-value	0,13	**0,000**	**0,041**	0,51	0,21	0,23	**0,049**	0,74
Spearman' rho	0,15	0,36	0,19	0,76	0,10	0,15	0,23	0,06
p-value	0,10	**0,000**	**0,041**	0,41	0,26	0,11	**0,011**	0,49
N	120	120	120	120	120	120	120	120

4.6.2. Relationship of age to location of DH, place of residence, depression, pain, disability and general health

From the results obtained for all respondents, we found a strong correlation between age and general health, while there is no statistically significant relationship between age and localization of DH, level of depression, pain intensity and disability (Table 21).

Table 21. *Correlation of the age factor with the localization of DH, place of residence, depression, pain, disability and General health*

	Localization of DH	**Residence**	**Depression**	**Pain (NRPS)**	**Disability (ODI, NDI)**	**Disability (CNFDS, RMDQ)**	**General health (SF-36)**
Pearson' coeff.	0,14	0,06	0,11	0,15	0,03	0,13	0,29
p-value	0,13	0,54	0,24	0,11	0,75	0,15	**0,001**
Spearman' rho	0,15	0,06	0,13	0,15	0,08	0,17	0,33
p-value	0,10	0,51	0,16	0,12	0,40	0,06	**0,000**
N	120	120	120	120	120	120	120

4.6.3. Correlation of gender with participants' depression, pain, disability and General health

With regard to the gender factor, in all respondents, apart from the above-mentioned correlation with the localization of DH, we found a correlation between gender and pain (p=0.006 Pearson, p=0.009 Spearman), shown on Table 22.

Table 22. *Correlation of gender with participants' depression, pain, disability, and General health*

	Depression	**Pain (NPRS)**	**Disability (NDI и ODI)**	**Disability (CNFDS, RMDQ)**	**General health (SF - 36)**
Pearson' coeff.	0,15	0,25	0,15	0,19	0,15
p-value	0,10	**0,006**	0,10	**0,04**	0,11
Spearman' rho	0,16	0,24	0,16	0,18	0,16
p-value	0,10	**0,009**	0,08	0,051	0,09
N	120	120	120	120	120

4.6.4. Relationship between pain, depression, disability and general health

When processing the results of all patients regarding the level of depression, pain (NRPS), disability assessed with the NDI, ODI, CNFDS and RMD Questionnaires, as well as those for General health from the SF-36 questionnaire, we found a strong statistically significant relationship between all these indicators ($p< 0.001$), (Table 23).

Table 23. *Relationship between pain, depression, disability and General health*

		Depression	Pain (NPRS)	Disability (NDI and ODI)	Disability (CNFDS and RMDQ)	General health (SF-36)
Pearson' coeff.	**Depression**		0,32	0,41	0,38	0,32
	p-value		**0,000**	**0,000**	**0,000**	**0,000**
	Pain (NPRS)	0,32		0,56	0,56	0,26
	p-value	**0,000**		**0,000**	**0,000**	**0,004**
Spearman' rho	**Depression**		0,32	0,38	0,32	0,35
	p-value		**0,000**	**0,000**	**0,000**	**0,001**
	Pain	0,32		0,61	0,60	0,27
	P	**0,000**		**0,000**	**0,000**	**0,003**
N		120	120	120	120	120

4.6.5. Impact of depression on quality of life

Regarding all indicators determining the quality of life for both physical and mental health, assessed by the SF-36 questionnaire, we found an extremely strong correlation with the severity of depression.

Table 24. *Relationship between depression and quality of life*

	Physical functioning	Role limit due phys. problems	Role limit due emot. problems	Energy/Fatigue	Emotional well-being	Social functioning	Pain (SF-36)	General health
Pearson' coeff.	-0,25	-0,33	-0,55	-0,50	-0,39	-0,46	-0,46	-0,32
p-value	**0,005**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Spearman' rho	-0,21	-0,33	-0,56	-0,48	-0,29	-0,44	-0,46	-0,31
p-value	**0,002**	**0,000**	**0,000**	**0,000**	**0,001**	**0,000**	**0,000**	**0,001**
N	120	120	120	120	120	120	120	120

4.6.6. Impact of disc herniation location on quality of life

In the statistical processing of the results, we found a correlation with physical functioning and role limit due to emotional factors. Regarding the indicator of emotional well-being, Spearman's test also found such a relationship ($p < 0.05$), but this was not confirmed by Pearson's test ($p = 0.054$).

***Table 25**. Impact of disc herniation location on quality of life*

	Physical functioning	**Role limit due phys. problems**	**Role limit due emot. problems**	**Energy/Fatigue**	**Emotional well-being**	**Social functioning**	**Pain (SF-36)**	**General health**
Pearson' coeff.	0,247	0,13	0,22	0,159	0,176	0,116	0,073	0,030
p-value	**0,007**	0,167	**0,014**	0,083	0,054	0,207	0,426	0,743
Spearman' rho	0,249	0,119	0,221	0,145	0,196	0,129	0,083	0,063
p-value	**0,002**	0,194	**0,015**	0,114	**0,032**	0,161	0,369	0,493
N	120	120	120	120	120	120	120	120

4.6.7. Influence of age on quality of life

As can be seen from the presented statistical analysis, there is a strong dependence of the age of the participants with the role limit due to emotional problems and with general health, and age does not have a statistically significant relationship with the other indicators determining the quality of life, (Table 26).

Table 26. *Dependence of participants' age on quality of life*

	Physical functioning	**Role limit due phys. problems**	**Role limit due emot. problems**	**Energy/Fatigue**	**Emotional well-being**	**Social functioning**	**Pain (SF-36)**	**General health**
Pearson' coeff.	0,070	0,088	0,275	0,138	0,093	0,023	0,114	0,290
p-value	0,450	0,338	**0,002**	0,134	0,314	0,800	0,217	**0,001**
Spearman' rho	0,084	0,120	0,287	0,146	0,123	0,046	0,056	0,331
p-value	0,363	0,190	**0,001**	0,111	0,180	0,617	0,544	**0,000**
N	120	120	120	120	120	120	120	120

4.6.8. Influence of participants' gender on quality of life

Correlation analysis revealed a statistical relationship between gender and physical functioning, between gender and role limit due to emotional problems, and between gender and energy / fatigue. Regarding the other indicators, we did not find such a dependence, (Table 27).

