8. Summary

Introduction. Spinal pain is a serious clinical problem. Its recurrent or chronic nature, leading to long-term disability, is a serious social problem. The most common type of spinal pain is spondylogenic pain, the sources of which may be associated with structures such as vertebral bodies, intervertebral discs, facet joints, sacroiliac joints, paraspinal muscles, spinal ligaments, nerves and spinal roots. In 97 % of cases its causes are mechanical. Most frequently, it affects the lumbosacral spine. In Polish reports, this type of pain is called "sacral pain", and in English it is called low back pain (LBP). Many epidemiological studies indicate that low back pain is one of the most common problems affecting the motor organs, and belongs to the main health problems affecting adult Poles. As many as 60–85 % of the population will have an episode of pain affecting the low back at least once in their life. Recurrence reaches 85 % throughout life. In about 5-7 % of patients, pain can become chronic. The total costs of the low back pain are great and mainly result from disability. The risk factors for non-specific low back pain and associated disability can vary.

Studies have shown that medical personnel are at a significant risk of developing low back pain. Numerous epidemiological studies have evaluated the frequency of low back pain in the occupational group of nurses. However, reports evaluating the scale of this problem in paramedics are not available. Procedures performed on patients frequently require lifting and maintaining an unnatural, forced body position, and are also associated with frequent twisting movements. This leads to the development of spinal overload syndrome, resulting from wear of the spine structures.

The reports published to date in Polish journals take into account the influence of various risk factors, and non-spinal disorders in particular, on the recurring or chronic nature of low back pain only to a small extent. A Polish report on predictive factors for lumbosacral pain in paramedics is still lacking.

The contribution of various predictive factors for low back pain, including overweight or obesity, sedentary lifestyle or genetic predispositions, is still under discussion. To date, scarce reports have been published in English, suggesting a relation between the low back pain and cardiovascular diseases, hyperlipidaemia, type 2 diabetes, allergies, urinary incontinence, or gastrointestinal diseases.

Considering the fact that low back pain is widely spread, amongst others, in medical personnel, a lack of consensus on the influence of various factors on low back pain occurrence, as well as published reports on the possibility of "new" predictive factors, further research on risk factors is necessary to ensure early identification of people at risk of developing health problems of this type and to prepare guidelines for the implementation of prevention programmes. Therefore, conducting such multidimensional analysis appears to be justified.

Study objectives. The main objective was a comparative evaluation of spondylogenic pain occurrence in nursing and paramedic personnel in north-east Poland, an analysis of the influence of selected predictive factors and comorbidities on back pain, an analysis of

predictive factors for the higher level disability on the basis of the Oswestry questionnaire, and determining the effects of spondylogenic low back pain on the quality of life.

Under the main objective, answers to research questions, being at the same time specific objectives, were sought:

1. Evaluation of frequency and types of back pain in nurses and paramedics, depending on age and the location of work performance.
2. Estimating the probability for the occurrence of recurring and chronic low back pain due to selected predictive factors (age, overweight or obesity, smoking, excessive coffee consumption, incorrect dietary habits, sedentary life, intense physical activity, insufficient number of hour of sleep, a history of low back pain in the respondent's family, low self- assessment of own health status, work tenue and location, shift work, comorbidities and concurrent symptoms in the musculoskeletal system) in studied medical personnel, and evaluation of their influence on spondylogenic pain occurrence in paramedics, when compared to nurses.
3. Evaluation of a relationship between chronic comorbidities, and in particular, components of metabolic syndrome and problems in the musculoskeletal system, and recurrent and chronic low back pain and the comparative evaluation in nursing and paramedic personnel.
4. Evaluation of predictive factors for a higher degree of disability on the basis of the Oswestry questionnaire in a group of respondents with recurrent and chronic low back pain (age, overweight or obesity, smoking, excessive coffee consumption, incorrect dietary habits, sedentary life, insufficient number of hour of sleep, a history of low back pain in the respondent's family, low self- assessment of own health status, work tenue and location, shift work)
5. Comparison of quality of life (taking into account both physical and mental aspects) in people with recurrent and chronic low back pain on the basis of the SF-36 questionnaire, versus other respondents.
6. Estimating the probability for the occurrence of recurring and chronic low back pain due to selected predictive factors (age, overweight or obesity, smoking, excessive coffee consumption, incorrect dietary habits, sedentary life, intense physical activity, insufficient number of hour of sleep, a history of low back pain in the respondent's family, low self- assessment of own health status, work tenue and location, shift work) in studied medical personnel.
7. The evaluation of a relationship between recurrent pain in the cervical and thoracic spine and concurrent chronic disorders, as well as other problems in the motor system.