Table 27*. Dependence of participants' gender on quality of life*

	Physical functioning	**Role limit due phys. problems**	**Role limit due emot. problems**	**Energy/Fatigue**	**Emotional well-being**	**Social functioning**	**Pain (SF-36)**	**General health**
Pearson' coeff.	0,238	0,139	0,198	0,229	0,098	0,057	0,074	0,148
p-value	**0,009**	0,131	**0,030**	**0,012**	0,285	0,537	0,420	0,106
Spearman' rho	0,215	0,132	0,198	0,235	0,119	0,068	0,062	0,158
p-value	**0,018**	0,151	**0,030**	**0,010**	0,196	0,458	0,503	0,085
N	120	120	120	120	120	120	120	120

4.6.9. Influence of the place of residence on the quality of life

No statistically significant relationship was found with any of the indicators determining the quality of life and place of residence of the study participants, (Table 28).

Table 28. *Dependence of place of residence on quality of life*

	Physical functioning	Role limit due phys. problems	Role limit due emot. problems	Energy/Fatigue	Emotional well-being	Social functioning	Pain (SF-36)	General health
Pearson' coeff.	0,080	0,035	0,054	0,080	0,114	0,051	0,168	0,100
p-value	0,387	0,704	0,557	0,384	0,215	0,580	0,067	0,276
Spearman' rho	0,081	0,045	0,087	0,088	0,079	0,056	0,177	0,134
p-value	0,381	0,623	0,342	0,339	0,391	0,541	0,053	0,145
N	120	120	120	120	120	120	120	120

4.6.10. Impact of pain on health-related quality of life

In the statistical processing of the pain intensity results obtained through the NPRS, we found a strong statistical dependence of pain with all quality of life indicators from the SF-36, analogous to the influence of depression, with the difference that in our respondent pain influenced the least emotional well-being.

Table 29. *Impact of pain on health-related quality of life*

	Physical functioning	**Role limit due phys. problems**	**Role limit due emot. problems**	**Energy/Fatigue**	**Emotional well-being**	**Social functioning**	**Pain (SF-36)**	**General health**
Pearson' coeff.	0,267	0,463	0,491	0,316	0,197	0,347	0,488	0,264
p-value	**0,003**	**0,000**	**0,000**	**0,000**	**0,031**	**0,000**	**0,000**	**0,004**
Spearman' rho	0,288	0,405	0,481	0,319	0,185	0,352	0,493	0,273
p-value	**0,001**	**0,000**	**0,000**	**0,000**	**0,043**	**0,000**	**0,000**	**0,003**
N	120	120	120	120	120	120	120	120

The severity of depression negatively affects all indicators of physical and mental health. Worse results for quality of life are reported in those examined with cervical DH, (Table 30).

Table 30. *Results of the SF-36 questionnaire depending on the location of disc herniation and degree of depression*

	Grade of depression	Physical functioning	Role limit due phys.	Role limit due emot.	Energy/ Fatigue	Emotional well-being	Social functioning	Pain	General health
Cervical DH	Лека	67,9	32,9	43,9	47,9	58,5	60,4	47,2	54,7
	Умерена	61,4	7,1	14,3	40,7	45,7	42,1	43,6	42,1
	Умерено тежка	27,5	0,0	16,7	55,0	34,0	32,5	17,5	45,0
	Тежка	5,0	0,0	0,0	10,0	12,0	0,0	10,0	40,0
Lumbar DH	Липсва	51,8	48,0	85,6	61,5	67,0	68,2	54,3	57,8
	Лека	62,2	38,9	70,4	57,8	66,4	66,0	43,1	58,6
	Умерена	28,8	18,8	27,1	43,8	52,0	37,3	26,1	45,3
	Умерено тежка	49,0	25,0	46,7	36,0	48,0	41,0	27,0	38,0

Table 31. *Results of the SF-36 questionnaire depending on the location of disc herniation and gender*

	Gender	Physical functioning	Role limit due phys. problems	Role limit due emot. problems	Energy/ Fatigue	Emotional well-being	Social functioning	Pain	General health
Cervical DH	мъж	56,9	26,9	71,8	52,7	55,4	58,8	52,9	51,9
	жена	65,3	28,2	37,6	48,2	55,7	51,7	45,3	53,5
Lumbar DH	мъж	46,1	42,6	66,7	57,8	63,3	58,5	45,4	57,0
	жена	55,6	29,0	68,0	49,8	60,8	61,2	40,9	48,2

5. DISCUSSION

In the present study, pain intensity, disability, and health-related quality of life were assessed in 120 patients with lumbar and cervical disc herniation.

5.1. Epidemiological data

The distribution of lumbar and cervical disc herniation in our study population is fully consistent with epidemiologic data from previous studies of a large database in the United States, according to

which cervical intervertebral disc injuries account for 36 % and lumbar disc injuries for 62 % of all intervertebral disc injuries. (R. Windsor, 2018). Of our examined, 63.3 % had lumbar DH, and 36.7 % had cervical DH. Similar results were reported in large-scale studies in South Korea (Y. K. Kim et al., 2018).

In our study cohort, men were 53.3 % and women were 46.7 %, which coincides with data from previous studies, according to which disc herniation is slightly more common in men than in women - 57 % versus 43 % (J. Cummins et al., 2006).