Material and methods. The technique used in the research was an auditorium questionnaire supervised by a researcher, i.e., the author of this paper. The following survey questionnaires were used:

1. A survey questionnaire partly based on the standardised Nordic Musculoskeletal Questionnaire

2. A lumbosacral region problems (LSRP) questionnaire validated according to International Epidemiological Association (IEA) guidelines

3. A proprietary survey questionnaire concerning sociodemographic data, selected lifestyle areas (smoking, coffee drinking), and an extended interview on chronic diseases in respondents and their families.

4. Short version of the International Physical Activity Questionnaire (IPAQ) .

5. Oswestry disability questionnaire

6. SF-36 questionnaire

609 correctly completed questionnaires were used for the analysis (with the response rate of 88 %). The study covered professionally active nurses and paramedics living in the Podlaskie Voivodeship. 324 nurses (53.2 % of all participants) and 285 paramedics (46.8 % of all participants) were included in the study. The studied group included 302 people in the age group of 30–40 years (49.6 % of all subjects) and 307 people in the age group of 41–60 years (50.4 % of all subjects).

Respondents treated for an autoimmunological disease, cancer, persons who suffered an osteoporotic fracture, pregnant women, respondents injured during the three months preceding the completion of the questionnaire, and respondents with symptoms possibly representing red flags for specific low back pain were excluded from the study.

"Recurrent" spondylogenic pain was understood as an episode of acute pain occurring ≥3 times over the last 12 months. "Chronic" spondylogenic pain was defined as pain lasting continuously for at least 3 months.

Statistical analysis. During the study, a database was established to stand as a source of variables and containing responses, opinions and assessments of respondents, enabling the use of calculation techniques. The statistical analysis started with a material and logical review of collected data. At the first stage, conformity and distribution of the studied continuous variables were verified against the Gauss distribution. The Shapiro-Wilk test was performed for all cases, and a hypothesis on the normality of the distribution was discarded. For this reason, the non-parametric Mann–Whitney U test was used in the analyses (two compared groups). The relationships between qualitative variables were evaluated with the chi-squared test. For variables of dichotomous nature, simple and multinomial logistic regression analyses were used (odds ratio was calculated), and the relationship between two quantitative variables was analysed using one-way and multiple linear regression models. The assumed statistical confidence level was $p < 0.05$. The statistical analysis was performed using the STATA/ 1.C 12.1 application manufactured by Stata Corp, LP, Texas, USA.

Results. Recurring or chronic low back pain was reported by 355 people (58.29 % of all subjects), of which 253 people (41.54% of all respondents) complained of recurrent low back pain, while 102 people (16.75% of all subjects) notified chronic low back pain. Recurring or chronic pain in the cervical spine occurred in 156 people (51 % of all respondents), while

recurring or chronic pain in the thoracic spine affected 112 people (18.39 % of all respondents).

Recurrent non-traumatic mechanical spondylogenic pain in the lumbosacral spine was significantly more frequent in paramedics, versus nurses (31.23 % of all paramedics vs. 20.68 % of all nurses) ($p=0.01$). Paramedics also significantly more frequently reported recurring spondylogenic thoracic pain (25.61 % of all paramedics vs. 11.42 % of all nurses) ($p <0.001$).

A lack of disability was found in 61 nurses (36.75% of nurses with recurring or chronic low back pain) and in 39 paramedics (20.63% of paramedics with recurring or chronic low back pain); a low degree of disability affected 63 nurses (37.95% of nurses with recurring or chronic low back pain) and in 73 paramedics (38.62% of paramedics with recurring or chronic low back pain); and a moderate degree of disability was found in 42 nurses (25.30% of nurses with recurring or chronic low back pain) and in 77 paramedics (40.74% of paramedics with recurring or chronic low back pain).

Spondylogenic pain proved to be the main health problem in 113 nurses (34.88 % of all nurses) and 106 paramedics (37.19 % of all paramedics).

<u>Predictive factors for recurring low back pain in simple and multinomial logistic regression models</u>

The risk of the occurrence of recurring low back pain was significantly increased by:

- in a simple logistic regression model: excessive consumption of coffee (≥ 6 cups/day)- over 16 times; shift work - over 7 times; smoking - over 7 times; incorrect dietary habits in the form of eating an insufficient number of meals and/or irregular eating - over 3 times; degenerative disease of the lower back - over 3 times; sedentary lifestyle - over 3 times; hyperlipidaemia - over 3 times; a history of low back pain in the respondent's family - over 3 times; type 2 diabetes - over 2 times; allergies - over 2 times; overweight or obesity - over 1.5 times; and working as a paramedic - 1.5 times ($p <0.001$; $p <0.001$; $p <0.001$; $p <0.001$; $p<0.001$; $p <0.001$; $p <0.001$; $p <0.001$; $p <0.01$; $p <0.05$; $p <0.01$; $p <0.05$, respectively). In the age group of 30–40 years, the risk of the occurrence of recurrent low back pain was significantly higher, by 79%, versus the age group of 41–60 years ($p<0.05$).
- in a multinomial logistic regression model: excessive consumption of coffee (≥ 6 cups/day) - over 29 times; degenerative disease of the lower back - over 16 times; depression and/or anxiety disorders - over 8 times; smoking - 7 times; sedentary lifestyle - over 4 times; a history of low back pain in the respondent's family - 3 times; and incorrect dietary habits in the form of eating an insufficient number of meals and/or irregular eating - over 2 times ($p <0.001$; $p <0.01$; $p <0.05$; $p <0.001$; $p<0.001$; $p <0.01$; $p <0.01$, respectively).

Predictive factors for chronic low back pain in simple and multinomial logistic regression models

The risk of the occurrence of chronic low back pain was significantly increased by:

- in a simple logistic regression model: degenerative peripheral joint disease - over 12 times; recurrent or chronic thoracic back pain - over 11 times; recurrent or chronic cervical back pain - over 10 times; urinary and reproductive system diseases - over 10 times; hypertension - over 9 times; degenerative disease of the lower back - over 9 times; scoliosis - over 8 times; insufficient number of hours of sleep (< 7 hours of sleep/day) - over 5 times; a history of low back pain in the respondent's family - nearly 3 times; cardiovascular diseases excluding hypertension - over 3 times; low self-assessment of own health status - 3 times; type 2 diabetes - 3 times; depression and/or anxiety disorders - nearly 3 times; hyperlipidaemia - over 2 times; postural disorders excluding scoliosis - nearly 2 times; obesity or overweight - nearly 2 times; and smoking - over 1.5 times ($p < 0.001$; $p < 0.001$; $p < 0.001$; $p < 0.001$; $p < 0.001$; $p < 0.001$; $p < 0.001$; $p < 0.001$; $p < 0.001$; $p < 0.001$; $p < 0.001$; $p < 0.01$; $p < 0.01$; $p < 0.05$; $p < 0.05$; $p < 0.05$, respectively). With each year of life, the risk of the occurrence of chronic back pain increased significantly by 7.2% ($p<0.001$).
- in a multinomial logistic regression model: urinary and reproductive system diseases - over 9 times; recurring or chronic pain in a thoracic spine - over 8 times; and hypertension - over 8 times ($p < 0.001$; $p<0.001$; $p < 0.001$, respectively).

Predictive factors for recurring low back pain in the group of paramedics

In the simple logistic regression model, the risk of the occurrence of recurring back pain in paramedics was significantly increased by, amongst others: hyperlipidaemia - over 10 times; excessive consumption of coffee ($\geq$ 6 cups/day) - over 5 times; smoking - over 5 times; incorrect dietary habits in the form of eating an insufficient number of meals and/or irregular eating - over 3 times; degenerative disease of the lower back - over 5 times; lumbar spondylosis - over 3 times; sedentary lifestyle - over 3 times; overweight or obesity - over 2 times; and a history of low back pain in the respondent's family - nearly 2 times ($p<0.001$; $p < 0.001$; $p < 0.001$; $p<0.001$; $p < 0.001$; $p < 0.001$; $p < 0.001$; $p < 0.05$, respectively).