When comparing the frequency distribution of lumbar disc herniation by sex, of our subjects with lumbar disc herniation, 67.1 % were male and 32.9 % were female, which is approximately a male to female ratio of 2:1, and our data are consistent with epidemiological data for the European population, in a study of over 34 000 patients over a 14-year period (A. M. Dydyk et al., 2020). According to other smaller studies in Northern Europe, the gender distribution of lumbar disc herniation is more balanced, but still with a male predominance of about 10 % (F. Strömqvist et al., 2016).

There is a match with the epidemiological data on the prevalence of disc herniation in our study population regarding cervical disc herniation. In our subjects with cervical DH, 70.5% were women, which is comparable to data from global studies (R. Windsor, 2018 et al., 2018, N. Al-Ryalat et al., 2017, K. Sharrak, 2023). A similar study on the impact of neck and shoulder pain among over 6 000 people in Saudi Arabia also found that more than half of the participants (72%) were female (M. Hashem et al., 2024). Epidemiological data from a study of a large group of participants with chronic neck pain showed that women were 70% (M. Weigl, 2021). In this direction are the reported data on the prevalence of neck pain in the female sex from the Global Burden of Diseases Study conducted from 1990 to 2017 (S. Safiri et al., 2020), as well as global data for the

period from 1966 to 2002, showing that in 83 % of studies, women had more frequent neck pain than men (R. Fejer, 2006).

The data for our studied population show an almost equal distribution of lumbar disc herniation among urban and rural residents - 51.5% versus 48.7%, but a significant preponderance of cervical disc herniation is found among urban residents - 70.5 % and only 29.5 % among rural residents. These data are comparable to the results of studies on the Bulgarian population that investigated the risk factors for disc herniation, including the performance of certain physical activities related to the profession and lifestyle (Zh. Ruseva, 2021, V. Kostova, 2001). It can be assumed that cervical disc herniation is more common among those who work in an office environment, in a sitting position, with prolonged neck flexion, which are predominantly urban residents. Data from global surveys are similar (J. Fakhoury, T. Dowling, 2023 and M. Machino et al., 2021).

The average age of our subjects was 47.5 years, for men it was 46.2 years, for women - 49 years, for those with lumbar disc herniation it was 46.3 years, and for those with cervical it was 49.5 years, for urban residents it was 46.9 years, for rural residents - 48.2 years. A comparison with the data from foreign literature reveals a similarity in the average age of patients with disc herniation - the average age of a patient with a herniated disc was 41 years (J. Cummins et al., 2006), in over 15 000 operations for lumbar DH, a mean age of 44 years was reported for men and 45 years for women (F. Strömqvist et al., 2016). According to a systematic review of medical databases from 2012 to 2022, lumbar DH is more common in men and in the age range of 30 to 50 years (M. Pojskic et al., 2024). Data from the Hungarian LBP Patient Quality of Life Study also showed a mean participant age of 45.25 ± 16.90 years (M. Jâromy et al., 2021).

Regarding the prevalence of cervical disc herniation, US studies report that it also occurs most frequently after age 40 (C.

Hammer et al., 2016) and is most common in the third to fifth decade in life according to A. M. Dydyk, (2020).

In our study, it is also noticeable that the majority of the studied population falls in the age groups of 45 to 65 years age, which completely overlaps with the conclusion of foreign sources, incl. in a study population of 100 000 people, showing that age is an equal risk factor for the occurrence of symptomatic disc herniation in both sexes (Y. K. Kim et al., 2018).

5.2. Discussion of pain and depression outcomes

In our study population, we found that women experienced higher levels of pain. The mean value of the Visual Analogue Pain Scale for women was 6.14 and for men was 5.23, which is consistent with results from similar studies in European countries where women also reported more low back pain and lower limb (O. P. Gautschi et al., 2016), as well as for greater intake of painkillers than men (F. Strömqvist et al., 2016).

Despite differences in pain perception between the two sexes, across all subjects the most common score was average pain level (VAS, NPRS 5.66 ± 1.83), similar to another study on quality of life in LBP patients in Romania, where mean scores were in the range of moderate pain (E. Sirbu et al., 2023), as well as in a study of over 800 participants with LBP in the USA, the majority of whom reported a moderate level of pain (M. Thiese et al., 2014). In a study of over 350 patients with LBP in lumbar DH in China, the mean pain levels assessed by NRPS were very close to ours - 5.68 ± 2.19 (M. Yao et al., 2020), for a similar result in terms of pain intensity also reported in a study of 570 people with chronic LBP in Denmark, where the mean score was 6.0 ± 1.3 (E. Mihlberg, B. Arnbak, 2024).

Similar results for moderate levels of pain were also shown in a study among Spanish patients with LBP (M. Garbi et al., 2014).

Moderate levels of pain - mean VAS value - 4.0 were reported also in a large population of patients with neck pain due to disc pathology (M. Hashem et al., 2024), the results of a study of patients with chronic neck pain were also similar, conducted in a rehabilitation clinic, reported a mean pain score of 4.3 as assessed by the VAS (M. Weigl, 2021). In contrast to these results, other investigators reported the presence of mild pain in 83 % among a study population of 918 patients with chronic LBP (E. Alfalogy, 2023).

In our subjects, there was no difference in the degree of self-reported pain sensation between the cervical and lumbar disc herniation groups, and our results do not match data from a study of over 300 people with neck pain and 300 people with LBP, according to which patients with low back pain had a lower pain threshold (N. Uluğ et al., 2016).

More than half of the subjects studied in the current work showed some depressive symptoms, with almost a third having a mild form, and the average score for all participants on the PHQ-9 questionnaire used was 6.24, which corresponds to a mild form of depressive disorder. Similar were the results of a study in Romania in patients with chronic LBP, in which mild levels of depression were reported (E. Sirbu et al., 2023). These results are also comparable to the results of a comparative study of patients with chronic neck pain and healthy controls, in which all those affected showed mild neuroticism, mild mental illness, and anxiety (R. F. Lin et al., 2010).