Predictive factors for chronic low back pain in the group of paramedics

In the simple logistic regression model, for the risk of the occurrence of chronic back pain was significantly increased by, amongst others: cardiovascular diseases excluding hypertension - over 44 times; hypertension - over 31 times; depression and/or anxiety disorders - over 22 times; degenerative disease of peripheral joints - over 15 times; lumbar spondylosis - over 12 times; urinary and reproductive system diseases - over 12 times; recurrent or chronic pain in the cervical spine - over 12 times; scoliosis - over 11 times; recurrent or chronic pain in the thoracic spine - over 6 times; insufficient number of hours of sleep (< 7 hours of sleep/day) - over 6 times; a history of low back pain in the respondent's family - over 4 times; low self-assessment of own health status - over 4 times; and overweight or obesity - over 3 times ($p<0.001$; $p < 0.001$; $p < 0.001$; $p<0.001$; $p < 0.001$;

p <0.001; p <0.001; p <0.001; p <0.001; p <0.001; p <0.001; p <0.001; p <0.001; p <0.01, respectively).

Comparison of statistically significant predictive factors for recurring and chronic low back pain in the group of paramedics versus nurses

In the simple logistic regression model, in the group of paramedics, in contrast to nurses, statistically significant predictive factors for recurrent low back pain appeared to be hyperlipidaemia and allergies. (p<0.001; p<0.05, respectively) The use of the simple logistic regression model showed that in the group of paramedics, in contrast to the group of nurses, a significant risk factor for chronic low back pain proved to be cardiovascular diseases, excluding hypertension (p <0.001).

Predictive factors for disability of a higher degree on the basis of the Oswestry questionnaire in the group of respondents with recurring low back pain

The end value on a point scale on the basis of the Oswestry questionnaire was significantly increased by:

- in a one-way linear regression model - overweight or obesity, hyperlipidaemia, working as a paramedic, insufficient number of hours of sleep (< 7 hours/day), degenerative disease of the lower back, scoliosis, and body weight (p <0.001; p <0.05; p=0.001; p <0.05; p <0.05; p =0.01; p<0.001, respectively)
- in a multiple linear regression model - working as a paramedic, hyperlipidaemia, scoliosis, recurring or chronic pain in the thoracic spine, and body weight (p <0.01; p <0.05; p <0.05; p <0.05; p <0.001, respectively).

Predictive factors for disability of a higher degree on the basis of the Oswestry questionnaire in the group of respondents with chronic low back pain

The end value on a point scale on the basis of the Oswestry questionnaire was significantly increased by:

- in a one-way linear regression model - overweight or obesity, degenerative disease of the lower back, working as a paramedic, type 2 diabetes, insufficient number of hours of sleep (< 7 hours/day), body weight, and height (p <0.001; p <0.001; p <0.001; p <0.01; p <0.01; p <0.001; p =0.001, respectively).
- in a multiple linear regression model - working as a paramedic, and body weight (p <0.01; p <0.001, respectively).

Comparison of the quality of life in respondents with recurrent or chronic low back pain on the basis of the SF-36 questionnaire, versus other respondents:

When compared to other respondents, people complaining of recurrent low back pain showed significantly deteriorated quality of life in the following areas: PF (physical fitness), BP (pain and its influence on daily work), GH (general health), SF (social functioning), RE (effect of emotional problems on limitations of daily activities and performed work),

MH (mental health), and PCS (physical component summary) ($p=0.043$; $p<0.001$; $p<0.001$; $p=0.004$; $p<0.001$; $p<0.001$; $p<0.001$, respectively).

When compared to other respondents, people complaining of chronic low back pain showed significantly deteriorated quality of life in the following areas: PF (physical fitness), RP (limited daily activities, also due to physical health), BP (pain and its influence on daily work), SF (social functioning), RE (effect of emotional problems on limitations of daily activities and performed work), MH (mental health), and PCS (physical component summary) ($p<0.001$; $p<0.001$; $p<0.001$; $p<0.001$; $p<0.001$; $p<0.001$, respectively).

Predictive factors for recurring cervical spine pain in the simple logistic regression model

In the logistic regression model, chances for the occurrence of chronic back pain were significantly increased by, amongst others: cervical spondylosis - over 24 times; a history of low back pain in the respondent's family - over 23 times; degenerative disease of peripheral joints - over 5 times; low back pain - nearly 5 times; hypertension - nearly 4 times; depression and/or anxiety disorders - 3 times; cardiovascular diseases excluding hypertension - nearly 4 times; recurrent or chronic pain in the thoracic spine - over 2 times; low self-assessment of own health status - over 2 times; intense physical activity - over 2 times; type 2 diabetes - over 2 times; and insufficient number of hours of sleep - over 2 times ($p<0.001$; $p<0.001$; $p<0.001$; $p<0.001$; $p<0.001$; $p<0.01$; $p<0.01$; $p<0.001$; $p<0.001$; $p<0.001$; $p<0.05$; $p<0.001$, respectively).

Predictive factors for recurring thoracic spine pain in the simple logistic regression model

In the logistic regression model, chances for the occurrence of recurring thoracic spine pain were significantly increased by: degenerative disease of thoracic spine - 21 times; low back pain - nearly 11 times; shift work - over 7 times; degenerative disease of peripheral joints - over 3 times; nearly 4 times - intense physical activity; urinary and reproductive system diseases - over 2 times; working as a paramedic - over 2 times; hypertension - over 2 times; hyperlipidaemia - over 2 times; and type 2 diabetes - over 2 times ($p<0.001$; $p<0.001$; $p<0.005$; $p<0.01$; $p<0.001$; $p<0.001$; $p<0.005$; $p<0.001$; $p<0.001$; $p<0.001$; $p<0.01$; $p<0.01$; $p<0.01$, respectively).

Conclusions:

1. The studies showed the occurrence of recurring or chronic spondylogenic pain in the lower back, in nearly 60% of the respondents; whilst the paramedics significantly more frequently complained of recurring lumbosacral pain, versus the nurses.

2. A high percentage (48.67 %) of recurring low back pain in young medical personnel indicates that actions preventing recurring low back pain should be addressed to young medical personnel.

3. Spondylogenic pain in the thoracic spine was significantly more frequent in paramedics, versus nurses. This finding should be taken into consideration in occupational counselling.

4. In the simple logistic regression model, the risk of recurring low back pain occurrence was significantly increased by excessive consumption of coffee, smoking, and shift work, while the risk of chronic low back pain occurrence was increased by an insufficient number of hours of sleep. These results confirm earlier evidence of the influence of incorrect lifestyle on the increase of spondylogenic pain occurrence.

5. The analysis of the simple or multinomial logistic regressions showed a significant influence of hyperlipidaemia, type 2 diabetes, hypertension, urinary and reproductive system diseases and allergies on occurrence of spondylogenic pain in the lower back, and this supports a hypothesis qualifying these disorders as "new" predictive factors for low back pain.

6. In the simple logistic regression model, chances for the occurrence of spondylogenic pain in the cervical and thoracic spine were significantly increased by factors such as: low self-assessment of own health status, shift work, disorders classified as components of the metabolic syndrome and this confirms previous research results.

7. The analysis of the one-way linear regression model showed that working as a paramedic appeared to be a differentiating factor for a disability of a higher degree based on the Oswestry questionnaire in a group of respondents with chronic spondylogenic pain in the lumbosacral spine.

8. The quality of life of respondents with recurring and chronic low back pain was deteriorated in MH (mental health) and RE (effect of emotional problems on limitations of daily activities and performed work), amongst others, and this may indicate the importance of psychotherapy in the prevention of chronic pain in particular.

9. The results of conducted studies indicate that it is advisable to include widely understood issues of prevention of recurring and chronic low back pain in the curriculum and later professional work of nurses and paramedics, as a part of preventing so-called civilisation diseases (with a particular emphasis on education about the importance of recreational physical activity and maintaining a correct body weight, and on instructions on biomechanical spine hygiene, avoiding overloading positions, and strategies for coping with mental and social stress, as well as understanding the concurrence of low back pain and cardiovascular diseases).

10. Further studies concerning risk factors for spondylogenic pain in the lower back are necessary. The evidence for "new" predictive factors may form the basis for the implementation of better prophylactic strategies aiming at the prevention of recurrent non-specific low back pain, as well as chronic low back pain together with associated functional disability. This would also allow the development of a list of "warning signals" for recurrent and chronic non-specific low back pain and associated functional disability.