In contrast to these data, according to the results of a study of the relationship between depression and various conditions causing chronic neuropathic pain, more than half of the patients reported symptoms of moderate or severe depression (Y. Zhang et al., 2024), and in a study of population of 60 LBP patients in Spain, participants exhibited moderate levels of depression (M. Garbi et al., 2014).

According to data from a Bulgarian study of patients with neck pain treated in a physiotherapy clinic, the pain leads to a

deterioration of the mental health of those affected (Y. Petrov, M. Mihailova, 2023), and in a similar study of over 500 middle-aged people in Japan, chronic neck and shoulder pain was found to negatively affect an individual's psychological well-being (M. Machino et al., 2021). Another similar study demonstrated that the comorbidity of LBP with depression worsened HRQoL compared to the presence of only one disease state (C. Ahrens, 2010). Our results are also somewhat comparable with the data of a two-year study of 225 patients suffering from chronic LBP in an orthopedic clinic in Taiwan, from which patients with prior mental illness or taking antipsychotics and antidepressants were previously excluded. The results of this study showed that 42.9 % of subjects had major depressive disorder and 42.9 % had partial remission of depressive disorder, with a mean pain intensity score of 5.0 on the VAS (C.P. Lee et al., 2017).

In the present study, higher levels of depression with the PHQ-9 Questionnaire were shown by female subjects - 7.09 compared to men - 5.50. The results obtained from our study are similar to the results of a study of patients with chronic neck pain and their comparison with healthy controls in Turkey, where higher levels of depression and worse sleep were also found in females (H. Yalcinkaya and et al., 2014). Other researchers have reported that patients with subacute LBP have significantly increased levels of depression, but this is independent of gender (D. Lopez-Lopez et al., 2017).

We also found higher rates of depression in rural residents, which contradicts data from older global studies that found more severe depressive symptoms in urbanized and more densely populated areas (B. Carpiniello et al., 1989, P. Sengupta, A. Benjamin, 2015). Our data are probably due to the specific conditions in Bulgaria and socio-economic factors, which some authors consider to be decisive (D. Brossart, 2013, N. Sun, 2020).

5.3. Discussion of disability results

In the present study, the results for the degree of disability assessed with the ODI and NDI Questionnaires show that the majority of participants fall into the mild or moderate disability group, distributed almost equally, 39.17 % mild and 30.83 % moderate, respectively, being very few with those without disability or with total disability, respectively 6.67 % and 5.00 %. Total disability was reported only in a part of the examined with cervical DH and in women, as well as in the age groups from 25 to 34 years, 45-54 years and 55-65 years old. In the results with the other two Questionnaires, RMDQ and CNFDS again mean scores indicated moderate disability and women reported more severe disability than men.

In a large-scale study of quality of life, pain, and disability among nearly 1 000 individuals with chronic LBP in Saudi Arabia, disability scores as measured by the ODI Questionnaire showed an approximately equal proportion of those with moderate severity, a mean of 33.2 % ± 15.6, while with us the average value of this parameter is 16.26 points, corresponding to 32.5 %.Results with higher disability rates were reported by Chinese researchers from a study of 353 patients with LBP due to lumbar DH. In their study, the mean value of disability assessed with the ODI Questionnaire was 49.57 %, compared to our score of 32.5 % disability, the mean value with the RMD Questionnaire was 13.31 points, corresponding to 55 % disability, while our mean score for disability in lumbar DH is 31.36 % (M. Yao et al., 2020). Similar results regarding disability in a study of over 200 people with chronic LBP were also reported by researchers from Taiwan - an average ODI score of 31.4 %, and a feature of this study population was the presence of leg pain in 42.7 % of those studied, “pins and needles,” numbness, and/or neurological deficits suggestive of lumbar DH (C. P. Lee et al., 2017). Results for RMDQ-assessed disability in persistent LBP in a large study in Denmark

showed a higher than our mean of 56.5 %, with their participants describing present pain in the lower limb in 83 %, as well as the presence of depression in 23 % and anxiety in 45 % of them (E. Mihlberg, B. Arnbak, 2024).

Urban residents, women, and those with cervical DH, who were about 2/3 women in our study cohort, reported higher rates of disability. These data are comparable to the results of a disability study with the CNFDS Questionnaire of patients with cervical radiculopathy due to herniated disc, in which all participants were found to have mild to moderate disability, but women had a higher degree of disability than men (S. Shreya et al., 2023). Our results are comparable to data from a large-scale study in France among over 17 000 people, which showed that female sex, older age and higher population density were associated with a higher risk of chronic back and low back pain and more severe disability (M. Husky et al., 2018), as well as with the conclusion that female gender and a sedentary lifestyle have a negative impact on the quality of life in LBP (M. Jâromi et al., 2021). Similar conclusions were drawn in a study of over 300 patients with degenerative disc disease, the results of which reported that women had higher levels of functional impairment compared to men (O. P. Gautschi et al., 2016). A similar conclusion was reported by researchers of a large group of patients operated for lumbar disc herniation, according to which women had a more severe degree of disability (F. Strömqvist et al., 2016). Regarding disability outcomes in both groups with cervical and lumbar disc herniation, our data also show higher levels of disability in cervical DH on both NDI and CNFDS Questionnaire scores. These results are in contrast to the results of a study of 600 people in Turkey, in which patients with low back pain reported more severe kinesiophobia and had lower levels of physical activity and hence more severe disability, independent of pain (N. Uluğ et al., 2016). It can be assumed that the higher disability reported in subjects with cervical DH is due to the fact that two-thirds

of patients with cervical herniation are female, who in our and most of the world studies have reported more severe disability in compared to men.

5.4. Discussion of quality of life results

The mean HRQoL score of all participants in our study assessed with the SF-36 questionnaire was 52.25 for all domains at a maximum value for the best health-related quality of life of 100, indicating its significant deterioration from the disease. The most significant influence is in the domain role limit due to physical problems - 34.38 and for physical pain - 42.25 and the least in the domain role limit due to emotional problems - 60.0 and emotional well-being - 59.97, while the domain general health is moderately affected with a score of 53.71. These results are comparable to the results of a study of over 3 000 people with acute and subacute LBP in Baltimore, in which the scores for the physical component of HRQoL were worse than for mental health, but close to our results - 52.2 for physical and 54.8 for mental component (T. Gonçalvez et al., 2021). Significantly worse results for HRQoL were shown by Croatian patients with low back pain, whose total scores for the physical component were 28.1 (for physical functioning - 35.0, for comparison in our subjects it was 49.21), but their mental health was also better. unaffected with a score of 39.4 (56.0 for emotional well-being vs. a score for our group of 62.47) (D. Hnatešen et al., 2022). When examining HRQoL among 200 people with LBP in Turkey and comparing them with healthy controls, the authors also concluded that it is the physical component of health that is affected, with quality of life being negatively affected primarily by pain intensity and physical disability (Ş. Günşah et al., 2012).

Regarding the individual domains of HRQoL, some differences are found between the individual groups of the studied.

The more significant influence of the role limit domain due to physical problems in women and in the subjects with cervical DH, mostly female, is striking.

To a lesser extent, we also found differences in the physical functioning indicator, where men and subjects with lumbar DH were more affected. Except for physical functioning, in general the women studied reported lower levels of all other domains of the SF-36. The same trend was observed when comparing the two groups studied with cervical and lumbar DH, where those with cervical herniation had worse scores in all domains except physical functioning and pain. When comparing urban and rural scores, there were no significant differences in all eight domains, but rural scores were lower, except for role limit scores due to physical problems.

When comparing the SF-36 profiles of the two groups of participants with lumbar and cervical DH and depending on the sex of the subjects, the significant difference and the lower values of the indicator role limit due to emotional problems in women with cervical DH and role limit due to physical problems in women with lumbar DH are striking. For men with cervical DH, the score for role limitation due to emotional problems was 71.80, and for women it was 37.63. We believe that this difference is not due to the greater number of women in this group, because according to the same indicator, there is no difference in both genders in the examinees with lumbar DH (for men it is 66.68, for women it is 68.00). A significant difference is also found in the role limit indicator due to physical problems in the subjects with lumbar DH, as in men it is 42.65 and in women it is 29.00, while in the group with cervical DH the difference in this indicator is minimal - 26.92 for men and 28.23 for the women.

The results of our study of HRQoL of patients with lumbar DH using the SF-36 Questionnaire were comparable to some results of a similar study of 249 patients aged 18 to 65 years with chronic non-specific LBP from a rehabilitation center in the Netherlands. Our

results were comparable to the domains of General health (54.08 in our subjects vs. 58.70 in the Dutch study population), social function (59.41 in our subjects vs. 55.00), and emotional well-being (62.47 in our subjects vs. 65.3). Our study patients reported better scores in the following domains: bodily pain (43.91 in our study vs. 36.9), role limitation due to physical problems (38.16 in our study vs. 15.7), and vigor/fatigue (55.20 in our study vs. 41.00). Worse results were shown by our participants for the domains of physical functioning (49.21 in our subjects versus 65.2) and role limit due to emotional problems (38.16 in our subjects versus 53.7). In the larger study of 1155 participants with chronic non-specific LBP in Hungary, for the majority of domains subjects reported better quality of life compared to our participants, respectively: bodily pain 64.24 vs. 43.91, social functioning 76.86 vs. 59.41, role limitation due to emotional problems 73.69 vs. 67.11, role limitation due to physical problems 63.9 vs. 38.16, and physical functioning 74.67 vs. 49.21. Regarding the other two domains, there was no significant difference: General health was 55.69 in non-specific LBP and 54.08 in our participants, energy/fatigue was 53.46 vs. 55.20, and emotional well-being was 67.34 vs. 62.47, respectively (M. Jâromi et al., 2021). Another large study of 2 400 residents with non-specific LBP in Brazil reported higher scores, correspondingly better quality of life for all domains of the SF-36 profiles compared to our results, with the most significant difference being found in physical functioning - 87.7 vs. 49.21 and the role limit due to physical problems - 83.6 compared to 38.16 in our subjects (A.M. Iguti, 2021). Similar results were reported by researchers of the quality of life of patients with non-specific LBP in terms of almost all domains (M. Adorno, J. Brasil-Neto, 2013). From the data thus presented, it can be concluded that LBP due to disc herniation negatively affects HRQoL indicators more than those of patients with non-specific LBP, especially in terms of physical functioning and role limitation due to emotional problems.

HRQoL results from the SF-36 questionnaire in our subjects with cervical disc herniation are partially comparable with results from a study of 100 patients with chronic neck pain, as for the domains social functioning, role limitation due to physical problems and/or emotional problems, bodily pain and fatigue/vigor, they are similar, and for the other domains our results show a weaker impact of the disease on the quality of life (F. Altug, and et al., 2013).

Comparing the SF-36 profiles of participants with cervical DH in the present dissertation with the results of a cohort study of patients with spondylogenic cervical myelopathy in China revealed a partial concordance of SF-36 data. It is interesting that in men we find matching results only in three of the indicators - physical function, bodily pain and social function, and in the remaining domains the patients with myelopathy reported worse results, with the exception of the emotional well-being domain, where our subjects had worse results - 55.39 compared to 64.3. On five of the indicators, the results of our study women were comparable to those of patients with cervical spondylogenic myelopathy, and these were role limitation due to physical problems, bodily pain, energy/fatigue, social functioning, and emotional well-being (Y. Zhang, 2015). In general, in our patients with cervical DH and in those with cervical spondylogenic myelopathy, in both sexes, of all eight HRQoL domains measured by the SF-36, role limitation due to physical problems was most negatively affected, but in patients with cervical disc herniation is reported to have a more significant impact on the negative aspect of emotional well-being, and for women, role limitation due to emotional problems.

Data from a study of health-related quality of life in patients with chronic neck pain also reported better values of the emotional well-being domain compared to our study population: 64.7 versus 58.85 in men and 51.69 in women in our study. but they also believe that this indicator is more affected in women (M. Weigl, 2021). In a

large-scale two-year study of 2,356 patients with chronic nonspecific neck pain in the United States, the results of the SF-36 profiles partially differed from those of our study. In terms of physical and social functioning, vigor and role limitation due to physical problems, there is a match with our data, but general health and especially emotional well-being are worse in our subjects with cervical DH, at the expense of bodily pain and role limitation due to emotional problems, which in our subjects are less affected. Again, it is striking that the role limit domain is most negatively affected due to physical problems (H. Tee, 2002).

In our study, the HRQoL results differed from those of a large French population of 17 000 people with chronic back pain, including neck pain and low back pain. It is noteworthy that in this large group of subjects almost all domains were less affected by the disease, with the exception of energy/fatigue - 56.81 compared to 53.13 in total in our subjects (M. Husky et al., 2018).

When comparing the results obtained from a study of the SF-36 profiles of our subjects with the results of a similar comparative study of 2633 patients with rheumatic diseases and healthy controls, we find a great similarity with the profiles of patients with LBP, with a difference in the domains emotional well-being, role limitation due to emotional problems and energy/fatigue, where our subjects performed better. Only with regard to the physical functioning domain, our patients had the same score as those studied with fibromyalgia – 49 compared to 49.21 in our patients with lumbar DH. In the same study, patients with rheumatoid arthritis, systemic lupus erythematosus and osteoporosis with fractures had the worst quality of life, while patients with LBP and shoulder pain reported a better quality of life compared to others (F. Salaffi et al., 2018).

5.5. Correlation dependencies

In our subjects, a strong correlation between pain intensity (VAS, NPRS) and gender was found, with female gender being associated with higher levels of pain compared to males (p=0.006; p=0.0009). In support of this conclusion of a gender difference in pain perception are data from a meta-analysis of epidemiologic and clinical studies, according to which women are at increased risk of developing chronic pain, have a lower pain threshold, and experience more severe pain. with less capacity for pain inhibition than men (E.J. Bartley, R.B. Fillingam, 2013). The authors of a cross-sectional study in the USA among adults aged 30 to 89 also report a different perception of pain. age, including neuroimaging methods such as functional MRI. The conclusion of this study is that women have a higher perception of pain and the hypothesis that there is an age-related and gene-modulated reduction of the descending inhibitory pain pathway is discussed in them (M. Failla et al., 2024). Similar results were found in a study on the qualitative and quantitative assessment of pain by gender in Poland, according to which women, in addition to reporting more severe pain, were also more likely to use more detailed and factual descriptions when describing it. saturated speech, showing greater sensitivity (G. Puto et al., 2024). That men are more tolerant of pain and rate it as weaker than women also reported by O.P. Gautschi, (2016) and R. Martin, (2019). The same results were obtained in a systematic critical analysis of worldwide data for the period 1966 to 2002 regarding neck pain, with 83 % of studies again reporting higher levels of pain than men in women (R. Fejer et al., 2006). Regarding the other investigated factors, in our study we found a correlation of pain perception with age, place of residence and localization of DH. Regarding the relationship of pain perception with age, similar are the conclusions of a systematic and meta-analysis of 40 studies, according to which there is evidence that age, and even

more than 70 years, only reduces the perception of mild pain (S. Lautenbacher et al., 2017), but in our study the age of the participants was limited to 65 years of age.

In the present study, higher rates of depression were found in rural residents. In the statistical processing of the results, a correlation dependence of the degree of depression with the place of residence ($p=0.01$) and lack of correlation with gender, localization of DH and age ($p>0.05$) was found. Our results do not correspond to those of a study of 317 adults in the Scandinavian countries, which found higher rates of depression among women and among urban residents, but it was examined in relation to individuals' marital status and comorbidities (B. Carpiniello et al., 1989). Differences in the prevalence of depressive symptoms among adults in the USA were the subject of a large-scale study of nearly 6 000 people, including data from 2006 to 2016, and its results did not prove a link between where you live and the development of depressive symptoms, but rather - recently linked to socio-economic factors (N. Sun, 2020). In a similar study of a large Indian population of urban and rural adults, researchers found an association of depression with urban living, female sex, older age, poverty, and functional and cognitive impairment (P. Sengupta, A. Benjamin, 2015). In a study of depression among rural communities in the USA, results showed that regardless of the assessment tools used, women and African Americans were more at risk for depression, regardless of where they lived (D. Brossart, 2013). According to J. Cummins, patients with intervertebral disc herniation show differences in terms of both sociodemographics, access to medical and health care resources and suggest that differences in patient resource utilization may also reflect differences in access to care (J. Cummins et al., 2006).

Based on these data, consider that all our results on the correlation of depression with the place of residence of ours are examined on the specific conditions in Bulgaria and primarily on

social and economic factors such as poverty in rural areas, social isolation, provision of primary medical care, control of socially significant diseases and inadequate transport connectivity to larger medical centers.

Despite the differences in the results for the assessment of disability and its higher levels in women, in our participants with the Oswestry Disability Index and Neck Disability Index Questionnaires, we did not establish a correlation dependence with the studied factors - gender, age, place of residence and location of disc herniation ($p > 0.05$), while the results of the RMDQ and CNFDS Questionnaires revealed a weak correlation with gender ($p=0.038$[1], $p=0.046$[2]) and with the localization of DH ($p=0.049$[1], $p=0.011$[2]). This gives us reason to assume that there is no dependence of these indicators with the degree of disability in our study group and to assume that pain and depression have a greater importance. Similar are the conclusions of A. Heapy et al., according to which the disability Questionnaires, respectively, their results can be affected by additional factors, some of which are more relevant: intensity of pain, presence of pain in the lower limbs, distance from medical center, marital status, education, pain catastrophizing index and depression (A. Heapy et al., 2016).

Examining gender differences in HRQoL with the SF-36 Questionnaire in a large population of 46 290 urban residents in Turkey, the authors reported better outcomes in men, with women performing worse in all mental health domains than men, but the differences were not significant (Y. Demiral et al., 2006).

Our study found a strong correlation between gender and location of disc herniation ($p=0.000$), with a higher prevalence of cervical DH among females, which is comparable to epidemiological data from worldwide studies (R. Windsor, 2018, Y. K. Kim et al., 2018, N. Al-Ryalat et al., 2017, K. Sharrak, 2023, M. Weigl, 2021, M.

[1] Pearson
[2] Spearman

Hashem et al., 2024). The same is the conclusion of the Global Burden of Diseases Study 2021, namely that neck pain is more common in women – 2 890 to 2 000 per 100 000 people by 2020 and, accordingly, women have a higher number of disability years due to neck pain (GBD Collaborators, 2021). Localization of DH in our patients showed a weak correlation with place of residence (p=0.041) with a higher prevalence of cervical DH among urban residents. This result confirms data from a meta-analysis of studies on neck pain, which found that it is more prevalent among women, in higher-income countries and in urban areas (D. Hoy, 2010). Other studies of neck pain in terms of epidemiology and risk factors have found that occupational factors, such as prolonged sitting, computer work, more typical of urban residents, are a significant risk factor (S. Kazeminasab et al., 2022). Similar conclusions were drawn by researchers of neck pain in the general population in China from 1990 to 2019, according to which neck pain is more common and increasing in areas with better economic development, in urbanized areas, and among the more educated. population (X. Weiwei et al., 2024).

Regarding the individual domains of the quality of life measured with the SF-36 profile, we found the following correlations:

There is a correlation between gender and physical functioning (p=0.009[1], p=0.02[2]), and women having worse results than men. A similar conclusion was drawn by researchers of HRQoL in patients with diabetic foot and according to their results, women reported stronger body pain and worse physical function, having a significant difference with those of men and overall poorer physical health (M. Del Core et al., 2018). In contrast to physical function, in social functioning and role limitation due to physical problems, we did not find a statistically significant relationship with the different groups studied. Regarding the role limit due to emotional problems, we found a correlation with gender (p=0.03) and localization of DH (p=0.01[1],

[1] Pearson [2] Spearman

p=0.02[1]) and a strong correlation with the age of the subjects (p=0.002[1], p=0.001[2]). Women and subjects with cervical DH performed significantly worse on this indicator and on this outcome, as we account for the greater number of women with cervical DH in our study population. Age is the other factor that clearly affects this indicator, similar are the results of a study of the quality of life in Bulgaria (M. Encheva et al., 2020), as well as in other countries in Europe, Australia and Asia (S. Noto, 2023). These data indicate that age is an independent factor affecting quality of life and is probably unrelated to the presence of a given disease.

Females also performed worse on the energy/fatigue domain, and we found a statistically significant association with this measure from participants' SF-36 profiles (p=0.012[1], p=0.010[2]). In a comparative study of fatigue in men and women, differences are found in the scientific literature depending on comorbidities. In osteoarthritis, for example, women performed worse than men in all age groups (B. Boyan et al., 2013), the same results were shown in a study among patients with B-cell leukemia (C. Pashos et al., 2013), while in multiple sclerosis, often leading to fatigue, both sexes demonstrate the same or similar reduction in vigor (A. Skurvydas et al., 2011). In healthy individuals, however, women have shown less tendency to develop fatigue due to the presence of more fatigue-resistant muscle groups (S. Hunter et al., 2006). Obviously, different diseases affect this HRQoL indicator differently, regardless of gender, with disc herniation approaching musculoskeletal diseases such as osteoarthritis and having a more adverse effect on females.

Despite worse depression scores in female participants in our study, analysis of emotional well-being scores in the SF-profiles showed no correlation with age, sex, and location of DH. Paradoxically, women in surveys report that they are sadder, more

[1] Spearman [2] Pearson

restless, more depressed and lonely, but at the same time happier and more satisfied with their lives than men (D. Blanchflower, A. Bryson, 2024). These data are also confirmed by the Organization for Economic Cooperation and Development (OECD) and their studies in the field of quality of life, according to which, although women share more often negative emotions than men, they are more satisfied with their lives than men and clearly the disease does not change this trend in our respondents.

In the present study, the analysis of the results of the SF-36 questionnaire showed that the localization of DH, gender and place of residence did not have a statistically significant relationship with the general health domain, but it was found to be strongly correlated with the age of the participants ($p=0.001$[1], $p=0.000$[2]). Similar data were also reported by researchers on the HRQoL of 1 207 adult patients after experiencing COVID-19 infection using the SF-36 questionnaire. They reported a correlation of age only with the general health and physical functioning domains (G. Wright et al., 2023).

The current dissertation found a strong positive reciprocal relationship between pain and depression ($p=0.000$), a finding consistent with the proposition that pain and depression are comorbidities and that both pain can cause depression and vice versa due to long-term neuroplastic CNS mechanisms occurring in these conditions (L. Doan et al., 2015). In this direction are the claims that those suffering from depression and anxiety are exposed to a higher risk of chronic pain (M. Gerrits et al., 2015) and that pain and depression influence each other, playing an important role in the development and maintenance of chronic health problems (S. Linton, S. Bergbom, 2011). Similar are the conclusions of other authors that depression and anxiety are associated with an increased perception of pain severity (A. Michaelides, P. Zis, 2019) and that future treatment

[1] Pearson
[2] Spearman

methods should aim to address both conditions simultaneously (S. Dhanju et al., 2018). Comparable to our study are results from other studies focusing on depression in LBP. Similar findings of a significant association between pain and depression were also made after a cross-sectional study of over 7 500 participants with LBP screened for depression with the PHQ-9 (T. Tsuji et al., 2016), as well as a study of 30 000 patients with chronic LBP (S. M. Park et al., 2018).

In addition to depression, pain intensity was strongly positively associated with disability (p=0.000) and General health (p=0.004[1], p=0.003[2]). We also found a strong correlation regarding depression with disability (p=0.000) and General health (p=0.000[1], p=0.001[2]). Similar findings were made in studies of chronic LBP, and the authors reported that depression was the most powerful factor associated with disability and considered that depression should be routinely measured in patients with this disease (C. Hung et al., 2015). It is evident that pain and depression are mutually related and negatively affect HRQoL, with the feature that we obtained worse results in participants with cervical DH for all domains studied, again related to the severity of depression.

Pain was found to be a significant factor negatively affecting all domains of HRQoL. Our results are supported by findings from a meta-analysis of quality-of-life studies in LBP, according to which there is a strong inverse relationship between pain intensity, psychological distress, functional limitations, and sense of health (X. Pericot-Mozo et al., 2024).

The individual studied factors such as gender, localization of DH, age and place of residence influence individual components of HRQoL. For example, participant gender had a statistically significant relationship with physical functioning (p=0.009[1], p=0.018[2]), role

[1] Pearson
[2] Spearman

limitation due to emotional problems (p=0.030), and energy/fatigue (p=0.012[1], p=0.010[2]) with worse results in women. Age has a statistically significant relationship with role limitation due to emotional problems (p=0.002[1], p=0.001[2]) and General health (p=0.001[1], p=0.000[2]), and DH localization with physical functioning (p=0.007[1], p=0.002[2]) and role limit due to emotional problems (p=0.014[1], p=0.015[2]) with worse results in cervical DH, while place of residence did not affect any of the HRQoL domains (p>0.05).

[1] Pearson
[2] Spearman

6. CONCLUSIONS

Based on the results of the present study and their analysis, the following conclusions can be drawn:

1. The location of the herniated disc has a strong statistically significant relationship with gender, the cervical disc herniation being more common in women, similar to studies in other populations.
2. A strong statistical dependence of depression with the place of residence of the studied population was established. Our data are not comparable with data from worldwide studies that associate higher levels of depressive symptoms with urban populations. We consider that the results of our research are due to the specific sociodemographic conditions in Bulgaria - social isolation, the older population in the villages, higher levels of poverty and the difficult access to medical care in these areas.
3. A strong statistical correlation of gender with pain perception was proven. Women with cervical and lumbar disc herniation had higher pain levels than men, regardless of other factors examined. Our results are fully comparable with those from foreign sources, which also found a lower pain threshold in women, and a reduced ability to inhibit pain as well.
4. We found a strong statistical correlation between pain and depression, and our results fully coincide with foreign sources that define pain and depression as two concomitant and related comorbidities. In addition, we also found a strong statistically significant association of disability and general health with pain and with depression.

5. Gender, age, location of disc herniation, and place of residence differentially affect some domains of mental and physical health, while some of these domains are not affected. The localization of disc herniation affects physical functioning, which is worse in subjects with lumbar DH, gender also affects this domain of HRQoL, which has lower values in men. Role limitation due to emotional problems was more negatively affected in women, older participants, and those with cervical disc herniation, and we found a statistically significant association of this domain with gender, age, and location of DH. Women performed worse on energy/fatigue and we found a statistically significant relationship of gender with this domain. Age has a strong influence on the General health domain, which is significantly worse in older subjects.
6. In terms of health-related quality of life, pain and depression were found to have a strong and identic negative impact on all separate domains of mental and physical health.

7. CONTRIBUTIONS

The contributions of this dissertation work have scientific-theoretical essence.

7.1 Contributions of original character

For the first time in our country, a study of the quality of life related to the health of patients with disc disease among the Bulgarian population was conducted.

For the first time in our country, a comparative analysis of the individual domains of health-related quality of life, as well as pain, depression and disability in individual groups of patients, depending on the location of the disc herniation and some sociodemographic factors such as age, gender, and place of residence has been performed.

7.2 Contributions of affirmative significance

Disc disease has been shown to negatively impact health-related quality of life, with a greater impact on physical than mental health. Cervical herniated discs have been confirmed to be more common in females.

It was reported that women have a lower pain threshold and a correlation of pain intensity with gender was established.

A negative correlation of age with General health and with the development of depressive symptoms in patients with disc herniation was established.

Was confirmed the strong interrelationship of depression and pain, which together and separately have the greatest impact on disability and all indicators of health-related quality of life.

8. PUBLICATIONS AND SCIENTIFIC MANIFESTATIONS RELATED TO THE DISSERTATION WORK

8.1. List of Publications:

1. Panayotov, K., **Krasteva, R**. Treatment of Neuropathic Pain Associated with Disc Herniation. Proceedings of University of Ruse, 2021, Vol. 60, Book 8.4.
2. **Krasteva, R**., Lenkova, A. Evaluation of Pain, Disability and Depression in Patients with Low Back Pain due to Disc Herniation. Proceedings of University of Ruse, 2023, Vol. 62, Book 8.4
3. **Krasteva, R.,** Lenkova, A. A Comparative Study and Analysis of Pain, Disability and Depression in Patients with lumbar and cervical Disc Herniation. Spine Surgery, 2024, Vol. 3, 1-4, 43-47

8.2 Scientific Manifestations:

1. „Treatment of Neuropathic Pain Associated with Disc Herniation" on 60. Annual Scientific Conference of the University of Ruse "Angel Kanchev" and Union of Scientifics of Ruse, 28-30 Oct 2021, Ruse-Plenary Report
2. „A Comparative Study and Analysis of Pain, Disability and Depression in Patients with lumbar and cervical Disc Herniation.". V International Conference of Spinal Surgery, 25-28 Apr 2024, Ruse-Presentation
3. „Impact of Low back Pain on Health Related Quality of Life" 63. Annual Scientific Conference of the University of Ruse "Angel Kanchev" and Union of Scientifics of Ruse, 25-26 Oct 2024, Ruse- Plenary Report